22519VIC

Certificate IV in Integrated Technologies
Version 2
(August 2020)

This course has been accredited under Part 4.4 of the Education and Training Reform Act 2006.

Accredited for the period: 1st January 2020 to 31st December 2024

Version History

Version No.	Date	Comments
Version 1	01 January 2020	Initial release
Version 2	06 August 2020	Four (4) Victorian units referred to as Cisco units are replaced with updated units. Details are:

<table>
<tr><td colspan="2">Superseded units: (There are to be no new enrolments in these units after 05 August 2020)</td></tr>
<tr><td>VU22758</td><td>Build a simple network and establish end to end connectivity</td></tr>
<tr><td>VU22759</td><td>Configure and troubleshoot network switches and routers</td></tr>
<tr><td>VU22760</td><td>Apply network scaling tools and techniques</td></tr>
<tr><td>VU22761</td><td>Establish connectivity to a wide area network (WAN)</td></tr>
<tr><td colspan="2">Replacement units: (To meet Cisco version 7 requirements)</td></tr>
<tr><td>VU22963</td><td>Build and implement a basic network</td></tr>
<tr><td>VU22964</td><td>Configure a small to medium network for an organisation</td></tr>
<tr><td>VU22965</td><td>Secure and monitor the performance of a small to medium network</td></tr>
<tr><td>VU22966</td><td>Investigate design concepts of an accessible and secure network</td></tr>
</table>

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Contents

Section A: Copyright and course classification information

1. Copyright owner of the course	Copyright of this course is held by the Department of Education and Training, Victoria © State of Victoria (Department of Education and Training) 2019.
2. Address	Executive Director Engagement, Participation and Inclusion Division Higher Education and Skills Group Department of Education and Training (DET) GPO Box 4367 Melbourne Vic 3001 <u>Organisational Contact:</u> Manager Training Products Higher Education and Skills Group Email: course.enquiry@edmail.vic.gov.au <u>Day-to-Day Contact</u> Curriculum Maintenance Manager-Engineering Industries Box Hill Institute of TAFE Private Bag 2014 Box Hill, Victoria 3128 Ph: 03 9286 9880 Email: gadda@bhtafe.edu.au
3. Type of submission	Re-accreditation.
4. Copyright acknowledgement	The following units of competence:

ICTICT103	Use, communicate and search securely on the internet
ICTNWK301	Provide network systems administration
ICTNWK303	Configure and administer a network operating system
ICTNWK405	Build a small wireless local area network
ICTNWK408	Configure a desktop environment
ICTNWK410	Install hardware to a network
ICTSAS307	Install and configure and secure a small office or home office network
ICTSAS409	Manage risks involving ICT systems and technology
ICTSAS410	Identify and resolve client ICT problems
ICTSAS412	Action change requests
ICTSAS418	Monitor and administer security of an ICT system
ICTSAS419	Support system software

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	ICTSAS420	Provide first-level remote help desk support
	ICTSAS421	Support users and troubleshoot desktop applications
	ICTSAS424	Support different operating systems
	ICTSAS425	Configure and troubleshoot operating system software
	ICTSAS426	Locate and troubleshoot ICT equipment, system and software faults

are from the **ICT- Information and Communications Technology Training Package**

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The following units of competence:

MEM23064A	Select and test mechatronic engineering materials
MEM30007A	Select common engineering materials
MEM30011A	Set up basic pneumatic circuits
MEM30031A	Operate computer-aided design (CAD) system to produce basic drawing elements

are from the **MEM05-Metals and Engineering Training Package**

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The following units of competence:

UEENEED104A	Use engineering applications software on personal computers
UEENEED115A	Administer computer networks
UEENEED124A	Integrate multiple computer operating systems on a client server local area network
UEENEEE101A	Apply Occupational Health and Safety regulations, codes and practices in the workplace
UEENEEE102A	Fabricate, assemble and dismantle utilities industry components
UEENEEE104A	Solve problems in multiple path d.c. circuits
UEENEEE105A	Fix and secure electrotechnology equipment
UEENEEE107A	Use drawings, diagrams, schedules, standards, codes and specifications
UEENEEE141A	Use of routine equipment/plant/technologies in an energy sector environment
UEENEEG006A	Solve problems in single and three phase low voltage machines
UEENEEG101A	Solve problems in electromagnetic devices and related circuits
UEENEEG102A	Solve problems in low voltage a.c.circuits
UEENEEG106A	Terminate cables, cords and accessories for low voltage circuits

are from the **UEE11-Electrotechnology Training Package**

The following units of competence:

VU22333	Perform intermediate engineering computations
VU22338	Configure and program a basic robotic system

are from **22470VIC Certificate II in Engineering Studies**

The following unit of competency:

VU22674	Explore applications and operation of the Internet of Things (IoT)

is from **VU22499VIC Certificate II in Electrotechnology (Pre-vocational)**

The following unit of competency:

VU21270	Implement control processes using PLCs

is from **22478VIC Diploma of Engineering Technology**

The following units of competence:

VU21988	Utilise basic network concepts and protocols required in cyber security
VU21990	Recognise the need for cyber security in an organisation
VU21993	Secure a networked personal computer

are from **22334VIC Certificate IV in Cyber Security**

The following unit of competency:

VU22257   Configure security devices for an organisation

is from **22445VIC Advanced Diploma of Cyber Security**

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The following unit of competency

VU22563   Set up mechatronics engineering systems

is from **22479VIC Advanced Diploma of Engineering Technology**

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6. Course accrediting body	Victorian Registration and Qualifications Authority
7. AVETMISS information	**ANZSCO code:** 313199 ICT Support Technicians nec **ASCED Code:** 0313 Electrical and Electronic Engineering and Technology ***National course code:*** 22519VIC
8. Period of accreditation	1st January 2020 to 31st December 2024

Section B: Course Information

1. Nomenclature	Standard 1 AQTF Standards for Accredited Courses
1.1 Name of the qualification	Certificate IV in Integrated Technologies
1.2 Nominal duration of the course	500 - 950 hours

2. Vocational or educational outcomes	Standard 1 AQTF Standards for Accredited Courses
2. Purpose of the course	The purpose of this course to provide learners with knowledge and skills in a range of technologies in particular, the blending of these technologies into new and innovative applications and to service and maintain these applications. Applications of integrated technologies are found in a diverse range of industries such as process control manufacturing, medical equipment servicing, telecommunications, building automation, computer networking, transport/automotive renewable energy etc. The primary target group for this course are school leavers who want to gain employment in a technical role in a range of industry areas. The course also provides a pathway for tradespeople in the electrotechnology or engineering industries, to upskill to a leading tradesperson, technician or technical officer role.

3. Development of the course	Standards 1 and 2 AQTF Standards for Accredited Courses

3.1 Industry /enterprise/ community needs	Integrated technology is the coming together of various technologies that were stand alone, into new and innovative integrated applications. The term primarily relates to the transfer of information through electronic means. This technology is changing the nature of work, the way people work and the skills they need. The impact of the application of integrated technologies is being increasingly felt within a range of industry areas such as automotive, building and construction, engineering, electrical, electronic, information technology and telecommunications industries. The technology used by these industries range from traditional electronics, hardware platform, networking automation, fibre internet connectivity
	
	The following industry examples illustrate the application integrated technology skills:
	  – Hospitals employing technicians who are involved with installing and maintaining a complex array of medical equipment. This sector has a need for people with skills spanning electronics, microwaves, computer networking, pneumatics, hydraulics and general engineering.
	  – Engineering manufacturing companies who employ technologists with skills spanning programmable control, robotics, fabrication together with skills in estimating, quoting and tendering.

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- Telecommunications companies whose employees' skills span installation and maintenance of sustainable energy systems together with providing technical support such as customer training and post sales helpdesk.

The ongoing availability of this course has the support of key industry organisations that represent the industries (see membership of the PSC), which are reliant on access to well-trained integrated technology technicians. In the absence of a suitable training package qualification to meet the needs of integrated technology training, the Higher Education and Skills Group, of the Victorian Department of Education and Training has funded the review and reaccreditation of this course.

The Certificate IV in Integrated Technologies also includes a cluster of recently updated Cisco Systems approved units which when successfully completed result in the learner receiving certification, as a Certified Cisco Networking Associate (CCNA) This certification will enhance the graduate's employment opportunities.

The primary target group for this course are school leavers who want to gain employment in a technical role in a range of industry areas.

The qualification also provides a pathway for secondary students who have studied 22289VIC Certificate II in Integrated Technologies through VET in Schools programs. As well, the course provides a pathway for tradespersons in electrotechnology or engineering industries, wanting to progress to a leading tradesperson, technician or technical officer role.

Specific skills in an integrated technology context will cover:

- installation
- setting up
- maintenance
- fault diagnosis and rectification.

A general knowledge and skills list for a technician working with blended technologies has been included in Appendix 1.

The review of the current course for reaccreditation has been guided by a project steering committee (PSC) consisting of the following people:

Anna Henderson (Chairperson)	Business Skills Viability
Emma McDonald	Telstra Corporation Ltd.
Emma Broadbent	Cisco Systems
Dominic Schipano	Communication & Information Technology Training Ltd. (CITT)
Gabriele Giofre	Australian Digital & Telecommunications Industry Association Inc (adtia)
Alex Newman	Future Energy Skills
Alan Bradley	Engineers Australia

	Ian Turnbull	Applied Technology Training and Consulting Australia
	Husnen Rupani	Infinispark Pty Ltd.
	In attendance:	
	George Adda	CMM - Engineering Industries
	Trevor Lange	CMM – Engineering Industries
	This course: − does not duplicate, by title or coverage, the outcomes of an endorsed training package qualification − is not a subset of a single training package qualification that could be recognised through one or more statements of attainment or a skill set − does not include units of competency additional to those in a training package qualification that could be recognised through statements of attainment in addition to the qualification − does not comprise units that duplicate units of competency of a training package qualification	
3.2 Review for re-accreditation	The 22263VIC - Certificate IV in Integrated Technologies has been monitored throughout its' accreditation period by the CMM – Engineering Industries. During this period the most significant change has been updating of the four Cisco units. These units were updated in May 2018 to address version 6 in the Cisco environment. The units remain current and have been carried over unaltered into the revised course and new codes have been applied. The units are: VU22324 Build a simple network and establish end to end connectivity VU22325 Configure and troubleshoot network switches and routers VU22326 Apply network scaling tools and techniques VU22327 Establish connectivity to a wide area network (WAN) Enrolment figures for the 22263VIC Certificate IV in Integrated Technologies for the past four years are: − 2014 - 61 − 2015 - 143 − 2016 - 150 − 2017 - 129 − 2018 – 79 Based on the individual unit enrolment data for the past five years it was evidence that a number of elective units in the current course were not used. It was the decision of the PSC these units should be deleted from the revised course.	

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All imported training package units and State accredited course units retained have been reviewed for their currency and replaced where necessary, with their more updated versions.

Seven cyber security units were added to the elective bank in response to the need for increasing demand for knowledge and skills in this area.

In addition to the reduction in the number of elective units, the use of technology specialisations streams was discontinued and replaced by a single cluster of elective units.

The current maths unit in the core component of the course structure was replaced with a less challenging unit. RTO feedback indicated that many students were having difficultly completing the current mathematics unit (VU2153). This unit however, has been retained as an elective unit for those students seeking a higher level of mathematics.

Finally, the course structure has been simplified to now require the completion of the core units plus a selection of six (6) elective units rather than core units plus a selection of units to meet a numbers of hours from two or more specialisations.

This course will replace 22263VIC Certificate IV in Integrated Technologies and is **not equivalent** to the replaced course.

The transition arrangements between the current and revised course are provided in **Table 1** below.

Table 1: Transition Arrangements

22263VIC Certificate IV in Integrated Technologies		22519VIC Certificate IV in Integrated Technologies		Comments
Unit code	Unit Title	Unit code	Unit Title	
Core		**Core**		
MEM30007A	Select common engineering materials	MEM30007A	Select common engineering materials	Same unit
UEENEEE101A	Apply Occupational Health and Safety regulations, codes and practices in the workplace	UEENEEE101A	Apply Occupational Health and Safety regulations, codes and practices in the workplace	Same unit
UEENEEE102A	Fabricate, assemble and dismantle utilities industry components	UEENEEE102A	Fabricate, assemble and dismantle utilities industry components	Same unit
UEENEEE141A	Use of routine equipment /plant/ technologies in an energy sector environment	UEENEEE141A	Use of routine equipment /plant/ technologies in an energy sector environment	Same unit
VU21534	Apply mathematics in an integrated technology context	VU22333	Perform intermediate engineering computations	Not Equivalent
VU21535	Implement an integrated technology project	VU22746	Undertake an integrated technology project	Equivalent
VU21536	Apply computer tools and networking in an integrated technology context	VU22747	Apply computer tools and networking in an integrated technology context	Equivalent
Electives		Electives		
		ICTICT103	Use, communicate and search securely on the internet	New Unit
ICANWK301A	Provide network systems administration	ICTNWK301	Provide network systems administration	Equivalent

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ICANWK303A	Configure and administer a network operating system	ICTNWK303	Configure and administer a network operating system	Equivalent
ICANWK405A	Build a small wireless local area network	ICTNWK405	Build a small wireless local area network	Equivalent
ICANWK408A	Configure a desktop environment	ICTNWK408	Configure a desktop environment	Equivalent
ICANWK410A	Install hardware to a network	ICTNWK410	Install hardware to a network	Equivalent
		ICTSAS307	Install, configure and secure a small office or home office network	New Unit
ICASAS409A	Manage risks involving ICT systems and technology	ICTSAS409	Manage risks involving ICT systems and technology	Equivalent
ICASAS410A	Identify and resolve client IT problems	ICTSAS410	Identify and resolve client ICT problems	Equivalent
ICASAS412A	Action change requests	ICTSAS412	Action change requests	Equivalent
ICASAS418A	Monitor and administer security of an IT system	ICTSAS418	Monitor and administer security of an ICT system	Equivalent
ICASAS419A	Support system software	ICTSAS419	Support system software	Equivalent
ICASAS420A	Provide first-level remote help-desk support	ICTSAS420	Provide first-level remote help desk support	Equivalent
ICASAS421A	Support users and troubleshoot desktop applications	ICTSAS421	Support users and troubleshoot desktop applications	Equivalent
ICASAS424A	Support different operating systems	ICTSAS424	Support different operating systems	Equivalent
ICASAS425A	Configure and troubleshoot operating system software	ICTSAS425	Configure and troubleshoot operating system software	Equivalent
ICASAS426A	Locate and troubleshoot IT equipment, system and software faults	ICTSAS426	Locate and troubleshoot ICT equipment, system and software faults	Equivalent
MEM23064A	Select and test mechatronic engineering materials	MEM23064A	Select and test mechatronic engineering materials	Same Unit
MEM30011A	Set up basic pneumatic circuits	MEM30011A	Set up basic pneumatic circuits	Same Unit
		MEM30031A	Operate computer-aided design (CAD) system to produce basic drawing elements	New Unit
UEENEED104A	Use engineering applications software on personal computers	UEENEED104A	Use engineering applications software on personal computers	Same Unit
UEENEED115A	Administer computer networks	UEENEED115A	Administer computer networks	Same Unit
UEENEED124A	Integrate multiple computer operating systems on a client server local area network	UEENEED124A	Integrate multiple computer operating systems on a client server local area network	Same Unit
UEENEEE104A	Solve problems in multiple path d.c. circuits	UEENEEE104A	Solve problems in multiple path d.c. circuits	Same Unit
UEENEEE105A	Fix and secure electrotechnology equipment	UEENEEE105A	Fix and secure electrotechnology equipment	Same Unit
UEENEEE107A	Use drawings, diagrams,schedules,standards,codes and specifications	UEENEEE107A	Use drawings, diagrams,schedules,standards,codes and specifications	Same Unit
		UEENEEG006A	Solve probles in single and three phase low voltage machines	New unit
		UEENEEG101A	Solve problems in electromagnetic devices and related circuits	New unit
		UEENEEG102A	Solve problems in low voltage a.c.circuits	New unit
		UEENEEG106A	Terminate cables,cords and accessories for low voltage circuits	New unit
		VU22748	Apply mathematics in an integrated technology context	New Unit
VU21083	Test and commission transducers and sensors	VU22749	Install, test and commission transducers and sensors	Equivalent

VU21087	Write programs for programmable logic controllers	VU22750	Write programs for programmable logic controllers (PLCs)	Equivalent
VU21339	Set up and commission programmable logic controllers	VU22751	Set up and commission programmable logic controllers (PLCs)	Equivalent
VU21086	Develop, enter and verify programs for SCADA systems	VU22752	Develop, enter and verify programs for SCADA systems	Equivalent
VU21572	Install and maintain induction motors	VU22753	Install and maintain induction motors	Equivalent
VU21610	Perform precision measurements	VU22754	Perform precision measurements	Equivalent
VU21573	Diagnose and rectify faults in AC. motor drive systems	VU22755	Identify and repair faults in AC motor control systems	Equivalent
VU21574	Diagnose and rectify faults in DC. motor drive systems	VU22756	Identify and repair faults in DC motor control systems	Equivalent
		VU22757	Apply basic scientific principles and techniques in mechanical engineering situations	New Unit
VU21270	Implement control processes using PLCs	VU21270	Implement control processes using PLCs	Same unit
		VU21988	Utilise basic network concepts and protocols required in cyber security	New Unit
		VU21990	Recognise the need for cyber security in an organisation	New Unit
		VU21993	Secure a networked personal computer	New Unit
		VU22257	Configure security devices for an organisation	New Unit
		VU22674	Explore applications and operation of the Inernet of Things (IoT)	New Unit
VU22324	Build a simple network and establish end to end connectivity	VU22758	Build a simple network and establish end to end connectivity	Equivalent
VU22325	Configure and troubleshoot network switches and routers	VU22759	Configure and troubleshoot network switches and routers	Equivalent
VU22326	Apply network scaling tools and techniques	VU22760	Apply network scaling tools and techniques	Equivalent
VU22327	Establish connectivity to a wide area network (WAN)	VU22761	Establish connectivity to a wide area network (WAN)	Equivalent
VU21561	Build a simple network and establish end to end connectivity	Unit removed		
VU21562	Configure and troubleshoot network switches and routers	Unit removed		
VU21563	Scale an existing network	Unit removed		
VU21564	Establish connectivity to a wide area network (WAN)	Unit removed		
VU20906	Configure and program a basic robotic system	VU22338	Configure and program a basic robotic system	Equivalent
VU21219	Set up mechatronics engineering systems	VU22563	Set up mechatronics engineering systems	Equivalent
VU21170	Implement and maintain control systems for industrial processes	Unit removed		
VU21172	Apply instrumentation principles to industrial control systems	Unit removed		
VU21173	Interface control systems to industrial processes and analyse data from Data Acquisition Systems (SCADA)	Unit removed		

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VU21174	Program control systems	Unit removed
VU21176	Utilise digital electronics for control applications	Unit removed
VU21232	Program, operate and select a robotics system	Unit removed
VU21203	Apply hydraulic principles in engineering	Unit removed
VU21204	Apply pneumatic principles in engineering	Unit removed
VU21388	Set up and test an embedded control system	Unit removed
VU21387	Test and verify correct operation of a "by-wire" control system	Unit removed
VU21352	Implement a digital circuit using a programmable logic devices (PLD)	Unit removed
VU21340	Program a basic robotic system	Unit removed
VU21086	Develop, enter and verify programs for SCADA systems	Unit removed
VU21085	Integrate programmable logic controllers into industrial control processes	Unit removed
VU21084	Set up electronically controlled robotically operated complex systems	Unit removed
VU21082	Set up electronically controlled mechanically operated complex systems	Unit removed
VU21611	Dismantle and assemble engineering components or subassemblies	Unit removed
VU20903	Produce basic engineering components and products using fabrication and machining	Unit removed
VU20904	Perform cutting, grinding and turning operations	Unit removed
VU20909	Develop an individual career plan for the engineering industry	Unit removed
VU20910	Produce basic engineering sketches and drawings	Unit removed
VU20911	Handle engineering materials	Unit removed
VU20912	Perform basic machining processes	Unit removed
VU20913	Apply basic fabrication techniques	Unit removed
VU20914	Form, bend and shape engineering materials	Unit removed
VU20915	Perform basic welding and thermal cutting processes to fabricate engineering structures	Unit removed
VU20916	Create engineering drawings using computer aided systems	Unit removed
VU21095	Apply electrotechnology principles in an engineering work environment	Unit removed

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VU21096	Use basic engineering concepts to plan the manufacture of engineering components	Unit removed
VU21207	Set up advanced manufacturing systems (AMS)	Unit removed
VU21232	Program, operate and select a robotics system	Unit removed
VU21239	Apply safe working practice when operating vacuum systems	Unit removed
VU21240	Apply vacuum principles to advanced manufacturing	Unit removed
VU21241	Identify & select vacuum components & materials	Unit removed
VU21242	Operate vacuum components and systems	Unit removed
VU21243	Maintain & repair vacuum systems	Unit removed
VU21537	Use computers for engineering related work activities	Unit removed
VU21538	Perform basic computational principles in engineering work activities	Unit removed
VU21539	Use fundamental refrigeration principles and processes to make refrigeration and/or air conditioning equipment operational	Unit removed
VU21540	Assemble and test electronic engineering equipment and make it operational	Unit removed
VU21541	Maintain rechargeable battery systems	Unit removed
VU21542	Identify and locate building blocks of a centralised power generation system	Unit removed
VU21543	Set up an extra low voltage emergency power supply system (not exceeding 32V)	Unit removed
VU21544	Install a sustainable extra low voltage energy power system	Unit removed
VU21609	Install and maintain hydraulic/pneumatic systems	Unit removed
VU21545	Evaluate proportional and servo controlled fluid power systems	Unit removed
VU21546	Monitor and adjust an integrated fluid power control system	Unit removed
VU21547	Select components for an integrated fluid power design project	Unit removed
VU21548	Install and commission an integrated fluid power system	Unit removed
VU21549	Conduct a feasibility study for an integrated fluid power system	Unit removed
VU21550	Evaluate performance of electrical machines	Unit removed
VU21551	Test and monitor fluid power circuits	Unit removed

VU20177	Plan and build a system using fibre optic equipment	Unit removed
VU20178	Use fibre optic equipment in engineering technology	Unit removed
VU20179	Use fibre optic equipment in communications technology	Unit removed
VU21552	Operate a small power supply system	Unit removed
VU21553	Assemble and connect an extra low voltage battery power source	Unit removed
VU21541	Maintain rechargeable battery systems	Unit removed
VU21542	Identify and locate building blocks of a centralised power generation system	Unit removed
VU21543	Set up an extra low voltage emergency power supply system (not exceeding 32V)	Unit removed
VU21544	Install a sustainable extra low voltage energy power system	Unit removed
VU21239	Apply safe working practice when operating vacuum systems	Unit removed
VU21240	Apply vacuum principles to advanced manufacturing	Unit removed
VU21241	Identify & select vacuum components & materials	Unit removed
VU21242	Operate vacuum components and systems	Unit removed
VU21243	Maintain & repair vacuum systems	Unit removed
VU21554	Perform basic network and computer assembly	Unit removed
VU21555	Perform basic network and computer maintenance	Unit removed
VU21556	Install and configure basic network and computer operating systems	Unit removed
VU21557	Install and configure a home or small office network	Unit removed
VU21558	Install and configure a small to medium business network	Unit removed
VU21559	Implement and troubleshoot enterprise routers and switches	Unit removed
VU21560	Design, install and configure an internet	Unit removed
VU21565	Install and test a home entertainment system	Unit removed
VU21581	Build a small wireless LAN	Unit removed
VU21566	Install and test a wireless intercom system	Unit removed
VU21567	Conduct a site survey for a wireless network	Unit removed
VU21568	Set up and operate a wireless communications link	Unit removed
VU21569	Install communications antennae	Unit removed
VU21610	Perform precision measurements	Unit removed

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VU21611	Dismantle and assemble engineering components or subassemblies	Unit removed
VU21570	Apply electrical principles to route selection of power distribution networks	Unit removed
VU21571	Apply electrical considerations to developing the design of power distribution infrastructure	Unit removed
VU21550	Evaluate performance of electrical machines	Unit removed
BSBDES501A	Implement design solutions	Unit removed
CUFBRT401A	Install or upgrade broadcast equipment and facilities	Unit removed
CUFBRT402A	Maintain broadcast equipment and facilities	Unit removed
CUFBRT403A	Ensure quality of broadcast output	Unit removed
CUFBRT501A	Collaborate on the design of broadcasting facilities	Unit removed
ICANWK411A	Deploy software to networked computers	Unit removed
CPPSEC3035A	Identify technical security requirements	Unit removed
CPPSEC3036A	Program security equipment and system	Unit removed
CPPSEC3037A	Test installed security equipment and system	Unit removed
CPPSEC3038A	Commission and decommission security equipment and system	Unit removed
CPPSEC3039A	Identify and diagnose electronic security equipment and system fault	Unit removed
CPPSEC3040A	Plan and co-ordinate installation of security equipment and system	Unit removed
CPPSEC3041A	Maintain and service security equipment and system	Unit removed
CPPSEC3046A	Configure a security system	Unit removed
CUFDIG201A	Maintain interactive content	Unit removed
CUFDIG302A	Author interactive sequences	Unit removed
CUFDIG501A	Coordinate the testing of interactive media products	Unit removed
ICAICT101A	Operate a personal computer	Unit removed
ICAICT201A	Use computer operating systems and hardware	Unit removed
ICAICT203A	Operate application software packages	Unit removed
ICAICT301A	Create user documentation	Unit removed
ICAICT302A	Install and optimise operating system software	Unit removed
ICAICT411A	Select and employ software and hardware testing tools	Unit removed
ICASAS419A	Support system software	Unit removed

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ICTCBL2136B	Install, maintain and modify customer premises communications cabling: ACMA Restricted Rule	Unit removed
ICTCMP2239A	Perform restricted customer premises broadband cabling work: ACMA restricted Rule	Unit removed
ICTCBL2137B	Install, maintain and modify customer premises communications cabling: ACMA Restricted Rule	Unit removed
UEENEEH101A	Repair basic computer equipment faults by replacement of modules/sub-assemblies	Unit removed
UEENEEH102A	Repairs basic electronic apparatus faults by replacement of components	Unit removed
UEENEEH112A	Troubleshoot digital sub-systems	Unit removed
UEENEEH115A	Develop software solutions for microcontroller based systems	Unit removed
UEENEEH166A	Troubleshoot microcontroller based hardware systems	Unit removed
UEENEEI155A	Develop structured programs to control external devices	Unit removed
BSBEBU501A	Investigate and design ebusiness solutions	Unit removed
BSBITU301A	Create and use databases	Unit removed
BSBPUR301B	Purchase goods and services	Unit removed
BSBWRT401A	Write complex documents	Unit removed
MEM11012B	Purchase materials	Unit removed
MEM16009A	Research and analyse engineering information	Unit removed
MEM16010A	Write reports	Unit removed
MEM16011A	Communicate with individuals and small groups	Unit removed
MEM16014A	Report technical information	Unit removed
MEM22015A	Source and estimate engineering materials required	Unit removed
MEM30023A	Prepare a simple cost estimate for a manufactured product	Unit removed
PSPGOV603B	Develop a tender submission response	Unit removed
UEENEEC004B	Prepare specifications for the supply of materials and equipment for electrotechnology projects	Unit removed
UEENEEC005B	Estimate electrotechnology projects	Unit removed
UEENEEC006B	Prepare tender submissions for electrotechnology projects	Unit removed
MEM09002B	Interpret technical drawing	Unit removed
MEM09003B	Prepare basic engineering drawing	Unit removed
MEM10004B	Enter and change programmable controller operational parameters	Unit removed
MEM10005B	Commission programmable controller programs	Unit removed
MEM10007C	Modify control systems	Unit removed

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MEM13014A	Apply principles of occupational health and safety in the work environment	Unit removed
MEM18001C	Use hand tools	Unit removed
MEM18002B	Use power tools/hand held operations	Unit removed
MEM18020B	Maintain hydraulic system components	Unit removed
MEM18021B	Maintain hydraulic systems	Unit removed
MEM23041A	Apply basic scientific principles and techniques in mechanical engineering situations	Unit removed
MEM30012A	Apply mathematical techniques in a manufacturing engineering or related environment	Unit removed
MEM18052B	Maintain fluid power systems for mobile plant	Unit removed
MEM23006A	Apply fluid and thermodynamics principles in engineering	Unit removed
MEM23114A	Evaluate thermodynamic systems and components	Unit removed
MEM23115A	Evaluate fluid power systems	Unit removed
MEM234007A	Design fluid power systems	Unit removed
MEM30010A	Set up basic hydraulic circuits	Unit removed
ICTITU5144A	Test telecommunications network using virtual instruments	Unit removed
ICTOPN5121A	Test and commission a dense wavelength division multiplexing transmission system	Unit removed
ICTOPN5122A	Test the performance of specialised optical devices	Unit removed
ICTOPN5123A	Analyse and integrate specialised optical devices in the network	Unit removed
UEENEEE108A	Lay wiring cabling and terminate accessories for extra-low voltage (ELV) circuits	Unit removed
UEENEEK101A	Maintain safety and tidiness of remote area power supply systems	Unit removed
UEENEEK102A	Work safely with remote area power supply systems	Unit removed
UEENEEK103A	Conduct periodic maintenance of remote area power supply battery banks	Unit removed
UEENEEK104A	Conduct periodic maintenance of remote area power supply generator sets	Unit removed
UEENEEK105A	Conduct periodic maintenance of remote area power supply photo voltaic arrays	Unit removed
UEENEEK106A	Conduct periodic maintenance of remote area power supply wind generators	Unit removed

UEENEEK107A	Conduct checks in the demand side use of remote area power supplies (RAPS)	Unit removed
UEENEEK108A	Plan periodic maintenance schedules of remote area power supplies (RAPS)	Unit removed
UEENEEK109A	Attend to breakdowns in remote area power supplies (RAPS)	Unit removed
UEENEEK110A	Co-ordinate maintenance of renewable energy (RE) apparatus and systems	Unit removed
UEENEEK111A	Assemble and connect remote area power supplies	Unit removed
UEENEEK112A	Provide basic sustainable energy solutions for energy reduction in residential premises	Unit removed
UEENEEK114A	Promote sustainable energy practice in the community	Unit removed
UEENEEK116A	Maintain and repair remote area power generation facilities	Unit removed
UEENEEK117A	Maintain and repair facilities associated with remote area essential services operation	Unit removed
UEENEEK120A	Maintain operation of remote area power generation plant	Unit removed
UEENEEK123A	Carry out basic repairs to renewable energy apparatus	Unit removed
UEENEEK125A	Solve basic problems in photovoltaic energy apparatus and systems	Unit removed
UEENEEK127A	Diagnose and rectify faults in renewable energy control systems	Unit removed
UEENEEK128A	Solve problems in stand-alone renewable energy systems	Unit removed
UEENEEK130A	Solve problems in wind energy conversion systems rated up to 10 kW	Unit removed
UEENEEK132A	Develop strategies to address environmental and sustainability issues in the energy sector	Unit removed
UEENEEK137A	Install, set up and maintain ELV micro-hydro systems rated up to 6.4 kW	Unit removed
UEENEEK138A	Design micro-hydro systems rated to 6.4 kW	Unit removed
UEPMNT410B	Diagnose and repair faults in electronic equipment	Unit removed
UEPMNT411B	Diagnose and repair faults in complex electrical equipment	Unit removed
UEPMNT420A	Perform Electrical/Electronic Drafting	Unit removed
UEPMNT433B	Conduct Routine Generator Electrical Maintenance	Unit removed
UEPOPS238B	Maintain battery banks and cells	Unit removed
UEPOPS343B	Operate Hydro-Electric Generating Plant and Auxiliary Equipment	Unit removed

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UEPOPS347B	Operate and Monitor Supervisory, Control and Data Acquisition Systems	Unit removed
ICAWEB408A	Ensure basic website security	Unit removed
ICAICT302A	Install and optimise operating system software	Unit removed
ICAICT305A	Identify and use current industry-specific technologies	Unit removed
ICAICT401A	Determine and confirm client business requirements	Unit removed
ICAICT407A	Maintain website information standards	Unit removed
ICAICT409A	Develop macros and templates for clients using standard products	Unit removed
ICAICT410A	Conduct post-implementation IT system reviews	Unit removed
ICAICT411A	Select and employ software and hardware testing tools	Unit removed
ICAICT415A	Provide one-to-one instruction	Unit removed
ICAICT417A	Identify, evaluate and apply current industry-specific technologies to meet industry standards	Unit removed
ICAICT501A	Research and review hardware technology options for organisations	Unit removed
ICANWK305A	Install and manage network protocols	Unit removed
ICANWK401A	Install and manage a server	Unit removed
ICANWK402A	Install and configure virtual machines for sustainable ICT	Unit removed
ICANWK403A	Manage network and data integrity	Unit removed
ICANWK404A	Install, operate and troubleshoot a small enterprise branch network	Unit removed
ICANWK406A	Install, configure and test network security	Unit removed
ICANWK407A	Install and configure client-server applications and services	Unit removed
ICANWK409A	Create scripts for networking	Unit removed
ICANWK411A	Deploy software to networked computers	Unit removed
ICANWK416A	Build security into virtual private networks	Unit removed
ICANWK511A	Manage network security	Unit removed
ICANWK532A	Identify and resolve network problems	Unit removed
ICAPRG405A	Automate processes	Unit removed
ICAPRG407A	Write script for software applications	Unit removed
ICAPRG409A	Develop mobile applications	Unit removed
ICAPRG412A	Configure and maintain databases	Unit removed
ICAPRG414A	Apply introductory programming skills in another language	Unit removed
ICAPRG415A	Apply skills in object-oriented design	Unit removed
ICAPRG425A	Use structured query language	Unit removed
ICASAS301A	Run standard diagnostic tests	Unit removed

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ICASAS304A	Provide basic system administration	Unit removed
ICASAS305A	Provide IT advice to clients	Unit removed
ICASAS406A	Implement and hand over system components	Unit removed
ICASAS408A	Complete data transition in data migration process	Unit removed
ICASAS409A	Manage risks involving ICT systems and technology	Unit removed
ICASAS410A	Identify and resolve client IT problems	Unit removed
ICASAS411A	Assist with policy development for client support procedures	Unit removed
ICASAS412A	Action change requests	Unit removed
ICASAS414A	Evaluate system status	Unit removed
ICASAS415A	Optimise IT system performance	Unit removed
ICASAS416A	Implement maintenance procedures	Unit removed
ICASAS417A	Undertake IT system capacity planning	Unit removed
ICASAS418A	Monitor and administer security of an IT system	Unit removed
ICASAS419A	Support system software	Unit removed
ICASAS420A	Provide first-level remote help-desk support	Unit removed
ICASAS421A	Support users and troubleshoot desktop applications	Unit removed
ICASAS425A	Configure and troubleshoot operating system software	Unit removed
ICASAS426A	Locate and troubleshoot IT equipment, system and software faults	Unit removed
ICASAS502A	Establish and maintain client user liaison	Unit removed
ICASAS510A	Review and develop IT maintenance strategy	Unit removed
ICAWEB404A	Maintain website performance	Unit removed
ICAWEB405A	Monitor traffic and compile website traffic reports	Unit removed
ICAWEB413A	Optimise search engines	Unit removed
ICTCBL2136A	Install, maintain and modify customer premises communications cabling: ACMA Restricted Rule	Unit removed
ICTCBL2139A	Apply safe technical work practices for cabling registration	Unit removed
ICTEDU3053A	Train customers in new technology	Unit removed
ICTTEN4051A	Install configuration programs on PC based customer equipment	Unit removed
ICTTEN4199A	Install, configure and test a router	Unit removed
UEENEED102A	Assemble, set-up and test computing devices	Unit removed
UEENEED112A	Support computer hardware and software for engineering applications	Unit removed

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UEENEED117A	Install and configure network systems for internetworking	Unit removed
UEENEED146A	Set up and configure basic local area network (LAN)	Unit removed
ICAA5045C	Produce network architecture design	Unit removed
ICAD4217B	Create technical documentation	Unit removed
ICTCBL2005A	Install customer cable support systems	Unit removed
ICTCBL2006A	Place and secure customer cable	Unit removed
ICTCBL2008A	Terminate metallic conductor customer cable	Unit removed
ICTCBL2012A	Install functional and protective telecommunications earthing system	Unit removed
ICTCBL2017A	Alter services to existing cable system	Unit removed
ICTCBL2064A	Haul underground cable	Unit removed
ICTCBL2066A	Joint and terminate co-axial cable	Unit removed
ICTCBL2068A	Install a telecommunications service to a building	Unit removed
ICTCBL2131A	Install an above ground equipment enclosure	Unit removed
ICTCBL2132A	Erect aerial cable supports	Unit removed
ICTCBL2133A	Construct underground telecommunications infrastructure	Unit removed
ICTCBL2134A	Fix aerial cable	Unit removed
ICTCMP2022A	Organise and monitor cabling to ensure compliance with regulatory and industry standards	Unit removed
ICTPMG2130A	Prepare site for support installation	Unit removed
ICTRFN3055A	Install a radio communications antenna and feedline	Unit removed
ICTRFN4095A	Conduct radio frequency measurements	Unit removed
ICTTEN2140A	Use hand and power tools	Unit removed
ICTTEN3250A	Provide infrastructure for telecommunications customer equipment	Unit removed
ICTWOR2141A	Work effectively in a telecommunications technology team	Unit removed
ICTWOR3035A	Organise material supply	Unit removed
ICASAS411A	Assist with policy development for client support procedures	Unit removed
ICASAS413A	Manage resolution of system faults on a live system	Unit removed
ICASAS414A	Evaluate system status	Unit removed
ICASAS415A	Optimise IT system performance	Unit removed
ICASAS416A	Implement maintenance procedures	Unit removed
ICASAS417A	Undertake IT system capacity planning	Unit removed
ICAWEB405A	Monitor traffic and compile website traffic reports	Unit removed

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ICAWEB408A	Ensure basic website security	Unit removed			
ICAWEB413A	Optimise search engines	Unit removed			
ICAICT401A	Determine and confirm client business requirements	Unit removed			
ICAICT407A	Create technical documentation	Unit removed			
ICAICT409A	Develop macros and templates for clients using standard products	Unit removed			
ICAICT411A	Select and employ software and hardware testing tools	Unit removed			
ICAICT420A	Develop client user interface	Unit removed			
ICANWK407A	Install and configure client-server applications and services	Unit removed			
ICANWK416A	Build security into virtual private networks	Unit removed			
ICANWK411A	Deploy software to networked computers	Unit removed			
ICANWK402A	Install and configure virtual machines for sustainable ICT	Unit removed			
UEENEEE123A	Solve basic problems electronic and digital equipment and circuits	Unit removed			
UEENEEH114A	Troubleshoot resonance circuits in an electronic apparatus	Unit removed			
UEENEEH139A	Troubleshoot basic amplifier circuits	Unit removed			
ICANWK417A	Build an enterprise wireless network	Unit removed			
ICASAS406A	Implement and hand over system components	Unit removed			
		VU22963	Build and implement a basic network	New unit	
		VU22964	Configure a small to medium network for an organisation	New unit	
		VU22965	Secure and monitor the performance of a small to medium network	New unit	
		VU22966	Investigate design concepts of an accessible and secure network	New unit	

4. Course outcomes Standards 1, 2, 3 and 4 AQTF Standards for Accredited Courses

4.1 Qualification level	*Standards 1, 2 and 3 AQTF Standards for Accredited Courses*
	This course is consistent with the Australian Qualifications Framework (AQF) for a Certificate IV level qualification in that graduates will have the following learning attributes.
	Knowledge
	Graduates will have broad factual, technical and theoretical knowledge in a specialised field of work and learning. For example, in applying an in depth knowledge of regulatory and safety requirements relating to integrated technologies.
	Skills
	Graduates will have:

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	• cognitive skills to identify, analyse, compare and act on information from a range of sources. For example, in analysing cabling diagrams, machine drawings, system schematics and appropriated lists for commissioning, testing, maintenance and fault finding purposes • cognitive, technical and communication skills to apply and communicate technical solutions of a non-routine or contingency nature to a defined range of predictable and unpredictable problems. For example, in methodically solving problems by fault finding a wide range of equipment and associated infrastructure, even in unfamiliar contexts • specialist technical skills to complete routine and non-routine tasks and functions. For example, in applying integrated technologies to a range of tasks and functions; • communication skills to guide activities and provide technical advice in the area of work or learning. For example, in providing technical advice to clients and colleagues on integrated technology solutions. **Application of knowledge and skills** Graduates will demonstrate the application of knowledge and skills: • to specialised tasks and functions, such as the detailed maintenance and repair of a wide range of systems and infrastructure • with responsibility for own functions and outputs. For example, in commissioning and testing of electrical, mechanical, medical systems, telecommunications or sustainable energy systems equipment and associated infrastructure • with limited responsibility for organisation of others. For example, in supervising small integrated technology work teams and provide technical support. **Volume of learning** The volume of learning for this qualification is typically between 0.5 to 2 years. The Certificate IV course is designed to meet the requirements for an integrated technology practitioner and is equivalent to 1 full time year. It incorporates structure training as well as self-directed learning activities such as reading texts, research and gathering information, completing assignments and project work.
4.2 Employability skills	*Standard 4 AQTF Standards for Accredited Courses* The Employability Skills for the Certificate IV in Integrated Technologies are summarised in **Table 2**.

Table 2: Summary of the Employability Skills

Employability Skills	Industry/enterprise requirements for this qualification include the following facets. On successful completion of the course a graduate should be able to:
Communication	• Listening to and understanding given instructions • Speaking clearly and directly • Reading and following written work descriptions • Reporting work completion to appropriate personnel • Completing documentation
Teamwork	• Working cooperatively with other team members • Participating in group discussion of WHS/OHS procedures • Organising and supervise small team activities that provide technical support
Problem solving	• Applying problem solving techniques to routine problems with respect to integrated technologies • Developing practical solutions by applying combined technologies • Using a team approach to solve problems • Using simple mathematical calculations to support problem solving
Initiative and enterprise	• Adapting to new work situations • Improving knowledge with respect to changing technologies • Identifying process improvement opportunities • Showing some creativity in approach to work solutions/problem solving
Planning and organising	• Collecting, analysing and organising information • Managing and monitoring own and small group time and priorities • Taking initiative and making decisions
Self-management	• Working unsupervised • Having confidence in own knowledge to meet goals • Evaluating and monitoring own performance • Taking responsibility for work quality and completion timelines
Learning	• Managing own learning • Using skills in different contexts • Using mentoring and coaching activities
Technology	• Using internet and intranet • Using ICT skills to complete activities • Using industry relevant software, technology and equipment • Using technologies to perform tasks

4.3 Recognition given to the course	*Standard 5 AQTF Standards for Accredited Courses* Not applicable			
4.4 Licensing/ regulatory requirements	*Standard 5 AQTF Standards for Accredited Courses* No licensing, legislative, regulatory or certification requirements apply to this course at the time of publication.			

5. Course rules	**Standards 2, 6,7 and 9 AQTF Standards for Accredited Courses**

5.1 Course structure

To be eligible for the award of the *22519VIC Certificate IV in Integrated Technologies*, participants must successfully complete a total of fifteen (15) units consisting of:

- seven (7) core units *plus*

- any eight (8) elective units selected from the list below

  or

- minimum of any four (4) elective units selected from the list below and the remaining elective units (maximum of four (4) units), can be selected from any training package qualification or accredited course provided each unit is consistent with the vocational outcomes of this course and doesn't jeopardise the AQF integrity of this course.

Participants who do not complete all the required units for the qualification will be issued with a Statement of Attainment listing the units they have successfully completed.

Unit code	Field of Education code (six-digit)	Unit Title	Pre-requisite	Nominal hours
Core units:				
MEM30007A	030305	Select common engineering materials	None	40
UEENEEE101A	061301	Apply Occupational Health and Safety regulations, codes and practices in the workplace	None	20
UEENEEE102A	031313	Fabricate, assemble and dismantle utilities industry components	UEENEEE101A	40
UEENEEE141A	030717	Use of routine equipment/plant/technologies in an energy sector environment	UEENEEE101A	60

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Unit code	Field of Education code(six-digit)	Unit Title	Pre-requisite	Nominal hours
VU22333	030199	Perform intermediate engineering computations	None	40
VU22746	031399	Undertake an integrated technology project	None	60
VU22747	020199	Apply computer tools and networking in an integrated technology context	None	50
		Total nominal hours for core units =		**310**
Unit code	**Field of Education code(six-digit)**	**Unit Title**	**Pre-requisite**	**Nominal hours**
Electives units:				
VU22748	010101	Apply mathematics in an integrated technology context	None	50
VU22749	030703	Install, test and commission transducers and sensors	None	60
VU22750	030703	Write programs for programmable logic controllers (PLCs)	None	60
VU22751	030703	Set up and commission programmable logic controllers (PLCs)	None	40
VU22752	030703	Develop, enter and verify programs for SCADA systems	None	60
VU22753	031301	Install and maintain induction motors	UEENEEG006A	60
VU22754	030101	Perform precision measurements	None	30
VU22755	031301	Identify and repair faults in AC motor control systems	None	60
VU22756	031301	Identify and repair faults in DC motor control systems	None	60
VU22757	030701	Apply basic scientific principles and techniques in mechanical engineering situations	None	80
VU21270	030101	Implement control processes using PLCs	None	80

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VU21988	029901	Utilise basic network concepts and protocols required in cyber security	None	80
VU21990	029901	Recognise the need for cyber security in an organisation	None	60
VU21993	029901	Secure a networked personal computer	None	60
VU22257	029901	Configure security devices for an organisation	None	80
~~VU22758~~	~~020113~~	~~Build a simple network and establish end to end connectivity~~	~~None~~	~~90~~
VU22963	020113	Build and implement a basic network	None	100
~~VU22759~~	~~020113~~	~~Configure and troubleshoot network switches and routers~~	~~None~~	~~100~~
VU22964	020113	Configure a small to medium network for an organisation	None	90
~~VU22760~~	~~020113~~	~~Apply network scaling tools and techniques~~	~~None~~	~~90~~
VU22965	020113	Secure and monitor the performance of a small to medium network	None	100
~~VU22761~~	~~020113~~	~~Establish connectivity to a wide area network (WAN)~~	~~None~~	~~100~~
VU22966	020113	Investigate design concepts of a accessible and secure network	None	90
VU22338	030199	Configure and program a basic robotic system	None	60
VU22563	030703	Set up mechatronics engineering systems	None	60
VU22674	020113	Explore applications and operation of the Internet of Things (IoT)	None	20
ICTICT103	080905	Use, communicate and search securely on the internet	None	50
ICTNWK301	029999	Provide network systems administration	None	60
ICTNWK405	020113	Build a small wireless local area network	None	20

ICTNWK410	020113	Install hardware to a network	None	40
ICTSAS307	020113	Install and configure and secure a small office or home office network	None	50
ICTSAS409	029901	Manage risks involving ICT systems and technology	None	20
ICTSAS410	020305	Identify and resolve client ICT problems	None	40
ICTSAS412	031305	Action change requests	None	40
ICTSAS418	029901	Monitor and administer security of an ICT system	None	30
ICTSAS419	029999	Support system software	None	50
ICTSAS420	029999	Provide first-level remote help desk support	None	30
ICTSAS421	029999	Support users and troubleshoot desktop applications	None	20
ICTSAS424	080905	Support different operating systems	None	40
ICTSAS425	080905	Configure and troubleshoot operating system software	None	40
ICTSAS426	080905	Locate and troubleshoot ICT equipment, system and software faults	None	40
ICTNWK303	029999	Configure and administer a network operating system	None	70
ICTNWK408	080905	Configure a desktop environment	None	40
MEM23064A	030101	Select and test mechatronic engineering materials	None	60
MEM30011A	030999	Set up basic pneumatic circuits	None	40
MEM30031A	039999	Operate computer-aided design (CAD) system to produce basic drawing elements	None	40
UEENEED104A	080905	Use engineering applications software on personal computers	UEENEED101A	40
UEENEED115A	020113	Administer computer networks	UEENEED124A UEENEEE101A	80
UEENEED124A	020113	Integrate multiple computer operating systems on a client	UEENEEE101A	80

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		server local area network		
UEENEEE104A	031313	Solve problems in multiple path d.c. circuits	UEENEEE101A	80
UEENEEE105A	031317	Fix and secure electrotechnology equipment	UEENEEE101A	20
UEENEEE107A	031313	Use drawings, diagrams, schedules, standards, codes and specifications	UEENEEE101A	40
UEENEEG006A	031313	Solve problems in single and three phase low voltage machines	UEENEEE101A UEENEEE102A UEENEEE104A UEENEEE105A UEENEEE107A UEENEEG101A UEENEEG102A UEENEEG106A	80
UEENEEG101A	031313	Solve problems in electromagnetic devices and related circuits	UEENEEE101A UEENEEE104A	60
UEENEEG102A	031313	Solve problems in low voltage a.c. circuit	UEENEEE101A UEENEEE104A UEENEEG101A	80
UEENEEG106A	031313	Terminate cables, cords and accessories for low voltage circuits	UEENEEE101A UEENEEE102A UEENEEE105A UEENEEE107A	40
		Total nominal hour range for elective units =		**190-640**
		Total course nominal hour range =		**500-1010**

5.2 Entry requirements	*Standard 9 AQTF Standards for Accredited Courses*
	There are *no essential entry requirements* for this course. However, learners are best equipped to achieve the vocational outcomes of this course if they have:
	– language, literacy and numeracy skills that are equivalent to Level 3 of the Australian Core Skill Framework (ACSF). Full details,descriptors and tests of the ACSF can be found on website: https://www.education.gov.au/australian-core-skills-framework.

	– digital literacy and technology skills to self–manage generic software applications such as the ability to:
	      – navigate within the system
	      – save, retrieve and open files
	
	 or
	
	 – completion of Certificate II in Integrated Technologies or a trade qualification such as the Certificate III in Electrotechnology (Electrician)
	
	 Learners who have a lower level of language and literacy skills or digital literacy and technology skills to self–manage generic software applications, may require additional support to complete the course.

6. Assessment	**Standards 10 and 12 AQTF Standards for Accredited Courses**

6.1 Assessment strategy	All assessment, including Recognition of Prior Learning (RPL) must be compliant with the requirements of:
	
	 • Standard 1 of the Australian Quality Training Framework (AQTF): Essential Conditions and Standards for Initial/Continuing Registration and Guidelines 4.1 and 4.2 of the VRQA Guidelines for VET Providers
	     or
	 • the Standards for Registered Training Organisations 2015 (SRTOs)
	     or
	 • the relevant standards and guidelines for Registered Training Organisations in effect at the time of assessment
	
	 Assessment strategies must therefore ensure that:
	
	 • all assessments are valid, reliable, flexible and fair
	 • learners are informed of the context and purpose of the assessment and the assessment process
	 • feedback is provided to learners about the outcomes of the assessment process and guidance given for future options
	 • time allowance to complete a task is reasonable and reflect the industry expectations of a junior operator
	
	 Assessment strategies should be designed to:
	
	 • cover a range of skills and knowledge required to demonstrate achievement of the course aim
	 • collect evidence on a number of occasions to suit a variety of contexts and situations
	 • be appropriate to the knowledge, skills, methods of delivery and needs and characteristics of learners

	- assist assessors to interpret evidence consistently - be equitable to all groups of learners Assessment methods are included in each unit and include: - oral and/or written questioning - inspection of final process/product outcomes - portfolio of documented evidence - demonstration of required physical tasks A holistic approach to assessment is encouraged. This may be achieved by combining the assessment of more than one unit where it better replicates working practice. Assessment of the imported units must reflect the requirements of the Assessment Guidelines in the relevant training package/s.
6.2 Assessor competencies	*Standard 12 AQTF Standards for Accredited Courses* Assessment must be undertaken by a person or persons with competencies compliant with: - Standard 1.4 of the Australian Quality Training Framework (AQTF): Essential Conditions and Standards for Initial/Continuing Registration and Guidelines 3 of the VRQA Guidelines for VET Providers or - the Standards for Registered Training Organisations 2015 (SRTOs), or - the relevant standards and guidelines for Registered Training Organisations in effect at the time of assessment Assessors of the imported units must meet the requirements for assessors specified in the relevant training package/s.
7. Delivery	**Standards 11 and 12 AQTF Standards for Accredited Courses**
7.1 Delivery modes	*Standard 11 AQTF Standards for Accredited Courses* This course is available for full or part-time study. Providers should be flexible in the way the training is delivered to ensure they meet the needs of the learner cohort. The course can be delivered on the job or off the job. If the course is delivered off the job, it is important the training facilities reflect as close as possible, realistic workplace conditions. Integrated technology applications draw on technical concepts across different industry sectors, therefore RTOs should consider achieving outcomes for students by utilising: - project based strategies that allow learners to plan, organise and implement activities to achieve a defined outcome; and - problem based strategies that focus on introducing concepts to learners by challenging them to solve a real world problem.

	- other delivery methods may include: – classroom presentation from guest presenter from various technology based enterprises – case study analysis. Teaching and learning strategies must be selected to reflect the varying learning requirements, educational backgrounds and preferred learning styles of the individual students and the specific requirements of each unit. Some areas of content may be common to more than one unit and therefore integration may be appropriate. It is recommended unit VU22746 - Undertake an integrated technology project and unit VU22747- Apply computer tools and networking in an integrated technology context are delivered and assessed concurrently Delivery and contextualisation of imported units must be consistent with the assessment guidelines of the relevant training package.
7.2 Resources	*Standard 12 AQTF Standards for Accredited Courses* The resources that should be available for this course relate to normal work practice using procedures, information and resources typical of a workplace. This should include access to: - WHS/OHS policy and work procedures and instructions; - an actual or simulated integrated technology environment; - relevant electrical safety acts, service installation rules, standards, and codes of practice; - relevant equipment, tools, materials and consumables; - relevant plans, drawings and instructions to the level of operation Training must be undertaken by a person or persons with competencies compliant with: - Standard 1.4 of the Australian Quality Training Framework AQTF: Essential Conditions and Standards for Initial/Continuing Registration and Guidelines 3 of the VRQA Guidelines for VET Providers, or - the Standards for Registered Training Organisations 2015 (SRTOs), or - the relevant standards and guidelines for Registered Training Organisations in effect at the time of assessment. Imported units must reflect the requirements of trainers specified in the relevant training package
8. Pathways and articulation	*Standard 8 AQTF Standards for Accredited Courses* There are no formal arrangements for articulation to other VET or higher education qualifications. When arranging articulation providers should refer to the: *AQF Second Edition 2013 Pathways Policy*

	Participants must negotiate individual pathway arrangements directly with the training provider.
	Applicants who have already successfully completed any endorsed unit of competency from previous study will receive direct credit transfer for the same unit/s in this course. Likewise, graduates of this course will also gain direct credit transfer for units successfully completed in any future course/s containing the same units.
9. Ongoing monitoring and evaluation	*Standard 13 AQTF Standards for Accredited Courses*
	The Certificate IV in Integrated technologies is monitored and maintained by the Curriculum Maintenance Manager (CMM) - Engineering Industries.
	A review will take place at the mid-point during the accreditation period. The review will be informed through feedback and consultation with teaching staff and graduates of the course and will also consider any changes required to meet emerging technologies or developing needs in the industries served by this course.
	Any significant changes to the course resulting from course monitoring and evaluation procedures will be reported to the VRQA.

Section C: Units of competency
Imported units of competency from National Training Package.

These units are not included in the course document and are available from: www.training.gov.au

ICTICT103	Use, communicate and search securely on the internet
ICTNWK301	Provide network systems administration
ICTNWK405	Build a small wireless local area network
ICTNWK410	Install hardware to a network
ICTSAS307	Install and configure and secure a small office or home office network
ICTSAS409	Manage risks involving ICT systems and technology
ICTSAS410	Identify and resolve client ICT problems
ICTSAS412	Action change requests
ICTSAS418	Monitor and administer security of an ICT system
ICTSAS419	Support system software
ICTSAS420	Provide first-level remote help desk support
ICTSAS421	Support users and troubleshoot desktop applications
ICTSAS424	Support different operating systems
ICTSAS425	Configure and troubleshoot operating system software
ICTSAS426	Locate and troubleshoot ICT equipment, system and software faults
ICTNWK303	Configure and administer a network operating system
ICTNWK408	Configure a desktop environment
MEM23064A	Select and test mechatronic engineering materials
MEM30007A	Select common engineering materials
MEM30011A	Set up basic pneumatic circuits
MEM30031A	Operate computer–aided design (CAD) system to produce basic drawing elements
UEENEED104A	Use engineering applications software on personal computers
UEENEED115A	Administer computer networks
UEENEED124A	Integrate multiple computer operating systems on a client server local area network
UEENEEE101A	Apply Occupational Health and Safety regulations, codes and practices in the workplace
UEENEEE102A	Fabricate, assemble and dismantle utilities industry components
UEENEEE104A	Solve problems in multiple path d.c. circuits
UEENEEE105A	Fix and secure electrotechnology equipment
UEENEEE107A	Use drawings, diagrams, schedules, standards, codes and specifications
UEENEEE141A	Use of routine equipment/plant/technologies in an energy sector environment
UEENEEG006A	Solve problems in single and three phase low voltage machines
UEENEEG101A	Solve problems in electromagnetic devices and related circuits
UEENEEG102A	Solve problems in low voltage a.c. circuits
UEENEEG106A	Terminate cables, cords and accessories for low voltage circuits

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New Victorian units of Competency

VU22746	Undertake an integrated technology project
VU22747	Apply computer tools and networking in an integrated technology context
VU22748	Apply mathematics in an integrated technology context
VU22749	Install, test and commission transducers and sensors
VU22750	Write programs for programmable logic controllers (PLCs)
VU22751	Set up and commission programmable logic controllers (PLCs)
VU22752	Develop, enter and verify programs for SCADA systems
VU22753	Install and maintain induction motors
VU22754	Perform precision measurements
VU22755	Identify and repair faults in AC motor control systems
VU22756	Identify and repair faults in DC motor control systems
VU22757	Apply basic scientific principles and techniques in mechanical engineering situations
~~VU22758~~	~~Build a simple network and establish end to end connectivity~~
VU22963	Build and implement a basic network
~~VU22759~~	~~Configure and troubleshoot network switches and routers~~
VU22964	Configure a small to medium network for an organisation
~~VU22760~~	~~Apply network scaling tools and techniques~~
VU22965	Secure and monitor the performance of a small to medium network
~~VU22761~~	~~Establish connectivity to a wide area network (WAN)~~
VU22966	Investigate design concepts of an accessible and secure network

Imported Victorian units of competency from other State accredited courses:

These units are also included in the course document. Refer Part A (Item 4) for details of the courses from which each unit is drawn.

VU22333	Perform intermediate engineering computations
VU22338	Configure and program a basic robotic system
VU22674	Explore applications and operation of the Internet of Things (IoT)
VU21270	Implement control processes using PLCs
VU21988	Utilise basic network concepts and protocols required in cyber security
VU21990	Recognise the need for cyber security in an organisation
VU21993	Secure a networked personal computer
VU22257	Configure security devices for an organisation
VU22563	Set up mechatronics engineering systems

VU22746 - Undertake an integrated technology project

Unit Descriptor	This unit describes the performance outcomes, skills and knowledge required to carry out an integrated technology project by merging distinct technology domains to achieve an innovative and integrated technical outcome. This includes deciding on technology options, planning, preparation and implementation of a project, in accordance with a project management plan. The use of appropriate mathematical techniques is required to determine system parameters.
	No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.
Employability Skills	This unit contains Employability Skills.
Application of the Unit	This unit of competency applies to a person working in an environment where merging technologies are utilised for innovative technical applications.

ELEMENT	PERFORMANCE CRITERIA
Elements describe the essential outcomes of a unit of competency.	*Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.*
1 Prepare for an integrated technology project	1.1 ***Integrated technology*** options and the scope of the desired project outcomes are considered and discussed with the ***appropriate personnel***
	1.2 A project brief outlining the expected project outcomes, required calculations, technical specifications and other relevant data is prepared and approved by the appropriate personnel
	1.3 Project stakeholders directly involved or other stakeholders who are affected by the project are consulted to ensure the work is coordinated and the impact of the planned work is minimised
	1.4 Relevant WHS/OHS requirements and risk control measures are clarified and implemented
	1.5 A ***integrated technology project*** implementation plan is prepared and approved by the appropriate personnel
	1.6 ***Resources and equipment*** needed for the project are obtained in accordance with enterprise procedures and checked for correct specifications and operation

2	Instigate the integrated technology project	2.1	Plant or machine circuits are checked as being isolated where necessary in accordance with WHS/OHS requirements and procedures
		2.2	Project activities are undertaken in accordance with the project plan and within specified time lines
		2.3	Appropriate **mathematical processes** are used to calculate and monitor the project variables
		2.4	Project progress is regularly reviewed against project plan and discussed with appropriate personnel
		2.5	Decisions for addressing unexpected situations are made after discussion with appropriate personnel, consideration of the job specifications, safety and compliance enterprise procedures.
		2.6	Methods for addressing unexpected situations are selected on the basis of safety and specified project outcomes.
		2.7	Network interactivity cycle is tested and evaluated to ensure connectivity, control and integration of different technologies
3	Complete and document project outcomes	3.1	**Key outputs** of the integrated technology project are measured, calculated and/or charted to confirm compliance with the specifications
		3.2	Final project outcomes are reviewed against specifications and intended objectives.
		3.3	Equipment and tools used in the project are checked and and stored in accordance with enterprise procedures.
		3.4	A clear and concise project report is prepared in accordance to enterprise procedures.

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills:

- interacting with others to determine work requirements
- establishing technical needs in relation to the integrated technology project
- conducting basic project planning
- utilising a range of relevant mathematical techniques to calculate and chart project variables
- using a network to connect, control and integrate different technologies
- using an interactive cycle of prototyping, testing and evaluation to assess the functional operation of the merging technologies
- using feedback to evaluate the success of the project

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- writing reports on the project in accordance with enterprise requirements

- presenting information in a clear and concise manner

- using tools and equipment correctly

- following enterprise WHS/OHS procedures relevant to the project

- dealing with unexpected situations on the basis of safety and specified project outcomes.

Required knowledge:

- relevant WHS/OHS regulations and requirements

- technology integration options and connectivity requirements

- integrated technology project specifications requirements including defining the project; project briefs; key outputs

- relevant mathematical techniques such as the use of geometry, trigonometry, algebra, graphs

- integrated technology project management plans requirements including: timelines, resources, costs, monitoring, milestones, contingencies, budgets

RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording in the Performance Criteria is detailed below. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts.

Integrated technology may include:	- fluid power - computer network technology e g Internet of Things (IoT) - wireless technology e g Bluetooth, Wi Fi - robotics and embedded controller technology - photonics technology - renewable energy technology - virtual/augmented reality technology - computer aided design/drafting (CAD/D)
Appropriate personnel may include:	- client/customer - manager - site engineer - supervisor - workplace trainer - workplace mentor

Integrated technology project may include:	– basic robotic prototype
	– small renewable generation system
	– automated ELV lighting system
	– alarmed ELV warning system
	– ELV security system
	– Basic IoT (connectivity) system eg
	– smart watering system
	– personalised light switch system
Resources and equipment may include:	– appropriate tools
	– test equipment
	– consumables
	– network cards/ connectors
	– appropriate software licences
	– manufacturers' specifications and manuals
	– diagnostics software
	– computer hardware and software
Mathematical processes may include:	– addition
	– subtraction
	– multiplication
	– division
	– percentages
	– geometry
	– trigonometry
	– algebra
	– graphs
Key outputs may include:	– electrical power
	– hydraulic power
	– heat output
	– flow rates
	– machine efficiency
	– internet connectivity

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EVIDENCE GUIDE

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.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	A person who demonstrates competency in this unit must be able to provide evidence of the ability to: – plan and carry out an integrated technology project by merging distinct technology fields to achieve an innovative integrated technologies outcome. The project must include: – a management plan with specified outcomes – application of relevant mathematical processes – integration of at least two (2) technologies – documented assessment of the project to meet the specified outcomes – apply relevant WHS/OHS regulations and risk control procedures
Context of and specific resources for assessment	This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit can be demonstrated by an individual working alone or as part of a team. The candidate will have access to required technology resources (this will vary according to the project), equipment, tools, materials and documentation required. The candidate will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

| **Method of assessment** | A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit: |

- direct observation of the candidate working alone or as a team member

- written and oral questioning to test underpinning knowledge

- assessment of action plan and any support documentation

- assessment of the final project outcomes and report

VU22747 - Apply computer tools and networking in an integrated technology context

Unit Descriptor	This unit describes the performance outcomes, skills and knowledge required to use relevant computer software and hardware to complete a range of integrated technology projects. This may involve the establishment of networked control of multiple technological devices and services.
	No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.
Employability Skills	This unit contains Employability Skills.
Application of the Unit	This unit of competency applies to a person working in an environment where merging technologies are utilised for innovative technical applications in a wide spectrum of engineering and electrotechnology applications.

ELEMENT	PERFORMANCE CRITERIA
Elements describe the essential outcomes of a unit of competency.	*Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.*
1 Determine computer and network requirements for the integrated technology project	1.1 Nature and scope of the integrated control system and network is established from project briefs, specifications and/or discussions with ***appropriate personnel***
	1.2 WHS/OHS requirements and risk control procedures required for the preparation of the work area are clarified and followed.
	1.3 ***Computer tools*** are selected and, where required, procured to meet the integrated technology project needs, in accordance with enterprise procedures
	1.4 Network operating system versions and updates needed to configure and maintain the network are obtained in accordance with established procedures and checked against job specifications.
	1.5 Appropriate personnel are consulted to ensure the work is coordinated effectively with others involved at the workplace.
	1.6 The computer tools are trialled to ensure their suitability for the ***integrated technology*** project.

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2	Set up and maintain control system networks.	2.1	Control application network components are installed, and configured in accordance with manufacturer's specifications and enterprise procedures
		2.2	Devices, desktop environment, network protocols and services and system security are implemented in accordance with requirements.
		2.3	Network malfunctions are identified and rectified using control devices, storage, network protocols, connections and services and system security configuration processes.
		2.4	Network performance and reliability is monitored and optimised in accordance with established procedures.
		2.5	Methods for dealing with unexpected situations were selected following discussion with appropriate personnel, review of job specifications, safety considerations and enterprise procedures
		2.6	Computer back-up arrangements are put in place to protect project outputs
3	Produce integrated technology project outputs	3.1	*Computer output* is checked to confirm compliance with the specifications and enterprise procedures
		3.2	Output style and format is confirmed as being consistent with specification
		3.3	Computer files and data are saved in accordance with enterprise procedures
		3.4	Appropriate personnel are notified of project completion, in accordance with enterprise procedures.

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills:

– following enterprise WHS/OHS procedures relevant to the project and work area

– interpreting instructions and specifications for computer application tasks

– preparing workplace for safe computer usage

– using a word-processor application to create documents, customise page layout, format documents, create tables, add images, use mail merge and print documents

– using a database application to modify and develop data tables, create forms and reports to logically retrieve and present information

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– using a spreadsheet application to modify and create spreadsheets, format cells and spreadsheet, apply engineering formulas in spreadsheets, create graphs and charts

– using CAD drawing tools and library components to modify and create engineering drawings

– developing open and common proprietary control system networks models (layers) and protocols

– developing a network of computers and control hardware such as:

    – input/output devices

    – peripherals such as 2D and 3D printers

    – automation production machines

– checking that the output conforms to the project brief and specification

– altering and customising computer programs

– writing short test routines

– accessing offline and online help and tutorial support

Required knowledge:

– relevant WHS/OHS regulations and requirements

– project specifications including: defining the project; project briefs; key outputs; computer tools required etc.

– functions and capabilities of various types of computer applications used in an engineering workplace

– project management plans including: timelines, resources, costs, monitoring, project teams, milestones, contingencies, budgets

– control system networks interface

– data link models or layers encompassing:

    - device types

    - bus arbitration

    - device initialisation

    - synchronous/asynchronous messaging

    - time management

    - specific functions of Link Active Scheduler (LAS)

– bus monitor encompassing:

    - capturing

    - filtering

- fieldbus message specification encompassing:
    - virtual field device
    - object dictionary
    - communicate objectives
    - communicate services
- high speed Ethernet encompassing:
    - protocols
    - FDA agents
    - messaging
    - sessions
    - time synchronisation
    - redundancy
- computer back-up techniques and data security processes

RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording in the Performance Criteria is detailed below. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts.

Appropriate personnel may include:	– supervisor
	– manager
	– site engineer
	– workplace trainer
	– workplace mentor
Computer tools may include:	– computer hardware
	– computer networks
	– internet access
	– database software
	– spreadsheet software
	– word processing software
	– simulation software
	– computer-aided design (CAD)
	– electrotechnology schematic capture and simulation

	− fluid power control schematic capture and simulation
	− process control modelling and simulation
	− diagnostics software
Integrated technology may include:	− fluid power
	− computer network technology eg Internet of Things (IoT)
	− wireless technology eg Bluetooth, Wi Fi
	− robotics and embedded controller technology
	− photonics technology
	− renewable energy generation
	− virtual/augmented reality technologies
	− computer aided design/drafting (CAD/D)
Computer output may include:	− reports
	− spreadsheets
	− database
	− graphs
	− design
	− control mechanisms, such as fluid power and electronic controls
	− robotics
	− open & common control system networks

EVIDENCE GUIDE

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.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	A person who demonstrates competency in this unit must be able to provide evidence of the ability to: − select computer tools appropriate to integrated technology project needs − utilise a range of computer tools to achieve relevant integrated technology project outputs

− utilise appropriate computer data security and back-up processes

− develop control system network models (layers) and protocols

Context of and specific resources for assessment	This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit can be demonstrated by an individual working alone or as part of a team. Evidence should show competency working in realistic environment and a variety of conditions. The candidate will have access to required computing hardware and software, related equipment, tools, materials and documentation required. The candidate is permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
Method of assessment	A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit: − direct observation of the candidate working as a team member − written and oral questioning to test underpinning knowledge − assessment of action plan and any support documentation − assessment of final integrated technology project outcomes
Guidance information for assessment	This unit should be assessed in combination with the unit: VU22746 – Undertake an integrated technology project

VU22748 - Apply mathematics in an integrated technology context

Unit Descriptor	This unit describes the performance outcomes, skills and knowledge required to apply mathematical processes to solve problems and/or analyse data in various integrated technology scenarios.
	It unit includes various mathematical procedures commonly applied in association with a range of technologies.
	No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.
Employability Skills	This unit contains Employability Skills.
Application of the Unit	This unit of competency applies to a person working in a technical role where where mathematical processes are required to solve problems and verify data in various engineering and electrotechnology applications.

ELEMENT	PERFORMANCE CRITERIA
Elements describe the essential outcomes of a unit of competency.	*Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.*
1 Determine the mathematics required for integrated technology tasks	1.1 The **mathematical requirements** of the **integrated technology** tasks are examined
	1.2 Relevant data for specific mathematical processing or calculation is collected
	1.3 The **materials or devices** needed to carry out the required calculations are obtained
2 Apply mathematics to specific integrated technology tasks	2.1 Relevance data for the tasks is checked for accuracy
	2.2 Appropriate formulae or **mathematical process** is used to achieve the required information for each task
	2.3 **Various parameters** of the integrated technology task are calculated
	2.4 Ongoing checks of the accuracy of the calculations are undertaken, in a accordance with established procedures
3 Complete the mathematical activities	3.1 The mathematical calculations are checked against estimates or specifications
	3.2 Any errors or discrepancies in the calculations are detected and corrected promptly, in a accordance established procedure

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3.3   The results of the calculations are conveyed to the **appropriate personnel**

3.4   Appropriate records of the calculations are compiled and maintained, in accordance with established procedure

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills:

– Investigating or examining the task to determine the mathematical requirements
– Determining processes techniques and requirements for data collection and analysis
– Checking and validating results and record keeping
– Using tools/equipment/materials eg computer programs, calculators, reference charts
– *Shapes and representation*
    – Extracting the geometric parameters of lines, curves, shapes and solids and their graphical and/or diagrammatic representations
    – Linear scaling and to achieve enlargement and reduction of area, surface area and volume
– *Number systems*
    – Applying basic mathematical skills in addition, subtraction, multiplication and division
    – Using percentages and decimal fractions in practical contexts
    – Applying approximation strategies, extrapolation and analysis calculations to obtain predictions, estimates and exact values
– *Data presentation and analysis*
    – Utilising graphs and tables of linear and non-linear relations to interpret information
    – Utilising spread-sheet tools as a means of capturing and presenting data with a range of graphical techniques
    – Characterising typical data sets in terms of mean, median, range and other key parameters
    – Qualitative interpretation of features of graphs, including consideration of axis intercepts, slope, asymptotic behaviour, symmetry, local linearity, tangents, gradients and rates of change
    – Interpretation of non-linear graphs representing practical situations, interpolation and extrapolation to predict values, estimation of maximum and minimum values and average rate of change
    – Construction and interpretation of motion graphs – displacement-time and velocity-time
– *Measurement*
    – Conducting linear measurements using the metric system and consideration of required accuracy, tolerances, rounding, truncation and approximations
    – Reading, recording and analysing digital and analogue instrument scales

- *Formulae and algebraic representation*
  - Using appropriate mathematical symbols, formula and basic algebra to obtain information in specific contexts
  - Using algebraic formulae to model and analyse integrated technology phenomena
  - Transforming and solving algebraic formula to determine unknown parameters
- *Geometry and trigonometry*
  - Representing practical problems in two and three dimensional geometric form
  - Applying right angle trigonometry and Pythagoras theorem
  - Applying trigonometric ratios sine, cosine and tangent, sine and cosine rules and area of triangle formulas to solve problems in two and three dimensions
  - Calculating angles and distances using triangulation approaches
- *Random processes*
  - Identifying, characterising and independence of random events, processes and experiments
  - Simulating random events using simple devices, processes and technology and consideration of probability concept
  - Characterising a normal distribution in terms of mean and standard deviation.

Required knowledge:

- Basis of number systems
- Basis of measurement processes
- Addition, subtraction, multiplication and division processes
- Principles of geometry and trigonmetry
- Principles of basic algebra and transformation of formulae
- Graphical and tabular approaches to data presentation and analysis
- Principles of non-deterministic data characterisation

RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording in the Performance Criteria is detailed below. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts.

Mathematical requirements **may include:**

- number systems
- linear measurements
- algebraic formulae

- spatial representation
- graphical techniques, analysis and representation
- data presentation, characterisation and analysis
- geometric and trigonometric analysis
- statistical representation
- mathematical modelling

Integrated technology may include:

- broadcast engineering
- building automation and security
- control technologies
- engineering business
- robotics and manufacturing technology
- medical systems engineering
- sustainable energy systems
- energy generation
- telecommunications and wireless communications
- electrotechnology
- computer network technology
- robotics and embedded controller technology
- photonics technology
- fluid power
- connectivity technology

Materials or devices may include:

- linear measuring devices
- computer
- data acquisition, presentation, design and analysis software
- calculator
- analogue and digital instruments

Mathematical process may include:

- addition
- subtraction
- multiplication
- division
- scaling
- percentages

- decimal fractions
- averages
- extrapolation and interpolation
- rate of change
- approximation
- geometry
- trigonometry
- graphical techniques and graphical interpretation
- random data, processes and characterisation

Various parameters may include:

- electrical parameters such as current, voltage, energy and power
- linear and rotational motion parameters such as distance, velocity, acceleration
- fluid power parameters such as:
- pressure
- flow rates
- power
- cycle times
- business modelling parameters
- project planning, costing and management parameters
- process and system monitoring, control and optimisation parameters
- design and performance parameters
- quality assurance parameters

Appropriate personnel may include:

- supervisor
- manager
- technologist
- engineer
- workplace trainer
- workplace mentor

EVIDENCE GUIDE

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.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	A person who demonstrates competency in this unit must be able to provide evidence of the ability to: − identify the mathematics required for specific integrated technology work activities − utilise a variety of mathematical processes to achieve required information − check the accuracy of calculations against estimates and specifications for the integrated technology project − use apppropriate materials or devices necessary to conduct the calculations accurately
Context of and specific resources for assessment	Assessment should be conducted in a real or simulated workplace environment using procedures, information and resources typical of a workplace. Where simulation is used, the conditions for assessment must be authentic and as far as possible reproduce and replicate the workplace Resources required for assessment include a suitable work environment including equipment and materials to undertake the work specified including access to computer hardware appropriate software, calculator, measuring devices and reference charts
Method of assessment	A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit: − written and oral questioning to test underpinning knowledge − direct observation of the candidate's ability to apply the appropriate mathematical process to achieve the required information.

VU22749 - Install, test and commission transducers and sensors

Unit Descriptor	This unit describes the performance outcomes, skills and knowledge required to select and commission transducers and sensors for control systems. This includes selecting transducers and sensors suitable for a given control application, determining interfacing requirements, perform installation and/or maintenance tasks, and setting up, testing and adjusting them as per specifications.

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication. |
| **Employability Skills** | This unit contains Employability Skills. |
| **Application of the Unit** | This unit of competency applies to a person working in an enterprise where transducers and sensors are used in integrated control processes in support of manufacturing or process control operations. |

ELEMENT	**PERFORMANCE CRITERIA**
Elements describe the essential outcomes of a unit of competency.	*Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.*
1 Assess appropriate transducers and sensors	1.1 **Established WHS/OHS requirements** and risk control measures and procedures for the work area are followed

1.2 Safety hazards, which have not previously been identified, are documented and risk control measures devised and implemented in consultation with **appropriate personnel**

1.3 System requirements for **transducers and sensors** are analysed from documentation, job brief or discussions with appropriate personnel

1.4 Transducer and sensors specifications are compared with system requirements and selections are made based on previously defined selection criteria

1.5 Equipment, resources, and testing devices needed to carry out the task are obtained and checked for correct operation and safety

1.6 Appropriate personnel are consulted to ensure the work is coordinated effectively with others involved at the work site |

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2	Install, test and adjust transducers and sensors	2.1	Transducers and sensors are installed and set-up according to manufacturers' specifications and ***enterprise procedures***
		2.2	Appropriate methods and tools are used to test and verify transducer and sensor operations
		2.3	Any faults and anomalies are identified and rectified
		2.4	Methods for dealing with unexpected situations are selected on the basis of safety and specified work outcomes
3	Complete commissioning and maintenance task	3.1	Work site is made safe in accordance with established safety procedures
		3.2	Testing and commissioning task is documented in accordance with enterprise procedures
		3.3	Appropriate personnel are notified in accordance with enterprise procedures.

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills:

- following enterprise WHS/OHS procedures relevant to the project and work area
- analysing documentation, specifications, diagrams and technical information to determine required transducers and sensors
- determining and estimating operating parameters
- installing and commissioning transducers and sensors in accordance with specifications
- using tools, equipment and testing devices to diagnose faults
- applying logical diagnostic methods
- rectifying faults and restoring system to operational standard
- recommissioning motor control systems
- establishing and maintaining a safe work environment
- communicating technical requirement to others

Required knowledge:

- relevant WHS/OHS regulations and requirements
- transducer and sensor classification specifications and operating parameters
- types of transducers and sensors

- transducers and sensors interface requirements
- maintenance and testing procedures and processes
- testing devices and related tools and equpment
- detection of:
    - light and radiation
    - temperature
    - flow and pressure
    - motion and force
    - moisture and humidity

RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording in the Performance Criteria is detailed below. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts.

Established WHS/OHS requirements may include:	- legislation - protective equipment - material safety management systems - hazardous substances and dangerous goods code - local safe operation procedures
Appropriate personnel. may include	- supervisor - leading hand - foreman - manager - site engineer - workplace trainer - workplace mentor
Transducers and sensors may include	- transducers - electrochemical - electromechanical - electroacoustic - photoelectric - electromagnetic - electrostatic - thermoelectric

- sensors
  - o thermal
  - o electromagnetic
  - o mechanical
  - o chemical
  - o optical and radiation
  - o acoustic

Enterprise procedures may include:
- the use of tools and equipment
- instructions including:
  - o job sheets
  - o cutting lists
  - o plans
  - o drawings and designs

EVIDENCE GUIDE

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.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	A person who demonstrates competency in this unit must be able to provide evidence of the ability to: – determine established WHS/OHS requirements and risk control procedures for a work area – demonstrate the ability to select, install, test and commission transducers and sensors on a control system – demonstrate the ability find and rectify faults and anomalies on at least two (2) occasions each in a in different situation or context
Context of and specific resources for assessment	Assessment should be conducted in a real or simulated workplace environment using procedures, information and resources typical of a workplace. Where simulation is used, the conditions for assessment must be authentic and as far as possible reproduce and replicate the workplace. Resources required for assessment include a suitable work environment including different types of transducers and sensors for various control systems, equipment, tools and materials to undertake the work specified.

The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.

Method of assessment

A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:

- observation of processes and procedures;

- oral and/or written questioning on required knowledge and skills;

- testimony from supervisors, colleagues, clients and/or other appropriate persons;

- inspection of the final product or outcome;

- a portfolio of documented evidence.

VU22750 - Write programs for programmable logic controllers (PLCs)

Unit Descriptor	This unit describes the performance outcomes, skills and knowledge required to write, test and modify programs for programmable logic controllers (PLCs). This includes working safely, applying knowledge of control systems, program control functions, develop and test control programs using a range of programming language approaches developed for PLCs.
	No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.
Employability Skills	This unit contains Employability Skills.
Application of the Unit	This unit of competency applies to a person working in an engineering environment where programmable logic controllers are used for automating processes in manufacturing, process control, building services, laboratories etc.

ELEMENT	PERFORMANCE CRITERIA
Elements describe the essential outcomes of a unit of competency.	*Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.*
1 Prepare to develop a PLC program.	1.1 ***Established WHS/OHS requirements*** and risk control measures and procedures for the work area are followed
	1.2 Safety hazards, which have not previously been identified, are documented and risk control measures devised and implemented in consultation with ***appropriate personnel***
	1.3 Control program and input/output interfacing requirements are determined from job specifications and consultation with appropriate personnel
	1.4 ***Equipment and software*** needed to carry out the work are obtained and checked for correct operation and safety
	1.5 Installation of programmable controller is checked for safety compliance and against job specification

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2	Develop, write and test control program	2.1	Plant or machines circuits are checked as being isolated where necessary in accordance WHS/OHS requirements and procedures
		2.2	Control solutions are established and documented based on the specified control mode and using acceptable methods for designing control systems
		2.3	Using appropriate software the developed control system is converted to an appropriate form for the programmable controller
		2.4	Program is entered into the programmable controller using a computer and appropriate software
		2.5	Entered instructions and settings are tested as meeting those specified in the control system scenario
		2.6	Appropriate methods and tools are used to test the control systems and operating faults and anomalies are identified and rectified
		2.7	Methods for dealing with unexpected situations are selected on the basis of safety considerations and specified work outcomes.
3	Finalise control program	3.1	Program is transferred from a programmable controller to an external medium for storage
		3.2	Control system specification and program are documented in accordance with **enterprise procedures**
		3.3	Work completion is reported and appropriate personnel notified in accordance with enterprise procedures

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills:

– reading and interpreting project briefs to determine programs requirements for control applications

– writing, testing, monitoring and debugging PLC programs

– saving and retrieving program code/data using external storage

– setting up and checking hardware operations

– producing appropriate documentation for control programs

– communicating technical requirement to others

– following relevant workplace WHS/OHS requirements and procedures

Required knowledge:

- PLC programming methods
- application and use of ladder diagram
- application and use of sequential function chart
- structure language programming
- tests for PLC control systems and operating faults
- PLC diagnostic indicator
- application of programming structures
- Input Output (I/O) programming
- relevant workplace WHS/OHS requirements and procedures

RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording in the Performance Criteria is detailed below. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts.

Established WHS/OHS requirements may include:	− legislation
	− protective equipment
	− material safety management systems
	− hazardous substances and dangerous goods code
	− local safe operation procedures
Appropriate personnel may include	− supervisor
	− leading hand
	− foreman
	− manager
	− site engineer
	− workplace trainer
	− workplace mentor
Equipment and software may include:	− personal computer station, preferably networked
	− PLCs
	− PLC programming and auxiliary software
	− interfacing hardware
	− transducers and actuators
	− hand tools
	− consumables

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Enterprise procedures may include:

  – the use of tools and equipment

  – instructions, including job sheets plans, drawings and designs

  – reporting and communication

  – manufacturers' specifications

  – operational procedures

EVIDENCE GUIDE

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.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	A person who demonstrates competency in this unit must be able to provide evidence of the ability to:
	
	– interpret job specifications and write, test and modify programs for PLCs on at least two (2) occasions using a range of programming features such as:
	
	    – input/output programming
	
	    – use of internal flags, counters and timers
	
	    – nested sub routines
	
	    – diagnostic indicators

Context of and specific resources for assessment	The candidate will have access to the relevant computer hardware and software, tools, equipment, materials and documentation required. The candidate will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials. This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.

Method of assessment   Assessment should include the demonstration of practical skills and may also include:

- observation of processes and procedures
- oral and/or written questioning on required knowledge and skills of PLC programming features
- testimony from supervisors, colleagues, clients and/or other appropriate persons
- inspection of the final outcome
- portfolio of documented evidence.

VU22751 - Set up and commission programmable logic controllers (PLCs)

Unit Descriptor	This unit describes the performance outcomes, skills and knowledge required to set up and commission programmable logic controllers (PLCs). This includes selecting PLCs suitable for a given control application, determining interfacing requirements, performing installation and/or maintenance tasks, and setting up, testing and making adjustments as per specifications.
	No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.
Employability Skills	This unit contains Employability Skills.
Application of the Unit	This unit of competency applies to a person working in an enterprise where programmable logic controllers are used in integrated control processes in support of manufacturing or process control operations.

ELEMENT	**PERFORMANCE CRITERIA**
Elements describe the essential outcomes of a unit of competency.	*Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.*
1 Prepare for set up and commissioning of PLCs	1.1 ***Established WHS/OHS requirements*** and risk control measures and procedures in preparation for the work area are followed
	1.2 Safety hazards, which have not previously been identified, are documented and risk control measures devised and implemented in consultation with ***appropriate personnel***
	1.3 System requirements for PLCs are analysed from documentation, job brief or discussions with appropriate personnel.
	1.4 ***Equipment, resources, and testing devices*** needed to carry out the task are obtained and checked for correct operation and safety
	1.5 Appropriate personnel are consulted to ensure the work is coordinated effectively with others involved at the work site
2 Set up and commission PLCs.	2.1 WHS/OHS requirements for carrying out the work are followed
	2.2 PLCs are installed and programmed according to manufacturers' specifications and ***enterprise procedures***
	2.3 Appropriate methods and tools are used to test and verify PLCs operations.

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		2.4	Any faults and anomalies are identified and rectified.
		2.5	Methods for dealing with unexpected situations are selected and implemented on the basis of safety considerations and specified work outcomes.
3	Finalise and document set up and commissioning of PLCs.	3.1	Work site is made safe in accordance with established safety procedures.
		3.2	Set up and commissioning task is documented in accordance with enterprise procedures
		3.3	Appropriate personnel are notified that the set up and commissioning task has been completed.

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills:

- applying WHS/OHS processes and procedures in a workplace environment
- reading specification statements, diagrams, programs and information
- installing, connecting and testing programmable logic controllers
- using test equipment effectively and adjusting PLC programs to specifications
- troubleshooting faulty PLCs
- producing appropriate documentation to record installation
- communicating technical requirement to others

Required knowledge:

- relevant WHS/OHS workplace requirements
- types of programmable logic controllers
- considerations for selecting PLCs for a given application
- PLC installation requirements
- setting–up and testing requirements
- PLC program modification and downloading
- PLCs interface requirements

RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording in the Performance Criteria is detailed below. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts.

Established WHS/OHS requirements may include:	– legislation
	– protective equipment
	– material safety management systems
	– hazardous substances and dangerous goods code
	– local safe operation procedures

Appropriate personnel may include:	–	supervisor
	–	leading hand
	–	foreman
	–	manager
	–	site engineer
	–	workplace trainer
	–	workplace mentor
Equipment, resources, and testing devices may include:	–	hand and power tools
	–	test equipment and instruments
	–	equipment manuals and documents
	–	mechanical/electrical control devices/systems
	–	programmable logic controllers
	–	consumables
Enterprise procedures may include:	–	use of tools and equipment
	–	instructions, including job sheets, programs, plans, drawings and designs
	–	reporting and communication
	–	manufacturers' specifications
	–	operational procedures

EVIDENCE GUIDE

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.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	A person who demonstrates competency in this unit must be able to provide evidence of the ability to: – select PLCs suitable for a given control application – determine interfaceing requirements – perform Installation , programming tasks – test and commission PLCs This must include more than one types of PLCs operating on different mechanical or electrical systems.

Context of and specific resources for assessment	The candidate will have access to the relevant computer hardware and software, tools, equipment, materials and documentation required.
	The candidate will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
	This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations.
	The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.

Method of assessment	Assessment should include the demonstration of practical skills and may also include:
	- observation of processes and procedures;
	- oral and/or written questioning on required knowledge and skills of PLC programming features;
	- testimony from supervisors, colleagues, clients and/or other appropriate persons;
	- inspection of the final outcome;
	– portfolio of documented evidence.

VU22752 - Develop, enter and verify programs in SCADA systems

Unit Descriptor	This unit describes the performance outcomes, skills and knowledge required to develop, install and test programs for Supervisory Control and Data Acquisition (SCADA) systems. This includes working safely, process analysis, developing a database of process conditions, developing Human-Machine Interface (HMI), using dedicated SCADA software packages and documenting programs.
	No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.
Employability Skills	This unit contains Employability Skills.
Application of the Unit	This unit of competency applies to a person working in an enterprise that uses automated control of processes through acquisition and analysis of process data, and adjustment of process variables for controlling plant and associated facilities.

ELEMENT	PERFORMANCE CRITERIA
Elements describe the essential outcomes of a unit of competency.	*Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.*

1	Prepare to develop programs for SCADA systems.	1.1	***Established WHS/OHS requirements*** and risk control measures and procedures in preparation for the work area are followed.
		1.2	Safety hazards, which have not previously been identified, are documented and risk control measures devised and implemented in consultation with ***appropriate personnel***.
		1.3	The extent of the SCADA system is determined from design brief and process specifications.
		1.4	Process data are analysed for development of graphical design/mimic diagrams.
		1.5	Analogue and digitised addresses are related to tag database.
		1.6	Tag data types are configured in the database.
		1.7	Graphic objects are created and added to a graphic library.
		1.8	***Equipment***, software and testing devices needed to carry out the work are obtained and checked for correct operation and safety.

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2	Develop and enter programs using dedicated SCADA software.	2.1	SCADA software is used to develop human-machine interface (HMI).
		2.2	Control functions, data acquisition components and automated tasks are programmed using SCADA software.
		2.3	Complex data are manipulated using the SCADA software.
		2.4	Alarms and limits for process variables are identified and programmed accordingly.
		2.5	Methods for dealing with unexpected situations are selected and implemented if required on the basis of safety considerations and specified work outcomes.
3	Monitor, verify and document programming activities	3.1	Device operation is tested in accordance WHS/OHS requirements and **enterprise procedures.**
		3.2	Program and settings are tested to ensure compliance with the specifications in the design brief
		3.3	SCADA software tools are used to test and monitor programs
		3.4	Operating faults and anomalies if any are rectified.
		3.5	SCADA system specification and program are documented in accordance with enterprise procedures.
		3.6	Work completion is reported and appropriate personnel notified in accordance with enterprise procedures.

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills:

- applying WHS/OHS processes and procedures in a workplace environment
- reading specification statements, diagrams and information
- interpreting project briefs to develop SCADA system for given application
- configuring tag type data
- creating graphic objects
- adding graphic objects to a library
- developing a HMI for an application
- incorporating alarms, trends and limits for process variables
- rectifying operating faults and anomalies
- communicating technical requirement to others

Required knowledge:

- SCADA system networking
- mimics and animated graphics
- trending and alarm logging variables
- recipes and scheduling
- data collection and basing
- SCADA software packages
- application of SCADA
- networking SCADA systems
- Human – Machine interface (HMI)
- relevant WHS/OHS regulations and requirements

RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording in the Performance Criteria is detailed below. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts.

Established WHS/OHS requirements may include:	− legislation − protective equipment − material safety management systems − hazardous substances and dangerous goods code − local safe operation procedures
Appropriate personnel may include:	− supervisor − leading hand − foreman − manager − site engineer − workplace trainer − workplace mentor

Equipment may include:	− a SCADA system consisting of:
	  − master terminal unit
	  − remote terminal units
	  − communications equipment and software
	− printer(s)

Enterprise procedures may include:	− the use of tools and equipment − instructions, including job sheets, plans, drawings and designs − reporting and communication − manufacturers' specifications − operational procedures

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EVIDENCE GUIDE

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.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	A person who demonstrates competency in this unit must be able to provide evidence of the ability to:
	
	– demonstrate developing, entering and verifying SCADA system on at least two (2) occasions each in a different situation or context. The demonstrations must show:
	
	   o collecting and analysing data
	   o converting data to an appropriate database
	   o creating graphic objects and adding them to the library
	   o developing an effective HMI
	   o programming SCADA functions and data acquisition components
	   o correcting programming faults and anomalies
	   o documenting SCADA systems.

Context of and specific resources for assessment	The candidate will have access to all hardware and SCADA software, tools, equipment, materials and documentation required. The candidate will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials. This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.
Method of assessment	A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit: - observation of processes and procedures to develop, enter and verify programs in SCADA - oral and/or written questioning on required knowledge for the above process - testimony from supervisors, colleagues, clients and/or other appropriate persons; - inspection of the final product or outcome

VU22753 - Install and maintain induction motors

Unit Descriptor	This unit describes the performance outcomes, skills and knowledge required to install and maintain induction motors. This includes working safely; applying knowledge and interpreting technical data to perform maintenance, testing, installation and replacement of single phase and three phase induction motors.
	If the work requires access to electrical plant and equipment that is fixed wired into relevant domestic, commercial and industrial electrical installations supplied at low voltage or above, the practice of the skills described in this unit are subject to the requirements of the Victorian Electricity Safety Act and Electricity Safety (Installation) Regulations.
	No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.
Employability Skills	This unit contains Employability Skills.
Application of the Unit	This unit of competency applies to a person working as a technician in an engineering or manufacturing/processing environment where induction motors are in use and require ongoing maintenance, replacement and/or new installations.
Pre requisite unit	UEENEEG006A – Solve problems in single and three phase low voltage machines

ELEMENT	PERFORMANCE CRITERIA
Elements describe the essential outcomes of a unit of competency.	*Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.*
1 Prepare to install and maintain induction motors	1.1 ***Established WHS/OHS requirements*** and risk control measures and procedures in preparation for the work area are followed.
	1.2 Safety hazards, which have not previously been identified, are documented and risk control measures devised and implemented in consultation with ***appropriate personnel***.
	1.3 The need for installation, maintenance or replacement is determined from job instriuctions, specifications/diagrams and discussion with appropriate personnel.
	1.4 Appropriate personnel are consulted to ensure the work is co-ordinated effectively with others involved on the work site.

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		1.5	***Tools, equipment and testing devices*** needed to install, maintain or replace induction motors are obtained in accordance with ***enterprise procedures*** and checked for correct operation and safety.
2	Install and maintain induction motors.	2.1	The need to test or measure live is determined in strict accordance with WHS/OHS requirements and when necessary conducted within established safety procedures.
		2.2	Plant or machine circuits are checked as being isolated where necessary in accordance with WHS/OHS requirements and enterprise procedures.
		2.3	Maintenance methods employing tests and measurements of operating parameters of induction motors are carried out and referenced to the system operational requirements
		2.4	Requirements for installation or replacement is identified and sourced in accordance to enterprise procedures
		2.5	Installation or replacement is performed to meet determined motor performance criteria.
		2.6	Induction motor protection systems are identified and installed.
		2.7	Installed motor is tested to verify operation is as intended and system is restored to specified requirements.
		2.8	Decisions for dealing with unexpected situations are made from discussions with appropriate personnel and job specifications and requirements.
		2.9	Methods for dealing with unexpected situations are selected on the basis of safety and specified work outcomes.
3	Complete and report installation and maintenance of induction motors	3.1	Work site is made safe in accordance with established safety procedures.
		3.2	Motor installation, maintenance and testing is documented in accordance with enterprise procedures.
		3.3	Appropriate personnel are notified that the motor installation, maintenance and testing is complete in accordance with enterprise procedure.

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills:

- reading installation instructions, specification, diagrams and related information for induction motor installations and/or repairs
- determining and estimating operating parameters for induction motors
- using tools, equipment and testing devices for maintenance and repairs of induction motors
- making measurements on operational and non-operational induction motor components to determine if replacement is required
- applying logical inspection and testing methods
- performing induction motor replacement and restoring system to operational standard
- establishing and maintaining a safe working environment when installing, repairing, maintaining and servicing induction motors
- communicating/consulting with other appropriate persons when installing, repairing, maintaining and servicing induction motors
- applying WHS/OHS processes and procedures in a workplace environment

Required knowledge:

- construction of single phase and polyphase induction motors
- operating principles of single phase and polyphase induction motors
- speed-torque relationships in induction motors
- induction motor performance testing
- induction motor starters and reduced voltage starting
- speed control of induction motors
- induction motor protection systems
- induction motor selection for a given application
- induction motor sevice requirements and repair procedures
- WHS/OHS responsibilities and safe work practices requirements in an engineering /manufacturing workplace environment

RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording in the Performance Criteria is detailed below. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts.

***Established WHS/OHS requirements** may include:*	– legislation
	– protective equipment
	– material safety management systems
	– hazardous substances and dangerous goods code
	– local safe operation procedures

Appropriate personnel may include:	– supervisor – leading hand – foreman – manager – site engineer – workplace trainer – workplace mentor
Tools, equipment and testing divices may include:	– hand and power tools – test equipment and instruments – induction motor system diagnostic tools – removal/installation tools and equipment – equipment manuals and documentation – single phase induction motor systems – 3 phase induction motor systems – consumables
Enterprise procedures may include:	– the use of tools and equipment – accessing instructions/job sheets, diagrams/drawings and related information – reporting and communication processes/procedures – enterprise operational procedures

EVIDENCE GUIDE

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.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	A person who demonstrates competency in this unit must be able to provide evidence of the ability to: – interpret job instructions and technical information to determine maintenance, testing, replacement or installation of single and 3 phase induction motors – confirm a circuit system is isolated in accordance with WHS/OHS requirements and enterprise procedures – carry out maintenance, testing, replacement and installation work at per job instructions – report and document completion of work.
Context of and specific resources for assessment	The candidate will have access to all equipment, tools materials and documentation required. The candidate will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials. This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then an appropriate simulation must be

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used where the range of conditions reflects realistic workplace situations.

The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.

Method of assessment   Assessment should include the demonstration of practical skills and may also include:

- observation of processes and procedures;

- oral and/or written questioning on required knowledge and skills;

- testimony from supervisors, colleagues, clients and/or other appropriate persons;

- inspection of the final product or outcome;

- a portfolio of documented evidence.

VU22754 - Perform precision measurements

Unit Descriptor	This unit describes the performance outcomes, skills and knowledge required to select and make accurate measurements using a range of engineering and scientific measuring devices and instruments.
	No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.
Employability Skills	This unit contains Employability Skills.
Application of the Unit	This unit of competency applies to a person working in an environment where it is required use a range measuring devices and instruments across a wide spectrum of electro-mechanical applications

ELEMENT	PERFORMANCE CRITERIA
Elements describe the essential outcomes of a unit of competency.	*Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.*
1 Determine precision measurement requirements	1.1 WHS/OHS requirements for carrying out measurement task are identified and followed
	1.2 Nature and scope of the measuring task is established from a job brief or discussion with ***appropriate personnel***
	1.3 Required measuring device or instrument is determined and obtained in accordance with ***enterprise procedures***
	1.4 Operating instructions and calibration information are identified and collected
	1.5 Measuring device or instrument working order is checked and if required calibrated in accordance with manufacturers' operating instructions
	1.6 Appropriate personnel are consulted to ensure the task is coordinated effectively with others involved at the workplace
2 Carry out precision measurement procedure	2.1 ***Measurement device or instrument*** is used according to manufacturers' instructions and enterprise procedures.
	2.2 Measurements are taken and checked for accuracy and validity
	2.3 Dimensions or cumulative results are determined or verified using ***basic calculations*** where required.
	2.4 Measurements are recorded and expressed with precision and units.

		2.5	Methods for dealing with unexpected situations are selected on the basis of safety and specified work outcomes.
3	Complete precision measurement procedure	3.1	Routine care and storage of measuring device or instrument is undertaken according to manufacturers' instructions and enterprise procedures.
		3.2	Measurements are logged and recorded in accordance with enterprise procedures
		3.3	Appropriate personnel are notified that the task has been completed, in accordance with enterprise procedures.

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills:

– Identifying and selecting the appropriate measuring device or instrument for a given measuring task

– checking measuring devices or instrument for correct operation before use

– using appropriate measuring techniques to complete required measuring task

– conducting simple calculations, such as addition, subtraction, multiplication, division, fractions, decimals to the verify accumulative results

– handling and storing measuring devices or instruments in accordance with manufacturers' instructions or standard operating procedures

– making, where appropriate, routine adjustments to measuring devices or instruments

– reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents

– applying WHS/OHS processes and procedures in a workplace environment

Required knowledge:

– WHS/OHS regulations and requirements relevant to the electro-engineering industry

– a range of measuring devices and instruments used in the electro-engineering industry

– procedures for adjusting, calibrating and zeroing a range of measuring devices or instruments

– appropriate measuring techniques for a range of measuring devices and instruments

– handling and storing a range of measuring devices and instruments

– methods of communicating measurements such as logging, recording or sketching, as required

RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording in the Performance Criteria is detailed below. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts.

Appropriate personnel may include:	– client/customer
	– manager
	– site engineer
	– supervisor
	– workplace trainer
	– workplace mentor
Enterprise procedures may include:	– use of tools and equipment
	– instructions, including job sheets, plans, drawings and designs
	– reporting and communication
	– manufacturers' instructions
	– operational procedures
Measuring device or instrument may include	– tape
	– ruler
	– calliper
	– micrometer
	– dial gauge
	– electrical meters - analogue and digital
	– cathode ray oscilloscope
	– counter/timer
	– spectrum analyser
	– thermometer
	– hygrometer
	– hydrometer
	– barometer
Basic calculations may include:	– addition
	– subtraction
	– multiplication
	– division
	– fractions
	– decimals

EVIDENCE GUIDE

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.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	A person who demonstrates competency in this unit must be able to provide evidence of the ability to: – make precision measurements in accordance to job instructions on at least six (6) occasions using a different measuring device or instrument on each occasion – check, adjust, calibrate and correctly use each measuring device or instrument in according to enterprise procedures and/or manufacturers' instructions – apply relevant WHS/OHS practices and procedure in the workplace while carrying out each measuring task.
Context of and specific resources for assessment	This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The candidate will have access to job instructions range of measuring devices and instruments including manufacturing instructions, specifications and safety equipment relevant to the workplace. The competencies covered by this unit can be demonstrated by an individual working alone or as part of a team
Method of assessment	A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit: – direct observation of the candidate carrying out measuring tasks using a range of measuring devices and instruments – written and oral questioning to test underpinning knowledge of measuring devices and instruments and the appropriate recording of measurements - testimonies from supervisors, clients and/or other appropriate person

VU22755 - Identify and repair faults in AC motor control systems

Unit Descriptor	This unit describes the performance outcomes, skills and knowledge required to identify and repair faults in Alternating Current (AC) motor control systems. This includes working safely; applying knowledge of AC motor control systems and operating parameters to logical fault finding processes, carrying out fault repairs, safety and functional testing and interpreting technical data.
	If the work requires access to electrical plant and equipment that is fixed wired into relevant domestic, commercial and industrial electrical installations supplied at low voltage or above, the practice of the skills described in this unit are subject to the requirements of the Victorian Electricity Safety Act and Electricity Safety (Installation) Regulations.
	No licensing legislative, regulatory or certification requirements apply to this unit at the time of publication.
Employability Skills	This unit contains Employability Skills.
Application of the Unit	This unit of competency applies to a technician working in an engineering, manufacturing or processing environment where AC motor control systems are used to control processes and require ongoing maintenance and repair.

ELEMENT	PERFORMANCE CRITERIA
Elements describe the essential outcomes of a unit of competency.	*Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.*
1 Prepare to identify and repair faults.	1.1 ***Established WHS/OHS requirements*** and risk control procedures for the work area are identified and followed
	1.2 Details of faults are determined from reports and other documentation and from discussion with ***appropriate personnel***
	1.3 Relevant personnel are consulted to ensure the work is co-ordinated effectively with others involved on the work area
	1.4 ***Tools and equipment*** needed to identify faults and carry out repairs are obtained in accordance with ***enterprise procedures*** and checked for correct operation.

2	Identify and repair faults.	2.1	Requirement to test and/or measure live is determined in accordance with WHS/OHS requirements and conducted within established safety procedures
		2.2	Plant or machines circuits are checked as being isolated in strict accordance with WHS/OHS requirements and enterprise procedures
		2.3	Logical fault finding processes to diagnose AC motor control system faults are applied employing measurements and estimations of system operating parameters referenced to system operational requirements
		2.4	Suspected fault scenarios are tested to confirm system problems
		2.5	Faults in the control components of the system are repaired and the system is restored to its operating condition
		2.6	If it is determined the cause of the fault/s is outside the control system then appropriately trained person/s are engaged to rectify the fault
		2.7	Methods for dealing with unexpected situations are determined on the basis of safety considerations, expected work outcomes and discussion with relevant personnel.
3	Restore control system and document repair work	3.1	Tests are conducted and data is interpreted to verify the control system is now operating within specified requirements
		3.2	Relevant personnel are notified that faults are repaired and the control system is restored
		3.3	System repairs are documented, in accordance with enterprise procedures.

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills:

− applying relevant WHS/OHS requirements and safe work practices in a manufacturing/processing environment

− reading AC control system fault reports, technical specifications and related information

- determining and estimating operating parameters of AC motor control systems

- using tools, equipment and testing devices to identify faults in AC motor control systems

- making measurements on suspect components to determine failure

- applying logical diagnostic methods to determine and identify faults

- repairing faults and restoring system to operational standard

- communicating technical information to others

- recommissioning AC motor control systems according to enterprise procedure.

Required knowledge:

- relevant WHS/OHS requirements and safe work practices in an engineering, manufacturing /processing environment

- AC motor control system construction and operation

- typical drive components and fault identification

- AC motor controlled devices and related component terminology

- AC motor control system, typical faults, symptoms and causes

- potential danger of charged high voltage (HV) capacitors

- effects of line output filtering malfunction

- inspection and testing procedures of AC motor control systems

RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording in the Performance Criteria is detailed below. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts.

Established WHS/OHS requirements may include:	- relevant legislation and standards
	- protective equipment
	- material safety management systems
	- hazardous substances and dangerous goods code
	- enterprise safe operating procedures
Appropriate personnel may include:	- supervisor
	- leading hand
	- foreman
	- manager
	- site engineer
	- workplace trainer
	- workplace mentor

Tools and equipment may include:	– hand tools – test equipment and instruments – equipment manuals and documentation – programming and fault diagnosis software – AC motor control system simulation software – controller test routines – consumables
Enterprise procedures may include:	– the use of tools and equipment – instructions, including job sheets, plans, drawings and designs – reporting and communication – manufacturers' specifications – operational procedures

EVIDENCE GUIDE

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.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	A person who demonstrates competency in this unit must be able to provide evidence of the ability to: – apply relevant WHS/OHS requirements and safe work practices at all times when working with electrical control systems in an engineering, manufacturing or processing work environment – apply logical fault finding processes and implement repairs to an AC motor control system – test and recommission AC motor control system to standard operating requirements The above requirements must be completed on at least two (2) occasions each in a different situation or context.
Context of and specific resources for assessment	This unit may be assessed on the job, off the job or a combination of both on and off the job.Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The candidate will have access to relevant equipment, tools system components, materials and documentation required and be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials. The competencies covered by this unit can be demonstrated by an individual working alone or as part of a team.

Method of assessment   Assessment must include the demonstration of practical skills and may also include:

- observation of processes and procedures;
- oral and/or written questioning on required knowledge and skills;
- testimony from supervisors, colleagues, clients and/or other appropriate persons;
- inspection of the final product or outcome;
- a portfolio of documented evidence.

VU22756 - Identify and repair faults in DC motor control systems

Unit Descriptor	This unit describes the performance outcomes, skills and knowledge required to identify and repair faults in Direct Current (DC) motor control systems. This includes working safely; applying knowledge of DC motor control systems and operating parameters to logical fault finding processes, carrying out fault repairs, safety and functional testing and interpreting technical data.
	If the work requires access to electrical plant and equipment that is fixed wired into relevant domestic, commercial and industrial electrical installations supplied at low voltage or above, the practice of the skills described in this unit are subject to the requirements of the Victorian Electricity Safety Act and Electricity Safety (Installation) Regulations.
	No licensing legislative, regulatory or certification requirements apply to this unit at the time of publication.
Employability Skills	This unit contains Employability Skills.
Application of the Unit	This unit of competency applies to a technician working in an engineering, manufacturing or processing environment where DC motor control systems are used to control processes and require ongoing maintenance and repair.

ELEMENT	PERFORMANCE CRITERIA
Elements describe the essential outcomes of a unit of competency.	*Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.*
1 Prepare to identify and repair faults.	1.1 ***Established WHS/OHS requirements*** and risk control procedures for the work area are identified and followed
	1.2 Details of faults are determined from reports and other documentation and from discussion with ***appropriate personnel***
	1.3 Relevant personnel are consulted to ensure the work is co-ordinated effectively with others involved on the work area
	1.4 ***Equipment*** needed to identify faults and carry out repairs are obtained in accordance with ***enterprise procedures*** and checked for correct operation and safety.
2 Identify and repair faults.	2.1 Requirement to test and/or measure live is determined in strict accordance with WHS/OHS requirements and conducted within established safety procedures

	2.2	Plant or machine circuits are checked as being isolated in accordance with WHS/OHS requirements and enterprise procedures
	2.3	Logical fault finding processes to diagnose DC motor control system faults are applied employing measurements and estimations of system operating parameters referenced to system operational requirements
	2.4	Suspected fault scenarios are tested to confirm system problems
	2.5	Faults in the control components of the system are repaired and the DC motor control system is restored to its operating condition
	2.6	If it is determined the cause of the fault/s is outside the control system then appropriately trained person/s are engaged to rectify the fault
	2.7	Methods for dealing with unexpected situations are made on the basis of safety considerations, expected work outcomes and discussion with relevant personnel.
3 Restore control system and document work	3.1	Tests are conducted and data are interpreted to verify the control system is now operating within specified requirements
	3.2	Relevant personnel are notified faults that faults are repaired and the control system is restored
	3.3	Control system repairs are documented, in accordance with enterprise procedures.

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills:

- applying relevant WHS/OHS requirements and safe work practices in a manufacturing/processing environment
- reading DC control system fault reports, technical specifications and related information
- determining and estimating operating parameters of DC motor control systems
- using tools, equipment and testing devices to identify faults in DC motor control systems
- making measurements on suspect components to determine failure
- applying logical diagnostic methods to determine and identify faults
- repairing faults and restoring system to operational standard
- communicating technical information to others
- recommissioning DC motor control systems according to enterprise procedure

Required knowledge:
- relevant WHS/OHS requirements and safe work practices in an engineering, manufacturing /processing environment
- DC motor control system construction and operation
- role of microcontrollers in DC motor control
- logical fault finding processes, symptoms and causes in DC motor control systems
- DC motor drive components and fault identification
- inspection and testing procedures of DC motor control systems

RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording in the Performance Criteria is detailed below. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts.

***Established WHS/OHS requirements** may include:*	– relevant legislation and standards – protective equipment – material safety management systems – hazardous substances and dangerous goods code – enterprise safe operating procedures
***Appropriate personnel** may include:*	– supervisor – leading hand – foreman – manager – site engineer – workplace trainer – workplace mentor
***Tools and equipment** may include:*	– hand tools – test equipment and instruments – equipment manuals and documentation – programming and fault diagnosis software – DC motor control system simulation software – controller test routines – consumables
***Enterprise procedures** may include:*	– the use of tools and equipment – instructions, including job sheets, plans, drawings and designs – reporting and communication – manufacturers' specifications – operational procedures

EVIDENCE GUIDE

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.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	A person who demonstrates competency in this unit must be able to provide evidence of the ability to: − apply relevant WHS/OHS requirements and safe work practices at all times when working with electrical control systems in an engineering, manufacturing or processing work environment − apply logical fault finding processes and implement repairs to an DC motor control system − test and recommission DC motor control system to standard operating requirements. The above requirements must be completed on at least two (2) occasions each in a different situation or context.
Context of and specific resources for assessment	This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations and a variety of conditions. The candidate will have access to relevant equipment, tools system components, materials and documentation required and be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials. The competencies covered by this unit can be demonstrated by an individual working alone or as part of a team.
Method of assessment	Assessment must include the demonstration of practical skills and may also include: − observation of processes and procedures; − oral and/or written questioning on required knowledge and skills; − testimony from supervisors, colleagues, clients and/or other appropriate persons; − inspection of the final product or outcome; − a portfolio of documented evidence.

VU22757 - Apply basic scientific principles and techniques in mechanical engineering situations

Unit Descriptor	This unit describes the performance outcomes, skills and knowledge required to apply basic scientific principles and techniques to appropriate mechanical and manufacturing engineering situations.
	The unit includes identifying the range of basic mechanical scientific principles and techniques relevant to mechanical and manufacturing engineering, selecting mechanical principles and techniques for particular applications, applying mechanical principles and techniques appropriately to engineering tasks and quoting results appropriately.
	No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication
Employability Skills	This unit contains Employability Skills.
Application of the Unit	This unit of competency applies to a person working as technician in a team supporting the design and development of mechanical and manufacturing applications.

ELEMENT	PERFORMANCE CRITERIA
Elements describe the essential outcomes of a unit of competency.	*Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.*
1 Identify the range of basic scientific principles and mechanical techniques relevant to mechanical and manufacturing engineering	1.1 The ***basic mechanical scientific principles*** are researched and reported on from ***appropriate sources of information*** and examination of applications
	1.2 The ***mechanical techniques*** and associated technologies required to implement the scientific principles are identified
2 Select and apply the relevant basic scientific principles and mechanical techniques for an application	2.1 The relevant basic scientific principles and mechanical techniques are selected for a particular situation
	2.2 The basic scientific principles are applied in a consistent manner to obtain an required solution
	2.3 Appropriate calculations and coherent units are used for the solution of engineering calculations
	2.4 Significant figures are used in engineering calculations
	2.5 The basic mechanical techniques and associated technologies, software and hardware are applied in a consistent and appropriate manner to obtain required solutions

3	Quote the results of the application of the basic mechanical scientific principles and basic techniques	3.1	For applications involving engineering calculations the solution is quoted in an appropriate style
		3.2	For applications not involving engineering calculations the solution is quoted in an appropriate style

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills:

- selecting appropriate basic mechanical scientific principles to suit specific applications
- selecting appropriate basic mechanical techniques and associated technologies, software and hardware to suit specific applications
- applying basic mechanical scientific principles to particular engineering situations
- applying and manipulating appropriate formulas for applications involving engineering calculations
- checking the validity of equations when applying dimensional analysis
- applying basic mechanical techniques and associated technologies, software and hardware in a manner appropriate to the application and identified scientific principles.
- referring solutions to the original aim of the application.
- quoting solutions in appropriate units, using appropriate significant figures.
- quoting limitations of solutions, due to assumptions, scientific principles and techniques used
- presenting solutions referring to the original aim of the application

Required knowledge:

- basic mechanical scientific principles
- limitations of selected basic scientific principles
- basic mechanical techniques and related technologies, software and hardware associated with implementing scientific principles in mechanical engineering solutions
- limitations of basic techniques and associated technologies, software and hardware
- applicability and limitations of basic mechanical scientific principles
- applicability and limitations of basic mechanical techniques and associated technologies, software and hardware
- appropriateness of calculations
- fundamental and derived quantities
- common systems of units
- procedure for converting between systems of units
- common prefixes used with units and their values
- procedure for carrying out dimensional analysis
- concept of significant figures
- uncertainty of computations based on experimental data
- procedures for determining the significance of figures in calculations
- procedures for estimating errors in derived quantities

RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording in the Performance Criteria is detailed below. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts.

***Basic mechanical scientific principles** may include:*	
	– Kinematics
	– Newton's law of motion
	– Friction
	– Momentum
	– Gravity
	– Motion (circular, orbital, rotational)
	– Fluid mechanics
	– Thermodynamics

***Appropriate sources of information** may include:*	
	– Reference texts
	– Internet search engines and websites
	– Manufacturer catalogues and industry magazines
	– Mechanical engineering conferences/forums

***Mechanical techniques** may include:*	
	– Machining
	– Turning
	– Fitting
	– Welding
	– Moulding
	– Fabricating
	– Wiring and programming

EVIDENCE GUIDE

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.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	A person who demonstrates competency in this unit must be able to provide evidence of the ability to:
	– select the mechanical principles and techniques for particular engineering task
	– apply mechanical prinicples and techniques appropriately to the engineering task
	– quote the results correctly
	The above requirements must be completed on at least two (2) occasions each in a different situation or context

Context of and specific resources for assessment	Assessment should be conducted in a real or simulated workplace environment using procedures, information and resources typical of a workplace.
	Where simulation is used, the conditions for assessment must be authentic and as far as possible reproduce and replicate the workplace
	Resources required for assessment include:

- – Suitable work environment
- – Facilities, equipment and materials to undertake the work specified including access to:
  - o computers and appropriate software
  - o calculators
  - o measuring devices.

Method of assessment	A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:

- – direct observation of the candidate ability to select and apply select and apply scientific principles and techniques to a mechanical engineering situation and quote the results appropriately
- – performing written and oral questioning to test underpinning knowledge

VU22758	**Build a simple network and establish end to end connectivity**
Unit Descriptor	This unit of competency describes the knowledge and skills required to apply an understanding of the architecture, structure, functions, protocols and components of a computer network in order to build a simple network and establish end to end connectivity. No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication
Employability Skills	This unit contains Employability Skills
Application of the Unit	The unit applies to IT practitioners who are required to build and maintain small to medium networks using a range of client server applications and services

ELEMENT	**PERFORMANCE CRITERIA**
Elements describe the essential outcomes of a unit of competency.	*Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.*
1. Identify the elements of an interconnected computer network	1.1 Use and methods of connecting multiple computer networks are explained 1.2 Devices and topologies used in a small to medium sized network are investigated 1.3 Characteristics of a computer network that facilitates data communication are recognised 1.4 Trends and developments in computer networking are explored
2. Configure a internetwork operating system enabling connectivity of a simple network	2.1 ***Network devices*** for a small computer network are identified 2.2 ***Computer operating system*** commands or utilities required to program the Network Interface Card (NIC) are obtained from manufacturer's manuals, data books or online resources 2.3 Internet Protocol (IP) addresses for the network interface card (NIC) are configured 2.4 Function and structure of the ***Internetwork Operating System (IOS)*** is defined 2.5 Relevant commands of an Internetwork Operating System that facilitate connection to a LAN are selected and configured 2.6 Physical network devices and components are identified from a network topological drawing

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	2.7	A *simple network topology* is cabled
	2.8	IOS testing commands are identified and utilised to verify end to end connectivity
	2.9	*Base level troubleshooting* skills and procedures are utilised to establish or re-establish network connectivity
3. Explain the operation of network protocols and layered communication models	3.1	Rules to facilitate data communication across the computer network are defined
	3.2	Role of protocols and standards in facilitating communication between networks is defined
	3.3	Methods of how devices access resources in a small to medium network are explained
	3.4	Open Source Interconnection (OSI) and Transport Control Protocol/Internet Protocol (TCP/IP) layered models of communication are compared
4. Recognise protocols that facilitate access to the computer network	4.1	Relationship between physical layer protocols and services that facilitate and support communication across a data network is defined
	4.2	Function and operation of the data link layer to support communication across a data network is recognised
	4.3	Media access control techniques are defined
	4.4	Role and operation of the ethernet protocol is defined
	4.5	Fundamental operation of a switch is explained
	4.6	Function and operation of the Address Resolution Protocol (ARP) to enable communication on a network is recognised
5. Outline the function and operation of the network layer	5.1	Operation of network layer protocols and services to support data communication across a network is explained
	5.2	Operation of routers to support end to end connectivity is explained
	5.3	Methods used by network devices to route data traffic are defined
	5.4	*Basic configurations for a router* are configured
6. Implement IPv4 and IPv6 addressing	6.1	*Network addressing* scheme is developed utilising IPv4 addresses
	6.2	Network addressing scheme is developed utilising IPv6 addresses
	6.3	Testing commands for end to end connectivity are identified and utilised

	6.4	Subnetting IPv4 network is demonstrated and implemented
	6.5	Subnetting IPv4 network utilising Variable Length Subnet Mask (VLSM) is demonstrated and implemented
	6.6	Design considerations for implementing IPv6 addresses are defined
7. Identify the function of and the protocols utilised for transport and application layers	7.1	Function and operation of transport layer protocols and services that support data communication across a network are developed
	7.2	Operation of the Transport Control Protocol (TCP) and User Datagram Protocol (UDP) transport layer protocols are explained
	7.3	Well known transport layer port numbers are described
	7.4	Function and operation of application layer protocols that facilitate end to end data communication across a network are defined
	7.5	Function and operation of well-known TCP/IP application layer protocols are defined
8. Build and verify a simple network	8.1	Addressing scheme for a small to medium network is designed
	8.2	Network routers and switches are selected and configured to establish end to end connectivity
	8.3	Base level troubleshooting skills and procedures are utilised to establish or repair network connectivity
	8.4	Network router and switch base level security functionality is configured
	8.5	**Network resources** are set up, configured and shared between network devices
	8.6	IOS commands to establish baseline performance are utilised

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills:

- using appropriate tools to develop and test network addressing
- translating paper network designs into a sketch of physical devices and connections
- using internetworking operating systems commands
- reading and interpret documents such as manufacturer's manuals, data books, online resources
- implementing basic network connectivity between devices
- configuring monitoring tools available for small to medium sized business networks
- configuring initial settings on a network device configuring router interfaces and testing and verifying correct functionality
- configuring applications and to verify their connection to provide network services

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Required knowledge:

- switch interface configuring and tests to verify correct functionality
- setting IP addresses on end points and network devices
- network devices
    - routers
    - switches
- network access
    - physical layer protocols
    - network media
    - data link protocols
    - medial access control
    - ethernet
- network layer
    - network layer protocols
    - routing protocols
    - Routers
    - configuring routers and switches
- Transport Layer Protocols (TCP)
- User Datagram Protocol (UDP)
- Application Layer Protocols (ALP)
- computer operating system commands
- network operating system commands
- computer network architecture
- internet and computer network communication
- OSI layered communication model
- TCP/IP layered communication model
- comparing similarities and differenced between the OSI and TCP/IP models
- encapsulation and de-encapsulation concepts as they relate to data flow in a network
- network addressing schemes
    - Classful & VLSM
    - IPv4 and IPv6 addressing
    - Network Address Translation (NAT) concepts
- subnetting IPV4 networks
- subnetting IPv6 networks
- cabling LANs
- base level troubleshooting procedures
- use testing commands eg (ping, Tracert, etc)

RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording in the Performance Criteria is detailed below. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts.

Network devices includes but not limited to:

- hubs
- switches
- routers
- workstations

	• IPads
	• android tablets
Computer operating system includes but not limited to:	• Windows versions
	• Linux
	• MacOS
Internetwork Operating System (IOS) includes but not limited to:	• Cisco IOS
	• Huawei IOS
	• Palo Alto IOS
	• HP IOS
	• VMWare IOS
Simple network topology includes but not limited to:	• routers
	• switches
	• end points
Base level troubleshooting includes but not limited to:	• ping
	• traceroute
	• examination of router routing table
	• examination of ARP table
	• inspection of interface configuration:
	• IPconfig
	• show CDP Neighbors
	• show IP interface brief
	• show interface
Basic configurations for a router includes but not limited to:	• configuring an IP address to an ethernet interface
	• enabling the interface
	• checking the interface address
	• configuring an IP address to an ethernet interface
	• enabling the interface
	• checking the interface address
Network addressing includes but not limited to:	• static addresses
	• dynamic addressing
	• subnets
Network resources includes but not limited to:	• files
	• software
	• TFTP Server
	• Wireshark

EVIDENCE GUIDE

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.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	To be considered competent in this unit assessors must be satisfied the candidate can demonstrate the achievement of all of the elements of the competency to the level defined by the associated performance criteria
	Specifically they must be able to:
	• identify the elements of an interconnected computer network
	• explain the operation of the OSI and TCP/IP layered communication models
	• identify the operation of and utilise relevant protocols at the Data link, Network, Transport and Application layers
	• construct IP addresses and subnets for a small to medium sized network
	• configure routers and switches and assign IP addresses to end points for a small to medium sized network
	• utilise test and troubleshooting commands and procedures for a small to medium sized computer network.
Context of and specific resources for assessment	Evidence should show competency working in a realistic environment and a variety of conditions. The candidate will have access to all tools, equipment, materials and documentation required. The candidate will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
	This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate
Method of assessment	Evidence can be gathered through a variety of ways including:
	– observation of processes and procedures
	– oral and/or written questioning
	– testimony from supervisors, colleagues, clients and/or other appropriate persons
	– inspection of the final product or outcome
	– portfolio of documented evidence.
	Where performance is not directly observed and/or is required to be demonstrated over a period of time and/or in a number of locations, any evidence should be authenticated by colleagues, supervisors, clients or other appropriate persons

VU22759	**Configure and troubleshoot network switches and routers**
Unit Descriptor	This unit of competency describes the knowledge and skills required to recognise and describe the architecture, components and operations of routers and switches in a small network.
	The unit also includes the knowledge and skills to configure and troubleshoot routers and switches and to resolve common issues with virtual Local Area Networks (VLANs) and inter-VLAN routing in both Internet Protocol (IP)v4 and (IP)v6 networks.
	No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.
Employability Skills	This unit contains Employability Skills.
Application of the Unit	The unit applies to an IT practitioner required to analysis, configure and troubleshoot routers and switches in small to medium sized business network.

ELEMENT

Elements describe the essential outcomes of a unit of competency.

PERFORMANCE CRITERIA

Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.

1. Configure a router for basic operation

    1.1 The process of how a router uses information in data packets to make forwarding decisions in the network is described

    1.2 Methods used by a router to learn about remote networks is explained

    1.3 Router to facilitate communication between multiple directly connected networks is configured

2. Configure and troubleshoot static and default routes

    2.1 Configuration of static and default routing protocols are described and followed

    2.2 Static and default routes are configured and implemented

    2.3 Static and default route configurations are tested for correct operation

3. Apply dynamic routing protocols and Routing Information Protocols (RIPv2)

    3.1 Function and operation of dynamic routing protocols are explained

    3.2 Operation of the RIPv2 routing protocol is implemented

    3.3 Route source, administrative distance and metric for a given route is determined from the routing table

4. Configure network switches	4.1	Function and operation of switched networks are explained
	4.2	Method used by layer 2 switches to forward data in a small to medium size LAN is described
	4.3	Layer 2 (switch) is configured to meet network specifications.
	4.4	***Standard troubleshooting techniques*** are utilised to establish end to end connectivity.
	4.5	***Best practise switch security*** for the network is configured
5. Configure Virtual Local Area Networks (VLANs)	5.1	Method in which VLAN segment broadcast domains is demonstrated
	5.2	VLAN segmentation is implemented
	5.3	Multiple VLANs are configured and established
	5.4	Inter VLAN routing is configured and tested
6. Secure a network using standard Access Control Lists (ACL's)	6.1	Security threats are recognised and control measures initiated according to enterprise procedures.
	6.2	Purpose and operation of standard ACL's are defined
	6.3	Layer 3 security utilising Standard Access Control Lists are implemented
	6.4	***Standard Access Lists troubleshooting techniques*** are followed and applied
7. Implement Dynamic Host Control Protocol (DHCP)	7.1	DHCP for IPv4 (DHCPv4) across multiple LANs is implemented
	7.2	DHCP for IPv6 (DHCPv6) across multiple LANs is implemented
8. Implement Network Address Translation (NAT) for IPv4	8.1	***Function and operation of NAT used to provide IPv4 addresses*** is explained
	8.2	NAT is configured and verified
	8.3	***Troubleshooting methods for NAT*** are deployed
9. Implement device discovery, management and maintenance	9.1	Discovery protocols used to map network topology are implemented
	9.2	Network Time Protocol (NTP) and System Logging (SYSLOG) protocols are implemented
	9.3	***Methods to maintain Router and Switch configuration files*** are followed

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills:

- implementing DHCP on a router
- implementing network address translation (NAT)
- implementing access control lists (ACLs) to filter traffic
- determining how a router will forward traffic based on the contents of a routing table
- implementing static routing
- demonstrating how switching operates in a small to medium-sized business network
- configuring Ethernet switch ports
- implementing VLANs
- using monitoring tools and network management protocols to troubleshoot data networks
- configuring monitoring tools used for small to medium size business networks
- configuring initial settings on a network device
- utilising and configuring Network Address Translation (NAT)
- utilising network discovery protocols eg CDP Neighbours
- configuring and interpreting Network Time Protocol (NTP)
- configuring and interpreting System Logging (SYSLOG) files

Required knowledge:

- base level network security with switches
- inter-VLAN routing
- network segmentation with VLANs
- routing tables and packet forwarding decisions
- static routes
- default routes
- dynamic routing
- distance vector routing protocols eg. RIP v2
- routing tables.
- Access Control Lists (ACL's)
- Dynamic Host Control Protocol (DHCP)
- Network Address Translation (NAT)
- Network Time Protocol (NTP)
- System Logging (SYSLOG) files
- Cisco Discovery Protocols eg Neighbours

RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording in the Performance Criteria is detailed below. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts.

Standard troubleshooting techniques include but not limited to:	• ping
	• traceroute
	• examine router routing table
	• examine Address resolution Protocol (ARP) table
	• inspection of interface configuration:
	    ○ IPconfig
	    ○ show Cisco Discovery Protocol eg Neighbours
	    ○ show IP interface brief
	    ○ show interface

Best practise switch security include but not limited to:	• setting passwords • unused port deactivation • blocking ports • secure Media Access Control (MAC) addresses
Standard Access Lists troubleshooting techniques Include but not limited to:	• access list placement • access list structure • access list configuration
Function and operation of NAT used to provide IPv4 addresses Include but not limited to:	• static NAT • dynamic NAT • Port Address Translation (PAT)

Troubleshooting methods for NAT Include but not limited to:	• NAT configuration
	• using test commands:
	    ○ clear ip nat statistics
	    ○ show ip nat translations
	    ○ debug ip nat
	    ○ ping
	    ○ show ip route

Methods to maintain Router and Switch configuration files Include but not limited to:	• copy and paste the configuration file to a text file • copy to a Trival File Transfer Protocol (TFTP) server

EVIDENCE GUIDE

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.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	To be considered competent in this unit assessors must be satisfied the candidate can demonstrate the achievement of all of the elements of the competency to the level defined by the associated performance criteria Specifically they must be able to: • configure a router for basic operation including static and dynamic routing

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- configure a switch for basic operation, including VLANs
- create and deploy standard access lists (ACL's) to control common security threats
- deploy Dynamic Host Control Protocol (DHCP)
- implement Network Address Translation (NAT) for IPv4
- implement device discovery, management and maintenance
- utilise test and troubleshooting commands and procedures.

Context of and specific resources for assessment	Evidence should show competency working in a realistic environment and a variety of conditions. The candidate will have access to all tools, equipment, materials and documentation required. The candidate will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
	This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate
Method of assessment	Evidence can be gathered through a variety of ways including:

- observation of processes and procedures
- oral and/or written questioning
- testimony from supervisors, colleagues, clients and/or other appropriate persons
- inspection of the final product or outcome
- portfolio of documented evidence.

Where performance is not directly observed and/or is required to be demonstrated over a period of time and/or in a number of locations, any evidence should be authenticated by colleagues, supervisors, clients or other appropriate person

VU22760

Apply network scaling tools and techniques

Unit Descriptor	The unit of competency describes the knowledge and skills required to use tools and techniques to scale an existing network design to improve reliability and accommodate predicted growth.
	The unit covers network architecture, configuring and troubleshooting routers and switches for advanced functionality, Spanning Tree Protocol (STP) concepts and configurations and implementation of etherchannel and Hot Shot Routing Protocol (HSRP). The unit also covers the implementation of dynamic routing such as Enhanced Interior Gateway Routing Protocol (EIGRP) and single and multi-area Open Shortest Path First (OSPF).
	No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication
Employability Skills	This unit contains Employability Skills
Application of the Unit	The unit applies to an IT practitioner required to scale (expand) an existing small to medium size business network to remove bottlenecks and accommodate predicted growth.

ELEMENT	PERFORMANCE CRITERIA
Elements describe the essential outcomes of a unit of competency.	*Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.*
1. Plan the expansion of an existing network	1.1 Identify Local Area Network (LAN) design concepts for a small to medium sized network
	1.2 ***Using the existing network design, data bottlenecks*** are identified
	1.3 Concepts of ***hierarchical scalable design*** for a network are explored
	1.4 Network devices based on feature compatibility are identified and selected
2. Implement scaling Virtual Local Area Network (VLAN) methods	2.1 Inter-switch connectivity for a switched LAN environment is identified and configured
	2.2 ***Inter VLAN routing troubleshooting tools and methodologies*** are utilised
	2.3 Inter VLAN routing using Layer 3 switching to forward data is implemented

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3.	Define and implement the Spanning Tree Protocol (STP) for a small to medium sized network	3.1	Simple switched network containing redundant links is configured and implemented
		3.2	Differences between **different implementations of STP** are defined
		3.3	Per VLAN Spanning Tree (PVST), Rapid PVST and STP in a switched LAN environment is implemented
4.	Implement etherchannel and Hot Shot Routing Protocol (HSRP)	4.1	Operation of link aggregation in a switched LAN environment is defined
		4.2	Link aggregation in a switched LAN environment is implemented and tested
		4.3	HSRP is implemented and tested
		4.4	Base level troubleshooting skills are utilised to verify network connectivity
5.	Configure Dynamic Routing Protocols	5.1	Features and characteristics of dynamic routing protocols are defined and implemented
		5.2	Function and operation of distance vector protocols are defined and implemented
		5.3	Function and operation of link state protocols are defined and implemented
6.	Configure Enhanced Interior Gateway Routing Protocol (EIGRP)	6.1	Function and operation of the EIGRP dynamic routing protocol is evaluated and implemented for a IPv4 network
		6.2	Function and operation of the EIGRP dynamic routing protocol is evaluated and implemented for a IPv6 network
		6.3	EIGRP is configured to improve network performance
		6.4	Trouble shooting methodologies and tools for EIGRP implementation are deployed
7.	Configure Open Shortest Path First (OSPF) protocol	7.1	Function and operation of single area OSPF dynamic routing protocol is defined
		7.2	Single area OSPFv2 dynamic routing protocol is implemented
		7.3	Single area OSPFv3 dynamic routing protocol is implemented
		7.4	Function and operation of multi-area OSPF dynamic routing protocol is defined
		7.5	Multi-area OSPFv2 dynamic routing protocol is implemented
		7.6	Multi-area OSPFv3 dynamic routing protocol is implemented

      7.7   Features of OSPF to improve network performance are configured

      7.8   Trouble shooting methodologies and tools for OSPF implementation are deployed

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills:

- configuring network interfaces
- configuring network routing
- verifying routing is functional
- troubleshooting advanced routing for client networks
- identifying network bottlenecks
- scaling VLANs

Required knowledge:

- principles of scaling a network
- scalable network architectures
  - o core layer
  - o distribution layer
  - o access layer
- principles of router redundancy
- likely causes of network bottlenecks
- etherchannel configuration for increased data throughput
- STP concepts
- STP implementation methodologies:
  - o Rapid Spanning Tree Protocol (RSTP)
  - o Per VLAN Spanning Tree Plus Protocol (PVST+)
- routing and packet forwarding
- static routing
- dynamic routing
- scalable routing strategies
  - o e.g. VSLM and CIDR
- routing tables
- link-state routing protocols.
  - o e.g. OSPF single and multi-area
- hybrid routing protocols
  - o e.g. EIGRP
- tuning mechanisms for EIGRP and OSPF
- network trouble shooting methodology

RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording in the Performance Criteria is detailed below. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts.

Using the existing network design, data bottlenecks includes but not limited to:

- switch trunk links
- highly subscribed LAN ports

Hierarchical scalable design includes but not limited to:

- core layer
- distribution layer
- access layer

Inter VLAN routing troubleshooting tools and methodologies includes but not limited to:

- bottom up testing
- ping
- traceroute
- examination of routing table
- inspection of interface configuration:
  - IPconfig
  - show IP interface brief
  - show interface

Different implementations of STP: includes but not limited to:

- STP
- PVST+
- RSTP
- Rapid PVST+

EVIDENCE GUIDE

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.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

To be considered competent in this unit assessors must be satisfied the candidate can demonstrate the achievement of all of the elements of the competency to the level defined by the associated performance criteria

Specifically they must be able to:

- identify LAN design concepts and requirements
- implement STP and HSRP for a small to medium sized network
- implement etherchannel to improve data throughput
- configure, implement and troubleshoot the EIGRP dynamic routing protocol for IPv4 and IPv6
- configure, implement and troubleshoot the OSPF dynamic routing protocol for IPv4 and IPv6 in a single or multi area small to medium sized network
- utilise test and troubleshooting commands and procedures

Context of and specific resources for assessment	Evidence should show competency working in a realistic environment and a variety of conditions. The candidate will have access to all tools, equipment, materials and documentation required. The candidate will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
	This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working as part of a team. The assessment environment should not disadvantage the candidate.
Method of assessment	Evidence can be gathered through a variety of ways including:

- observation of processes and procedures

- oral and/or written questioning

- testimony from supervisors, colleagues, clients and/or other appropriate persons

- inspection of the final product or outcome

- portfolio of documented evidence.

Where performance is not directly observed and/or is required to be demonstrated over a period of time and/or in a number of locations, any evidence should be authenticated by colleagues, supervisors, clients or other appropriate persons

VU22761	**Establish connectivity to a wide area network (WAN)**

Unit Descriptor	The unit of competency describes the knowledge and skills to connect a small to medium enterprise to a wide area network (WAN) and to plan appropriate network services. The unit includes serial WAN access technologies and protocols such as High Level Data Link (HDLC), Point to Point (PPP) and Point to point over Ethernet (PPoE). The unit also introduces General Routing Encapsulation (GRE) tunnelling and single homed and routing protocol and external Border Gateway Protocol (eBGP).
	Local Area Network (LAN) topics include configuring Simple Network Management Protocol (SNMP), Cisco Switched Port Analyser (SPAN) and examining Quality of Service (QoS) requirements.
	The unit also explores trends and directions in the evolution of computer networks
	No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication
Employability Skills	This unit contains Employability Skills
Application of the Unit	The unit applies to an IT practitioner required to establish connectivity of a small to medium sized network to a WAN network

ELEMENT	**PERFORMANCE CRITERIA**
Elements describe the essential outcomes of a unit of competency.	*Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.*
1. Plan the network connectivity to a Wide Area Network (WAN)	1.1 Range of ***WAN access technologies*** available to a small to medium sized network is evaluated
	1.2 Nature and scope of the network, ***WAN connection and performance expectations*** are established in consultation with ***relevant personnel***
	1.3 Network hardware, software, ***WAN communication protocol*** requirements are selected and sourced in accordance with ***established procedures***
	1.4 WAN access technology suitable for the small to medium sized network is selected
2. Configure point to point WAN connections	2.1 Operation of a High Level Data Link Control (HDLC) encapsulation for a serial point to point WAN connection is configured
	2.2 Operation of Point to Point Protocol (PPP) encapsulation for a serial point to point WAN connection is configured

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		2.3	**_Established troubleshooting procedure and tools_** are utilised to identify and rectify PPP WAN implementation issues
3.	Select and implement various branch connections available	3.1	Broadband remote access technologies to support business requirements are identified and selected
		3.2	Point to Point Protocol over Ethernet (PPPoE) for a router is configured and implemented
		3.3	Function and operation of Virtual Private Networks (VPN's) to secure a remote site to site connection is determined
		3.4	Generic Routing Encapsulation (GRE) tunnel for a remote site to site connection is implemented
		3.5	External Border Gateway Protocol (eBGP) for a single homed access network is implemented
4.	Review and implement Access Control Lists (ACL's)	4.1	Standard access lists for IPv4 are configured and implemented
		4.2	Extended Access lists for IPv4, are configured and implemented
		4.3	Access lists for IPv6 are configured and implemented
		4.4	Troubleshooting procedures are established and utilised to identify and rectify any ACL configuration and operational issues
5.	Monitor network security	5.1	Procedures to **_mitigate common security attacks_** for a small to medium sized LAN are defined
		5.2	Simple Network Management Protocol (SNMP) to monitor network operation is configured
		5.3	Cisco Switch Port Analyser (SPAN) to troubleshoot network problem are configured
6.	Explore Quality of Service (QoS) requirements	6.1	Purpose and operation of **_Quality of Service_** (**_QoS)_** are explained
		6.2	Methods that networking devices use to implement QoS for a network is explained
8.	Implement network troubleshooting methods	7.1	Network troubleshooting procedures are established and appropriate tools are selected
		7.2	End to end connectivity troubleshooting methodologies are performed
7.	Research trends and directions in the evolution of computer networks	8.1	Function, directions and operation of Internet of Things (IOT) devices are examined
		8.2	Directions in cloud computing and virtualisation in network computing are explored
		8.3	Requirements of network programming in emerging networks and devices are investigated

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills:

- assessing customer requirements and performance expectation regarding WAN connectivity
- determining and selecting appropriate WAN configurations and access technologies
- facilitating network connectivity by installing and configuring a WAN communication protocol such as PPP, HDLC and PPPoE
- implementing and troubleshooting IPv4 and IPv6 Access control Lists (ACL's)
- identifying QoS mechanisms to support WAN connectivity
- establishing procedures and selecting appropriate tools to troubleshoot client networks
- evaluating current trends and directions in networking. eg IOT, cloud computing, virtualised systems and network programming

Required knowledge:

- OSI layered communication model
- WAN link protocols such as PPP, HDLC and PPPoE
- VPN Technologies
- ADSDL Technologies
- network security monitoring
- QoS mechanisms
- methods to secure Site to Site Connectivity
    - VPN's
    - GRE
    - IPsec
    - Tunnels
    - eBGP
- tools to monitor a network
    - System Message Logging (SYSLOG)
    - Simple Network Monitoring Protocol (SNMP)
    - Netflow
    - Wireshark
    - Cisco Port Analyser (SPAN)
- WAN troubleshooting methodologies and diagnostic tools
- Internet of Things (IoT)
- cloud computing

RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording in the Performance Criteria is detailed below. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts.

WAN access technologies includes but not limited to:	• dedicated lines
	      ○ leased lines
	      ○ Integrated Services Digital Network (ISDN)
	      ○ frame relay
	      ○ Asynchronous Transfer Mode (ATM)
	      ○ dial up
	      ○ Ethernet Wan
	      ○ Multiprotocol Label Switching (MPLS)
	      ○ Very-small-aperture terminal (VSAT)
	
	 • public infrastructure
	      ○ digital subscriber line (DSL)
	      ○ cable
	      ○ wireless
	      ○ 3G/4G/5G Cellular

WAN connection and performance expectations includes but not limited to:	• connection bandwidth • connection services • Internet service provider (ISP)connections • Internet Protocol Telephony (ITP) future requirements
Relevant personnel includes but not limited to:	• IT supervisor • IT manager • IT site engineer • client
WAN communication protocols includes but not limited to:	• High-Level Data Link Control (HDLC) • Point to Point Protocol (PPP) • Point to Point Protocol over Ethernet (PPPoE) • Frame Relay • MPLS
Established procedures includes, but are not limited to:	• use of tools and equipment • instructions, including job sheets, plans, drawings and designs • reporting and communication • manufacturers' specifications • operational procedures
Established troubleshooting procedures and tools includes but not limited to:	• network documentation • troubleshooting process • layered approach to troubleshooting • software troubleshooting tools • hardware troubleshooting tools • protocol analysers • wireshark • Syslog

- Simple Network Management Protocol (SNMP)
- ping
- Traceroute
- examine router routing table
- examine Address Resolution Protocols (ARP) table
- inspection of interface configuration:
  - IPconfig
  - show IP interface brief
  - show interface

Mitigating common security attacks includes but not limited to:

- CDP Reconnaissance Attack
- Telnet attacks
- MAC address table flooding attack
- Virtual Local Area Network (VLAN) attacks
- Dynamic Host Configuration Protocol (DHCP) attacks

Quality of Service (**_QoS)_** **_mechanisms_** includes but not limited to:

- voice
- video
- data
- queuing algorithms
  - First In First Out (FIFO)
  - Weighted Fair Queuing (WFQ)
  - Cross Based Weighted Fair Queuing (CBWFQ)
  - Low Latency Queuing (LLQ)

EVIDENCE GUIDE

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.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	To be considered competent in this unit assessors must be satisfied the candidate can demonstrate the achievement of all of the elements of the competency to the level defined by the associated performance criteria
	Specifically they must be able to:
	- plan, configure and connect a wide area network connection for a small to medium organisation
	- identify QoS requirements for a small to medium sized network
	- utilise, test and troubleshoot commands to determine end to end connectivity for a small to medium sized computer network
	- demonstrate a knowledge of trends and directions in the evolution of computer networks eg IOT devices, virtualisation trends and network programming
Context of and specific resources for assessment	Evidence should show competency working in a realistic environment and a variety of conditions. The candidate will have access to all tools, equipment, materials and documentation required. The candidate will be permitted

VU22761 Establish connectivity to a wide area network (WAN) to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working as part of a team. The assessment environment should not disadvantage the candidate

Method of assessment   Evidence can be gathered through a variety of ways

including:

- observation of processes and procedures

- oral and/or written questioning

- testimony from supervisors, colleagues, clients and/or other appropriate persons

- inspection of the final product or outcome

- portfolio of documented evidence.

Where performance is not directly observed and/or is required to be demonstrated over a period of time and/or in a number of locations, any evidence should be authenticated by colleagues, supervisors, clients or other appropriate persons

VU22333 - Perform intermediate engineering computations

Unit Descriptor	This unit of competency describes the skills and knowledge required to prepare and apply intermediate level engineering computations.
	It includes the use of trigonometry, the application of sine and cosine rules, formulae and geometric principles relevant to the engineering and the calculation of areas and volumes of common engineering shapes.
	No licensing or certification requirements apply to this unit at the time of accreditation.
Employability Skills	This unit contains Employability Skills.
Application of the Unit	This unit would be applied by entry level engineering students/workers required to undertake a range of intermediate level engineering computations.

ELEMENT	PERFORMANCE CRITERIA
Elements describe the essential outcomes of a unit of competency	Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.
1. Determine job computation requirements	1.1 ***Job requirements*** are identified from specifications, drawings, job sheets or work instructions.
	1.2 ***Required calculations*** are determined from job instructions.
2. Determine and apply required formulae and establish estimate	2.1 ***Relevant formulae*** to suit the job requirement is determined.
	2.2 An estimation of the expected results, including rounding off is undertaken
3. Perform computation and comfirm estimate	3.1 ***Standard Operating Procedures (SOPs)*** are followed at all times.
	3.2 ***Calculation method*** is made to obtain accurate answer.
	3.3 Answer is checked against estimation.

REQUIRED SKILLS AND KNOWLEDGE

Required Skills:

- following work instructions, standard operating procedures
- obtaining and interpreting data from specifications, drawings, job sheets or work instructions to establish required outcomes
- determining the appropriate calculation method to suit the application
- performing calculations using:
  - trigonometric ratios
  - sine and cosine rules
  - pythagoras theorem
  - geometric formulae

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- manipulating of formulae to change the subject
- checking answers using estimations

Required Knowledge:

- formulae applicable to the determination of perimeter, area and volume of simple geometric shapes
- the reasons for ensuring calculations are carried out using the same units of measurement
- nomenclature used in trigonometry, pythagoras' theorem and geometry
- mathematical principles and order of operations
- techniques and procedures for rounding off figures when estimating approximate answers
- applications of geometric calculations in manufacturing and engineering situations

RANGE STATEMENT

This describes the essential skills and knowledge and their level, required for this unit. Bold italicised wording in the Performance Criteria is detailed below.

Job requirements may include but not limited to:
- timeframe for task
- tools and equipment
- working with others
- materials, parts and other resources
- specifications
- procedures
- special reporting requirements
- quality measures

Required calculation may include but not limited to:
- angles
- lengths
- areas
- perimeters
- volumes

Relevant formulae may include but not limited to:
- trigonometry:
  - o basic functions eg trigonometry ratios
  - o sine rule
  - o cosine rule
- pythagoras theorem
- geometric formulae

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Standard operating procedures (SOPs) may include but not limited to:	• the use of tools and equipment
	• instructions, including job sheets, cutting lists, plans, drawings and designs
	• reporting and communication
	• manufacturers' specifications and operational procedures
Calculation method may include but not limited to:	• subtraction
	• addition
	• multiplication
	• division
	• manipulation of formulae

EVIDENCE GUIDE

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.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	To be considered competent in this unit assessors must be satisfied the candidate can demonstrate the achievement of all of the elements of the competency to the level defined by the associated performance criteria
	Specifically they must be able to:
	• perform calculations using:
	− trigonometric ratios
	− sine and cosine rules
	− pythagoras theorem
	− geometric formulae
	• select the correct formulae for a given task and complete the required calculation/s on a number of occasions.
Context of and specific resources for assessment	Evidence should show competency working in a realistic environment and a variety of conditions. The candidate will have access to all tools, equipment, materials and documentation required. The candidate will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
Methods of assessment	Evidence can be gathered through a variety of ways including:
	• observation of processes and procedures
	• oral and/or written questioning
	• testimony from supervisors, colleagues, clients and/or other appropriate persons
	• inspection of the final outcome
	• portfolio of documented evidence.
	Where performance is not directly observed and/or is required to be demonstrated over a period of time and/or in a number of locations, any evidence should be authenticated by colleagues, supervisors, clients or other appropriate persons.

VU22338 - Configure and program a basic robotic system

Unit Descriptor	This unit of competency describes the knowledge and skills required to configure and program a basic robotic system. Typical tasks for basic robotic system operation include pick and place, motion and navigation. Code development will include testing code and producing code to control robotic systems.
	No licensing or certification requirements apply to this unit at the time of accreditation.
Employability Skills	This unit contains Employability Skills.
Application of the Unit	This unit would be applied by entry level engineering workers required to undertake basic operations with robotic systems for a range of repetitive and routine tasks.
	This unit does not include large, complex industrial robotic systems used in manufacturing operations.

ELEMENT	PERFORMANCE CRITERIA
Elements describe the essential outcomes of a unit of competency	Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.
1. Plan the configuration and programming of a basic robotic system	1.1 ***Workplace Health and Safety/Occupational, health and safety (WHS/OHS) requirements*** and ***environmental requirements*** for a given work area are obtained and understood.
	1.2 Established WHS/OHS requirements and risk control measures and procedures in preparation for the work area are followed.
	1.3 Safety hazards, which have not previously been identified, are documented and risk control measures devised and implemented in consultation with ***appropriate personnel.***
	1.4 Routine tasks that may be performed by a robotic system are analysed, documented and discussed with appropriate personnel.
	1.5 ***Robotic system*** configuration and programming requirements are determined from documentation, construction briefs and discussions with appropriate personnel.
	1.6 Appropriate personnel are consulted to ensure the work is coordinated effectively with others involved at the work site.
	1.7 ***Resources and equipment*** needed for the task are obtained in accordance with enterprise procedures and checked for correct operation and safety.
2. Configure and program a robotic system	2.1 WHS/OHS requirements for carrying out the work are followed.
	2.2 Equipment/machines/plant is checked as being isolated where necessary in strict accordance with WHS/OHS requirements.

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2.3 Robotic system is constructed and programmed in accordance with requirements, manufacturers' specifications and **enterprise procedures**.

2.4 Robotic system is programmed and configured for the intended task according to manufacturers' specifications and enterprise procedures.

2.5 Robotic system is tested for correct operation and, if required, incorrect hardware and software functions are identified and rectified.

2.6 Decisions for dealing with unexpected situations are made from discussions with appropriate personnel, job specifications and enterprise procedures.

2.7 Methods for dealing with unexpected situations are selected on the basis of safety and specified work outcomes.

3. Verify and document robotic system

3.1 WHS/OHS requirements for completing the work are followed.

3.2 Work site is made safe in accordance with established safety procedures.

3.3 Hardware and software tools used in configuration and programming tasks are maintained and stored according to enterprise procedures.

3.4 Robotic system overall function and requirements are verified, documented and information stored according to enterprise procedures.

3.5 Appropriate personnel are informed of the completion of work and, if required, provided with a demonstration of the operation of hardware and software aspects of the robotic system.

REQUIRED SKILLS AND KNOWLEDGE

Required skills:
- using tools and equipment configure and program a robotic system
- following enterprise and WHS/OHS procedures
- reading and interpreting robotics equipment manuals
- completing workplace documentation
- making decisions within a limited range of options
- installing and configuring integrated programming environments (IPE)
- saving, editing, documenting and compiling code
- defining and documenting a basic robotic task including requirement list; task steps; input requirements; output requirement; logic states
- testing code including systematic fault finding and documentation; debuggers and simulation; fault isolation; input checking; output checking; diagnostic code
- troubleshooting robotic system operation

Required knowledge:

- types of robotic devices including mobile robots; autonomous robots; robotic arms

- robot axis and degrees of movement

- robot power requirements and movement e.g. stationary robots with mains derived power; mobile robots with batteries; battery duration and recharging

- DC motor types including permanent magnet DC motors; brushed motors; brushless motors; stepping motor

- DC motor controls including speed control (pulse width modulation); forward and reverse control; 'H' drive

- positional feedback and servo systems including potentiometers; encodes (incremental and absolute)

- solenoid actuators

- input basic transducers including switches; potentiometers; IR infra-red sensors; ultra-sonic sensors

- robot electronics fundamentals including CPU/controller; input interfaces, analogue, digital; output interfaces, analogue, digital, drive capabilities protection

- drive mechanisms including gearboxes; belts; chains

- robot construction materials including metal; wood; plastics; composites

- download interfaces such as RS232; USB; IEEE1394 or similar

- flowchart symbols

- flowchart decisions and logic

- program code including input statements; output statements; logical operators (AND, OR, NOT, XOR, SHiFT); mathematical operators; flow control (IF THEN, FOR, WHILE); program modules (CALL, RETURN)

- code download including programming interfaces; isolation; programming mode; operational mode. eg Programming Raspberry Pi with Python and Open Computer Vision (CV)

- WHS/OHS considerations applicable to robotic systems

RANGE STATEMENT

This describes the essential skills and knowledge and their level, required for this unit. Bold italicised wording in the Performance Criteria is detailed below.

Workplace Health and Safety/Occupational, health and safety (WHS/OHS) requirements may include but not limited to:	• legislation • protective equipment • material safety management systems • hazardous substances and dangerous goods code • local safe operation procedures
Environmental requirements may include but not limited to:	• liquid waste • solid waste • gas, fume, vapour, smoke emissions, including fugitive emissions • excessive energy and water use • excessive noise

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Appropriate personnel may include but not limited to:	• supervisor
	• leading hand
	• foreman
	• manager
	• site engineer
	• trainer
	• mentor
	• teacher
	• team member

Robotic system may include but not limited to:	• mobile robots
	• autonomous robots
	• robotic arms

Resources and equipment may include but not limited to:	• appropriate tools
	• test equipment
	• consumables
	• appropriate software licences
	• manufacturers' specifications and manuals
	• diagnostics software
	• personal computer
	• programming tools

Enterprise procedures may include but not limited to:	• the use of tools and equipment
	• instructions, including job sheets, cutting lists, plans, drawings and designs
	• reporting and communication
	• manufacturers' specifications and operational procedures

EVIDENCE GUIDE

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.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	To be considered competent in this unit assessors must be satisfied the candidate can demonstrate the achievement of all of the elements of the competency to the level defined by the associated performance criteria
	Specifically they must be able to:
	• plan, and construct a robotic system for a routine task using handware and software tools
	• configure, program, test and rectify robotic system to achieve optimium performance of routine task

- apply relevant WHS/OHS procedures and safe work practices during construction, programming and testing of a robotic system.

Context of and specific resources for assessment	Evidence should show competency working in a realistic environment and a variety of conditions. The candidate will have access to all tools, equipment, materials and documentation required. The candidate will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
Methods of assessment	Evidence can be gathered through a variety of ways including:

- observation of processes and procedures
- oral and/or written questioning
- testimony from supervisors, colleagues, clients and/or other appropriate persons
- inspection of the final product or outcome
- portfolio of documented evidence.

Where performance is not directly observed and/or is required to be demonstrated over a period of time and/or in a number of locations, any evidence should be authenticated by colleagues, supervisors, clients or other appropriate persons.

VU22674 - Explore applications and operation of the Internet of Things (IoT)

Unit Descriptor	This unit describes the performance outcomes, skills and knowledge required to recognise the current applications and potential of the Internet of Things (IoT) including its application in the electrotechnology industry. Typical IoT devices are examined and an example IoT system is set up to familiarise the learner with the basic components and wireless technology required for operating the system.
	The unit also examines the function of Bluetooth and Wi-Fi technologies, their applications and the difference between the two technologies.
	No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.
Employability Skills	This unit contains Employability Skills.
Application of the Unit	This unit of competency is intended for use in an entry level qualification and applies to a person who is seeking an introductory knowledge of the real world and potential applications of the Internet of Things (IoT).

ELEMENT	PERFORMANCE CRITERIA
Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.
1　Identify the function and operation of the IoT	1.1　***Applications of IoT systems*** are explored and the impact of their connectivity is assessed
	1.2　***Typical IoT devices*** are identified and their function and application in the system are defined
	1.3　***Types of wireless technologies for the IoT networks*** are identified and examples of their application are provided
	1.4　Potential areas of vulnerability and security risks associated IoT devices and systems are recognised
2　Set up an example IoT system	2.1　***Example IoT system*** is determined and approved by ***appropriate person***
	2.2　Physical components and ***operating system software*** for the example IoT system are selected and sourced
	2.3　Operating system software is loaded to a smartphone, tablet or IoT device and its operation is verified
	2.4　Physical components of the system are assembled and programmed to operate in accordance with predetermined requirements

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		2.5	Example IoT system is set to operate in accordance with project requirements
		2.6	**Basic troubleshooting methodologies** are applied to the IoT system to verify functional operation
3	Utilise Bluetooth technology	3.1	Bluetooth technology is defined and its **applications** are recognised
		3.2	Bluetooth compatible devices are paired according to manufacturer instructions
		3.3	Operation of the Bluetooth compatible devices is demonstrated
4	Utilise Wi-Fi (WLAN) technology	4.1	Wi-Fi technology is defined and its applications are recognised
		4.2	The difference between Bluetooth and Wi-Fi technologies and their application is recognised and explained
		4.3	**Connecting securely to Wi Fi devices** is defined and demonstrated
		4.4	Signal level and connectivity to Wi-Fi hot spot is assessed
		4.3	Access to the internet using Wi-Fi technology is demonstrated

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills:

- investigate a range of real world applications of IoT and identify its potential within the electrotechnology industry
- identify typical IoT devices
- set up and operate an simple IoT system
- pair compatible devices using Bluetooth technology
- access the internet using Wi-Fi technology
- recognise the difference in the applications of Bluetooth and Wi-Fi technologies

Required knowledge:

- real world and potential applications of IoT
- IoT devices
- types of wireless technologies used for the IoT
- Bluetooth technology and its applications
- Wi-Fi technology and its applications
- applications of wireless technologies in the electrotechnology industry

RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording in the Performance Criteria is detailed below. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts.

Applications of IoT systems may include:	- smart home - wearables - connected cars - industrial internet - smart cities - smart farming - smart retailing - energy management - healthcare
Typical IoT devices may include:	- Rasberry PI - AWS (Amazon Web Services) IoT Button - Intel Quark SoCX1000 - Samsung Smarthings - Google Nest devices - Amazon Echo - Arduino
Types of wireless technologies for the IoT networks may include	- Bluetooth - Wi-Fi hot spots - WiMAX - ZigBee
Example IoT system may include:	- smart watering system - personalised light switch system - power on/off home appliances system - other systems
Appropriate person may include:	- supervisor - teacher - trainer - IT personnel
Operating system software may include:	- Google's Brillo - Microsoft's Windows 10 IoT Series - Samsung's Artik - Intel's Edison - Apple's HomeKit - IBM Bluemix

Basic troubleshooting methodologies may include:	− checking power connections to verify device has power
	− checking physical connections
	− turning system off and on
	− following suggested manual troubleshooting guidelines
Applications may include:	− smart phones
	− headsets
	− printers
	− computer keyboards/mouse
	− in-car speaker system
	− in-home speaker system
	− television
	− various data sharing devices
Connecting securely to Wi Fi devices may include:	− Service Set Identifier (SSID)
	− passwords

EVIDENCE GUIDE

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.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	A person who demonstrates competency in this unit must be able to provide evidence of the ability to:
	− recognise the applications of the Internet of Things (IoT) and their connectivity benefits
	− identify IoT devices and their functions
	− set up a simple example of a IoT system
	− demonstrate the application of Bluetooth and Wi-Fi technologies
Context of and specific resources for assessment	Skills will be demonstrated in a worksafe simulated environment that reflects workplace conditions using suitable facilities, equipment and resource. Assessment must ensure access to:
	− electronic components, software and equipment reflecting the technologies covered in this unit
	− relevant WHS/OHS procedures and requirements
	− equipment operating instructions/manuals
	− hand tools and hand held power tools normally used in a electrotechnology work environment

Method of assessment	A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:

- direct observation of the candidate performing specified tasks such as pairing wireless devices, assembling electronic components, uploading software, operating a smartphone using Wi-Fi technology
- written and oral questioning to test underpinning knowledge. For example, IoT connectivity applications and security awareness, basic difference and applications of Bluetooth and Wi-Fi technologies.

VU21270- Implement control processes using PLCs

Unit Descriptor	This unit of competency sets out the knowledge and skills required to program Programmable Logic Controllers (PLCs) within an industrial setting.
	No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.
Employability Skills	This unit contains employability skills.
Application of the Unit	This unit of competency applies to the use of PLCs to control manufacturing processes.
	Work associated with this unit of competency is carried out at a para-professional level.

ELEMENT	PERFORMANCE CRITERIA
Elements describe the essential outcomes of a unit of competency. Elements describe actions or outcomes that are demonstrable and assessable.	Performance criteria describe the required performance needed to demonstrate achievement of the element – they identify the standard for the element. Where bold/italicised text is used, further information or explanation is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.
1. Plan PLC application	1.1 ***Occupational Health and Safety/Workplace Health and Safety (OHS/WHS) requirements*** and ***environmental requirements*** for a given work area are determined.
	1.2 Established OHS/WHS requirements and risk control measures and procedures are followed in preparation of the work area.
	1.3 PLC application is determined from documentation, job sheets or discussions with ***appropriate personnel***.
	1.4 Measurements and data required are identified and appropriate control system components selected.
	1.5 ***Resources and equipment*** needed for the task are obtained in accordance with ***enterprise procedures*** and checked for correct operation and safety.
	1.6 Implementation of the control system is analysed and optimum approach selected, planned for and checked against requirements
	1.7 Appropriate personnel are consulted to ensure the work is co-ordinated effectively with others involved at the work site.
2. Design PLC program outline	2.1 OHS/WHS requirements for carrying out the work are followed.
	2.2 Ladder control circuits or logical flow of the application are drawn, if required.
	2.3 Ladder control circuits are converted to ladder logic, if required.

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3.	Program PLC for the application	3.1	OHS/WHS requirements for carrying out the work are followed.
		3.2	PLC is programmed according to manufacturers' specifications and job requirements.
		3.3	Decisions for dealing with unexpected situations are made from discussions with appropriate personnel, job specifications and enterprise procedures.
		3.4	Methods for dealing with unexpected situations are selected on the basis of safety and specified work outcomes.
4.	Test and document PLC program	4.1	OHS/WHS requirements for completing the work are followed.
		4.2	The PLC program is function tested and its operation verified.
		4.3	Equipment and machinery is checked as being isolated where necessary during testing process.
		4.4	Work site is made safe in accordance with established safety procedures.
		4.5	PLC program and function test is documented according to enterprise procedures.
		4.6	Work completion is notified to appropriate personnel according to enterprise procedures.

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills:

- consult and communicate with others
- identify and follow relevant OH&S procedures
- produce logic flow diagram
- write, test and debug PLC program code
- modify program online
- locate hardware and software faults
- document program

Required knowledge:

- programmable controller
  - input rack
  - output rack
  - central Processor Unit (CPU)
  - power supply
  - special units (e.g. motor control, A/D, D/A)
  - programmer

- control Logic
  - relay logic circuit (revision)
    - series circuits
    - parallel circuits
    - combination of series and parallel
    - interlocking
  - programmable logic
    - ON state instruction
    - series equivalent circuits
    - parallel equivalent circuits
    - combination series/parallel
    - OFF state instruction
  - control relay logic conversion
    - relay to logic programmable logic
    - programmable logic to relay logic
- fail safe
  - identifying need for fail safe
  - programming fail safe
  - hardware fail safe
- program editors
  - grafcet
  - statement list
  - ladder
  - graphical
- memory devices
  - terminology (RAM, ROM, EPROM, etc)
  - volatile, non-volatile, static
  - dynamic
  - I/O image registers
  - applications program
  - scratchpad area
  - timer/counter preset/acc registers
  - data tables
- advanced logic concepts
  - word logic operations
    - merge (word AND)
    - mask (word OR)
    - complement (word complement)
- counters & timers
  - timing diagrams
    - edge sensitive (leading and trailing)
    - level sensitive

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- interpreting timing diagrams
  - software timing functions
    - delay on timer (DOE)
    - delay off timer (DDE)
    - interval timer
  - time related software functions
    - one shot
    - time base generators
    - time clock
- advanced control instructions
  - general operations
    - master control function
    - subroutine function
    - input differentiation function
    - temporary relay function
    - bistable control function
    - sequencer control function
    - drum controller function
    - conditional branch function
    - labels and rung comments
  - math operations
    - addition, subtraction, division, multiplication, square, compare
    - conversions BIN to BCD to BIN
    - matrix, arithmetic shift left and right
  - block operations
    - block – move, compare, set, reset
    - word transfer
  - bit operations
    - carry – set, reset
    - shift left and right
    - rotate left and right
- hardware fault location
  - importance of documentation
  - field I/O devices and wiring
  - CPU diagnostic indicators
  - I/O module cards and status indicators
  - watch dog timer
- software fault location and rectification
  - programming console as diagnostic tool
  - override/force functions (safety considerations)
  - diagnostic/error code registers

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RANGE STATEMENT

The Range Statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold / italicised wording in the Performance Criteria is detailed below.

OHS/WHS requirements may include, but are not limited to:

- legislation
- protective equipment
- material safety management systems
- hazardous substances and dangerous goods code
- local safe operation procedures
- awards provisions

Environmental requirements may include, but are not limited to:

- liquid waste
- solid waste
- gas, fume, vapour, smoke emissions, including fugitive emissions
- excessive energy and water use
- excessive noise

Appropriate personnel may include:

- supervisor
- leading hand
- foreman
- manager
- site engineer
- trainer
- mentor
- teacher
- team member

Resources and equipment may include, but are not limited to:

- computer software
- software reference documentation
- internet access
- network access
- relevant standards
- suitable computer work station
- PLCs
- variety of input devices
- variety of output devices
- printer
- PLC interface units

Enterprise procedures may include, but are not limited to:

- the use of tools and equipment
- instructions, including job sheets, cutting lists, plans, drawings and designs
- reporting and communication
- manufacturers' specifications and operational procedures

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EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Elements, Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment section in Section B of the Accreditation Submission.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	• Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the associated performance criteria, including required skills and knowledge. Specifically they must be 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 – demonstrate the ability to successfully program PLCs within an industrial setting on more than one occasion and in different contexts. – test and document PLC programs
Context of and specific resources for assessment	• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate. • Resources required for assessment include: – OHS/WHS policy and work procedures and instructions. – access to workplace or work real environment and a variety of conditions – operational access to relevant machines, tools, materials and consumables – access to relevant plans, drawings and instructions and manufacturer's specifications/manuals
Methods of assessment	• For valid and reliable assessment of this unit, evidence should be gathered through a range of methods to indicate consistent performance. • Evidence must involve demonstration of practical skills and may also include: – observation of processes and procedures – oral and/or written questioning on required knowledge and skills – testimony from supervisors, colleagues, clients and/or other appropriate persons – inspection of the final product or outcome – a portfolio of documentary evidence. • Where performance is not directly observed any evidence should be authenticated by colleagues, supervisors, clients or other appropriate persons. • Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.

VU21988 - Utilise basic network concepts and protocols required in cyber security

Unit Descriptor	This unit provides a cyber security practitioner with an introduction to the skills and knowledge required to comprehend how data travels around the internet and the function and operation of protocols such as the Transmission Control Protocol/Internet Protocol (TCP/IP) suite and devices that facilitate this data transfer. The exposure to these protocols is at an introductory level in this unit.
	No licensing or certification requirements apply to this unit at the time of accreditation
Employability skills	This unit contains employability skills
Application of the Unit	This unit is applicable to individuals working as a cyber security practitioners and will support their ability to detect breaches in security infrastructure

ELEMENT	PERFORMANCE CRITERIA	
1. Outline key network security concepts	1.1	***Networking concepts*** that affect cyber security in a data network are defined
	1.2	Differences between **network security** and **cyber security** are clarified
	1.3	Open System Interconnection (OSI) and the Transmission Control Protocol (TCP)/***Internet Protocol (IP)*** models of data communication are defined**.**
	1.4	Function and basic operation of protocols in the TCP/IP are defined
	1.5	Organisation's security policy is reviewed
	1.6	***Business implications*** of cyber security breaches are introduced
2. Define key features of the TCP/IP and OSI models	2.1	Key protocols of the TCP/IP suite and OSI layered models are identified and demonstrated.
	2.2	Binary number system and hexadecimal number systems are defined.
	2.3	Conversions between number systems are demonstrated
	2.4	Differences and commonalities between the OSI and TCP/IP Internet Protocol models are described and demonstrated
	2.5	IPv4 and IPv6 (internet protocol versions 4 & 6) addressing schemes are demonstrated
	2.6	OSI Layer 1 standards are identified

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		2.7	OSI Layer 2 Protocols, standards and addressing media access control addresses (MAC) for both local area networks (LANs) and wide area networks (WANs) are described and demonstrated
		2.8	OSI Layer 3 Routed and Routing addressing protocols are describes and demonstrated
		2.9	OSI Layer 4 Protocols and Real Time Protocols (RTP) with particular emphasis on security vulnerabilities are defined and demonstrated.
		2.10	OSI Layer 5 to 7 protocols and networking applications are defined and demonstrated
3.	Implement and demonstrate the function and operation of key networking devices	3.1	Physical and logical network representations of a local area network are implemented
		3.2	Function and operation of network switches are described and implemented
		3.3	Function and operation of network routers are described, and implemented
		3.4	Function and operation of a firewall is described and demonstrated
		3.5	Function and operation of a wireless access point (WAP) is described, and implemented
		3.6	End to end network **troubleshooting methodologies and commands** are implemented and demonstrated.
3	Implement the components of a network security laboratory and testing environment	4.1	**Software tools** for the testing environment are identified
		4.2	Use of virtualisation is described and demonstrated in the testing environment
		4.3	Interconnectivity of the virtualised tools is described and demonstrated
		4.4	Basic use of the **testing environment** is demonstrated
4	Present current examples of cyber network attacks and resources	5.1	Example of a current distributed denial of service (DDoS) attack is presented
		5.2	Example of a current ransomware breach is presented
		5.3	**Useful resources** that increase industry's awareness of cyber security awareness are identified.

REQUIRED SKILLS AND KNOWLEDGE

Required skills

- Articulating issues arising from the operation of a network
- Applying numeracy skills to perform calculations in binary and hexadecimal number systems
- Base level problem solving to implement provided scripts for a switch and a router
- Reading and accurately interpreting documents and reports
- Operating a personal computer
    - Basic level ability in network cabling
    - Communicating with others to address cyber security network concepts and protocols

Required knowledge:

- OSI layered communication model
- TCP/IP layered communication model
- Media Access Layer (MAC) addresses
- Binary number system
- Hexadecimal number system
- Transmission Control Protocol (TCP) protocol
- User Datagram Protocol (UDP)
- IPV4 addressing
- Basics of IPV6 addressing
- Routers, switches, firewall fundamentals & wireless access points
- End to end test commands eg Ping, Traceroute
- Fundamentals of Cyber Security tools Wireshark, Kali, Netstumbler & Netstat
- Fundamental DOS & DDOS attack mechanisms
- Fundamental ransomware attack mechanisms
- Wireless LANs and their use and vulnerabilities
- Virtual images and their construction
- Fundamentals of a Scripting language eg Python

Range Statement

***Networking concepts** may include but not limited to:*	• Topology in which local area networks (LAN) and a wide area network (WAN) are connected • Connections involving equipment such as routers, switches, bridges and hubs using cables or wireless technology (Wi-Fi) • Devices used in the computer network etc

***Network security** may include but not limited to:*	• Components that constitute the security of the computer network such as:
	    o network architecture
	    o firewalls
	    o malware detecting software etc

Cyber security may include but not limited to:	• Components that constitute the cyber security features of a business such as:
	    o security hardware
	    o data collecting software
	    o malware detecting tools
	    o incident response plans etc.

Internet Protocol (IP) may include but not limited to:	• TCP • PPP • Ethernet • ARP • RARP • IP • FTP • HTTP • DHCP
Business Implications may include but not limited to:	• Financial • Organisation processes and policies • Human resources • Work practises • Communication structures etc.

Troubleshooting methodologies and commands may include but not limited to:	• Common testing commands used in end to end troubleshooting such as:
	    o Ping
	    o Traceroute

Software tools used for the testing environment may include but not limited to:	• Wireshark • Metasploit • Kali • Netstumbler • Netstat etc.
Useful resources may include but not limited to:	• Current articles • Newspaper items • TV documentaries • TV series • Useful URL sites • Visiting industry practitioner etc.

EVIDENCE GUIDE

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 section in Section B of the accreditation submission.

Critical aspects for assessment and evidence required to assess competency in this unit	Assessors must be satisfied that the candidate can: • demonstrate a working knowledge of network concepts and protocols required in cyber security • define key features of the TCP/IP and OSI models • demonstrate the interconnection and operation of key networking devices • implement the components of a network security laboratory and testing environment

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- identify current examples of cyber network attacks and resources available to increase awareness of cyber security.

Context of and specific resources for assessment	Evidence should show competency working in a realistic environment and a variety of conditions. The candidate will have access to all tools, equipment, materials and documentation required. The candidate will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
	This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.
Method of assessment	Evidence can be gathered in a combination of ways including: – observation of processes and procedures – oral and/or written questioning on required knowledge and skills – testimony from supervisors, colleagues, clients and/or other appropriate persons – inspection of the final product or outcome – portfolio of documentary evidence. Where performance is not directly observed and/or is required to be demonstrated over a period of time and/or in a number of locations, any evidence should be authenticated by colleagues, supervisors, clients or other appropriate persons

VU21990 - Recognise the need for cyber security in an organisation

Unit Descriptor	This unit provides introductory knowledge and skills to recognize threats, risks and vulnerabilities to cyber security in an organisation. It includes the threats an organisation encompasses such as networks, machines, applications, data, users and infrastructure. The unit also covers an introduction to common cyber security attack mechanisms and an introduction to identity and threat management as well as security issues surrounding Internet of Things (IOT) devices. Finally, the unit introduces the implementation of tools and systems an organisation can use to protect from cyber-attacks.
	No licensing or certification requirements apply to this unit at the time of accreditation.
Employability skills	This unit contains employability skills
Application of the Unit	This unit is applicable to individuals intending to work as a cyber security practitioner

ELEMENT	PERFORMANCE CRITERIA	
1. Define a cyber security framework for an organisation	1.1	Definition of information security is developed
	1.2	***Threat sources*** for an organisation are identified
	1.3	Relationship between data, networks, machines, users and applications in an enterprise is defined
	1.4	Introduction to identity and access management (IAM) is clarified
	1.5	Security of physical infrastructure of the enterprise is identified and evaluated
2. Identify the need for cyber security	2.1	Reasons to protect online identity and personal data are clarified
	2.2	Reasons to protect an organisation's data are explained
	2.3	Concept of ***cyber threat*** is defined
	2.4	Reasons for the need of cyber security professionals are explained

3	Identify common and emerging cyber security attacks, and techniques	3.1	Security vulnerabilities and malware are identified and demonstrated
		3.2	***Threat actors, threat vectors and threat goals*** are defined
		3.3	Techniques used by attackers to infiltrate a system are described and demonstrated
		3.4	Characteristics and operation of a cyber-attack are explained
		3.5	Trends of cyber threats are investigated
		3.6	Cyber-attacks on ***enterprise infrastructure*** are identified
		3.7	Examples of IOT devices are described and demonstrated
		3.8	Security vulnerabilities for IOT devices are defined
4	Implement methods to protect your data and privacy	4.1	Techniques to protect personal devices and data are described and implemented
		4.2	***Authentication techniques*** are identified and demonstrated
		4.3	Methods to protect personal devices from threats are implemented
		4.4	Methods and tools to safeguard personal privacy are defined
		4.5	Logical and physical access controls are defined and implemented
5	Implement methods to protect an organisation's data	5.1	Common equipment used to protect an organisation from cyber security attacks is identified
		5.2	Terms such as botnets, the cyber kill chain process and behavior based security in the context of cyber security protection methodologies are explained.
		5.3	Methods for protecting an organisation from cyber-attacks are developed and evaluated
		5.4	Introduction to behavior based approach to cyber security is presented
		5.5	***Incident response standards*** are defined

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills

- Using a PC or Laptop computer and software tools
- Implementing methods to protect personal data and privacy
- Communicating and working in a team environment
- Problem solving threats and vulnerabilities
- Interpreting and following documented material and procedures
- Evaluating an organisation's security policy document

Required knowledge:

- An enterprise security framework
- Current types of security vulnerabilities and malware
- Methods of cyber security attacks
- Methods to protect your own data and privacy
- Methods and tools used to protect an organisation's data
- Internet of Things (IOT) devices
- Access management techniques
- Access controls
- Overview of the responsibilities and resources that standards and organisation bodies provide for an enterprise
- Cyber security risk

Range Statement

The Range Statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance.

Threat sources may include but not limited to:	• network
	• data
	• applications
	• users
	• machines
Cyber threat may include but not limited to:	• Phishing
	• malicious coding
	• passwords attacks
	• outdated software vulnerabilities
	• removable media

Threat actors, threat vectors and threat goals may include but not limited to:	• *Threat actors* examples:
	    o Criminals
	    o Nation State
	    o Hactivist
	    o Insider etc.
	• *Threat vectors* examples:
	    o Malware
	    o Phishing
	    o DOS attacks etc.
	• *Threat goals* examples:
	    o Data steal
	    o Data disrupt
	    o Embarrass organisation etc.

Enterprise infrastructure may include but not limited to:	• Lighting • HVAC • programmable logic controllers (PLC's) • IOT devices
Authentication techniques may include but not limited to:	• Authentication, Authorizing and Accounting (AAA) • RADIUS
Incident response standards may include but not limited to:	• Standard ISO27035 • National Institute of Standards and Technology (NIST) • European Union Agency for Network and Information Security (ENSISA) • Information Security Forum (ISF) • Standards for Information Assurance for Small to Medium Enterprises Consortium (IASME) • National Cyber Security Centre - Australia (NCSC)

EVIDENCE GUIDE

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 section in Section B of the accreditation submission.

Critical aspects for assessment and evidence required to assess competency in this unit	Assessors must be satisfied that the candidate can: • define a cyber security framework for an organisation • explain the need for cyber security for an enterprise • recognise current and emerging cyber security attack methods and techniques • implement methods to protect personal data and privacy • implement methods to protect an organisation's data.

Context of and specific resources for assessment	Evidence should show competency working in a realistic environment and a variety of conditions. The candidate will have access to all tools, equipment, materials and documentation required. The candidate will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
	This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.
Method of assessment	Evidence can be gathered in a combination of ways including:

- observation of processes and procedures
- oral and/or written questioning on required knowledge and skills
- testimony from supervisors, colleagues, clients and/or other appropriate persons
- inspection of the final product or outcome
- portfolio of documented evidence.

Where performance is not directly observed and/or is required to be demonstrated over a period of time and/or in a number of locations, any evidence should be authenticated by colleagues, supervisors, clients or other appropriate persons.

VU21993 - Secure a networked personal computer

Unit Descriptor	This unit provides base level skills and knowledge to configure an operating system on a personal computer, adding security, setting user level passwords and privileges to limit and identify user access – all required to increase protection of the end point from cyber security attacks. The unit also provides an overview of internet of things (IOT) devices, an introduction to computer networking virtualisation and base level Linux commands – deemed to be invaluable in using cyber security tools.
	No licensing or certification requirements apply to this unit at the time of accreditation.
Employability skills	This unit contains employability skills.
Application of the Unit	This unit is applicable to individuals intending to work as a cyber security practitioner.

ELEMENT	PERFORMANCE CRITERIA	
1. Identify the role of personal computers and other computing devices in cyber security	1.1	Computer system components are identified and how they work together is explained.
	1.2	Identification and selection of appropriate components for a computer system are selected
	1.3	Configuration of specialised computer systems is described and demonstrated
	1.4	Role of security relevant peripherals is defined
	1.5	Common computer input output devices are identified
	1.6	Emerging Internet of Things (IOT) devices are identified and demonstrated
2. Undertake preventative maintenance and base level troubleshooting procedures for a computer	2.1	***Preventative maintenance*** procedures for a personal computer are described and demonstrated
	2.2	Base level troubleshooting procedures are demonstrated
3 Configure and use a computer operating system and relevant applications	3.1	Operating system (OS) installation is performed
	3.2	Operating system structure is examined
	3.3	Appropriate security applications are installed and configured
	3.4	Routine system management tasks with appropriate operating system tools are demonstrated

	3.5	Common preventative maintenance techniques for operating systems are described and demonstrated
	3.6	**Configuring access controls for the workstation** is described and implemented
	3.7	Setting passwords and allocating privileges are described and implemented
	3.8	Basic operating system troubleshooting processes are explained and demonstrated
4. Configure and use virtualised images	4.1	Environmental requirements for installing the virtualisation software are reviewed
	4.2	Required services and ports, according to virtualisation software vendors are installed
	4.3	Environmental requirements to ensure virtual machines function are configured
	4.4	Remote client access to virtual machines is configured
5. Identify key concepts in networking	5.1	Key components of a computer network are identified
	5.2	Purpose and characteristics of networking standards are explained
	5.3	Changing the IP address in an operating system is performed
	5.4	Network connectivity between computers is configured and tested
6. Connect devices to networks	6.1	Process of connecting a computer to a wired and wireless network is demonstrated
	6.2	Purpose and characteristics of internet service provider (ISP) connection technologies are defined
	6.3	Cloud concepts and network host services are examined
	6.4	Preventative maintenance procedures for networks are demonstrated
	6.5	Base level troubleshooting methods for networks are described and demonstrated
7. Demonstrate base level Linux commands	7.1	Structure and characteristics of the Linux operating system environment are defined
	7.2	Use of **base level Linux commands** is defined and demonstrated

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills

- Identifying the components and explain the operation of a personal computer

- Operating a personal computer

- Performing preventive maintenance and troubleshooting on personal computers.

- Installing Windows operation systems

- Performing management and maintenance of Windows operating systems

- Programing networking devices from provided scripts

- Reading and comprehending computer technology reports

- Securing user level access for a personal computer

- Identifying and using networking devices

Required knowledge:

- Hardware components of a personal computer

- Virtulisation concepts

- PC peripherals

- PC input output devices

- Internet of Things (IOT) devices

- Communication protocols for IOT devices

- Security issues relating to IOT devices

- Operating systems (Windows or Linux)

- Virtualization operation and structure

- Creating and configuring virtualised images

- Linux base level commands

- Networked device connections

Range Statement

The Range Statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance.

Preventative maintenance may include but not limited to:	• Hardware tasks such as:
	   ▪ remove dust from fans, power supply, internal components and peripherals
	   ▪ clean the mouse, keyboard & display
	   ▪ check for loose cables.
	• Software tasks such as:
	   ▪ review and install appropriate OS, security and driver updates
	   ▪ regularly scan for viruses
	   ▪ remove unwanted programs
	   ▪ scan for hard drive errors.

Configuring access controls for the workstation may include but not limited to:	• Regular password changes which define minimum password length and strength, • Protecting key files with operating system features like group policies
Base level Linux commands may include but not limited to:	• Pwd (print current directory) • Cd (change directory) • Mkdir (make directory) • Rmdir (remove directory) • ls (list files) • Rm file (removes file) • lsblk (list block devices) • Chmod (change file mode bits)

EVIDENCE GUIDE

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 section in Section B of the accreditation submission.

Critical aspects for assessment and evidence required to assess competency in this unit	Assessors must be satisfied that the candidate can: • demonstrate preventative maintenance and base level troubleshooting procedures for a computer • demonstrate the ability to configure and use a computer operating system and relevant applications • demonstrate the ability to configure and use virtualised images for a computer • identify key concepts in networking • connect devices to networks • demonstrate base level Linux commands.

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Context of and specific resources for assessment	Evidence should show competency working in a realistic environment and a variety of conditions. The candidate will have access to all tools, equipment, materials and documentation required. The candidate will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
	This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.
Method of assessment	Evidence can be gathered in a combination of ways including:

- observation of processes and procedures
- oral and/or written questioning on required knowledge and skills
- testimony from supervisors, colleagues, clients and/or other appropriate persons
- inspection of the final product or outcome
- portfolio of documented evidence.

Where performance is not directly observed and/or is required to be demonstrated over a period of time and/or in a number of locations, any evidence should be authenticated by colleagues, supervisors, clients or other appropriate persons.

VU22257 - Configure security devices for an organisation

Unit Descriptor	This unit seeks to build on previous skills in configuring security devices by providing knowledge and skills to configure and modify where required an organisation's existing security devices. After implementation the devices will be monitored and assesed for their effectiveness. New security devices and technologies will be researched, evaluated and implemented in order to improve the security performance of the organisation
	No licensing or certification requirements apply to this unit at the time of accreditation.
Employability Skills	This unit contains employability skills.
Application of the Unit	This unit is applicable to individuals intending to work as cyber security paraprofessionals responsible for the security infrastructure
Pre requisite Unit	Nil

ELEMENT	PERFORMANCE CRITERIA
Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the required performance needed to demonstrate achievement of the element – they identify the standard for the element. Where bold/italicised text is used, further information or explanation is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.
1. Collate the current network security diagram, security infrastructure functional operation and security device documentation	1.1 Existing security infrastructure diagram for the organisation are sourced
	1.2 In consultation with **appropriate personnel** the function and operation of the existing network security infrastructure is evaluated
	1.3 **Network security devices, systems and tools** are identified
2. Configure security devices according to the functional specification	2.1 Resources and documents to configure these network security devices are gathered
	2.2 **Security policy** document is sourced
	2.3 Selection of network security devices, systems and tools are configured according to the functionality described in the network security policy
3. Verify operation of security devices	3.1 Baseline functionality of network security devices are determined or identified
	3.2 Utilising software or hardware tools, network security device operation and performances is monitored according to baseline functionality
	3.3 Effectiveness of the security device operation are evaluated with appropriate personnel
4. Investigate and implement new network security architectures and devices	4.1 New network security devices and technologies are researched
	4.2 New network security devices and technology is evaluated and selected
	4.3 Higher level packet inspection technology is described then implemented on a network security device

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4.4   Holistic approaches to traffic inspection technologies is described and implemented on a network security device

4.5   Concept of dynamic update technology for defending against new cyber-attacks is described then implemented on a network security device

4.6   New network security technology solution is implement for a *small to medium size organisation*

4.7   *Virtual network security technologies* are investigated and compared

4.8   A virtual network security technology is selected

4.9   A virtual network security technology solution is configured and implemented for the organisation

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills:

- Articulate relevant issues encountered in the work environment
- Base level problem solving skills to implement provided scripts for a networking security device
- Read and accurately interpret documents and reports
- Operate a personal computer
- Interpreting network diagrams
- Assembling, participating in and coordinating a work team
- Problem solving within a team environment
- Evaluating the performance of a work team
- Contributing to the process of enhancing team performance
- Installing and using software packages
- Connecting cyber security equipment and networked devices
- Evaluating effectiveness of network security devices
- Preparing technical documentation
- Identifying and collating relevant documents
- Evaluating operation performance
- Making presentation to clients

Required knowledge:

- Testing methodologies
- Identifying and using networking devices
- Evaluating new firewall technologies
- Writing reports to justify equipment purchases
- Command Line Interface (CLI) to configure network security devices
- Handle and use network security devices
- Overview of network security devices that provide network security functionality like:
  - Access Control Lists (ACLs)

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- o Firewalls including Zone based policy firewalls
- o Packet filtering
- o Inspection rules
- o Intrusion detection Systems (IDS)
- o Intrusion Prevention Systems (IPS)
- o Virtual Private Networks (VPNs)
- o Network Access Control (NAC)
- o Web Application Firewalls (WAF)
- o Honeypots
- o Packet Shapers
- o Proxies
- o Reverse Proxies

- Network security device deployment
- Patch and vulnerability management of network devices
- Testing of network security devices
- New network security technologies
- Access lists

Range Statement

The Range Statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance

Appropriate personnel *includes but not limited to:*	- Cyber security paraprofessional - Cyber security manager - External consultants - Relevant managers - Business stakeholders
Network security devices, systems and tools *includes but not limited to:*	- Access lists (ACL's) - Firewalls including Zone based policy firewalls - Packet filtering - Inspection rules - Intrusion detection Systems (IDS) - Intrusion Prevention Systems (IPS) - Virtual Private Networks (VPNs) - Network Access Control (NAC) - Web Application Firewalls (WAF) - Honeypots - Packet Shapers - Proxies - Reverse Proxies

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Security policy includes but not limited to:	• Breech consequences
	• Policy enforcement
	• User Access
	• Security profiles
	• Passwords
	• E-mail use
	• Internet use
	• Anti-Virus requirements
	• Back-up and recovery processes
	• Intrusion detection processes and procedures
	• Remote Access
Small to medium size organisation includes but not limited to:	• Single internet connection
	• Three VLANs
	• Five servers
	• Single demilitarized zone (DMZ) Firewall
Virtual network security technologies includes but not limited to:	• Palo Alto virtual solution
	• Cisco virtual solution
	• VMWare virtual solution
	• HP Tipping Point framework

EVIDENCE GUIDE

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 section in Section B of the accreditation submission.

Critical aspects for assessment and evidence required to assess competency in this unit	To be considered competent in this unit assessors must be satisfied the candidate can demonstrate the achievement of all of the elements of the competency to the level defined by the associated performance criteria
	Specifically they must be able to:
	• Collate the current network security diagram, security infrastructure functional operation and security device documentation;
	• Configure and verify security devices according to the functional specification;
	• Investigate and implement new network security architectures and devices.
Context of and specific resources for assessment	Evidence should show competency working in a realistic environment and a variety of conditions. The candidate will have access to all tools, equipment, materials and documentation required. The candidate will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
	This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

Method of assessment	Evidence can be gathered in a variety of ways including:

- observation of processes and procedures
- oral and/or written questioning on required knowledge and skills
- testimony from supervisors, colleagues, clients and/or other appropriate persons
- inspection of the final product or outcome
- portfolio of documented evidence.

Where performance is not directly observed and/or is required to be demonstrated over a period of time and/or in a number of locations, any evidence should be authenticated by colleagues, supervisors, clients or other appropriate persons.

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VU22563 - Set up mechatronics engineering systems

Unit Descriptor	This unit of competency describes the knowledge and skills required to plan and construct a mechatronics engineering system and interface it with a standard industrial programmable controller for a complete operating system.
	It includes all wiring and programming to achieve automation together with commissioning and troubleshooting requirements.
	No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.
Employability Skills	This unit contains employability skills.
Application of the Unit	This unit of competency applies to a person working at para professional level in an industrial engineering or manufacturing enterprise where mechatronics is applied to form part of the production of goods or services.

ELEMENT	**PERFORMANCE CRITERIA**
Elements describe the essential outcomes of a unit of competency. Elements describe actions or outcomes that are demonstrable and assessable.	Performance criteria describe the required performance needed to demonstrate achievement of the element – they identify the standard for the element. Where bold/italicised text is used, further information or explanation is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.
1. Identify principal mechatronics applications within the manufacturing and engineering industry	1.1 ***Occupational Health and Safety/Workplace Health and Safety (OHS/WHS) requirements*** for a given work area are determined and specific applications can be given.
	1.2 Principal mechatronics applications in manufacturing and engineering are identified, as required.
	1.3 Principles and features of mechatronics are provided, as required.
	1.4 Advantages and disadvantages of mechatronics for given manufacturing applications are identified.
2. Plan the implementation of a mechatronics system	2.1 Relevant OHS/WHS requirements for carrying out the work are incorporated into the plan.
	2.2 ***Specifications, installation and set-up requirements*** are determined from enterprise documentation and discussion with ***appropriate personnel.***
	2.3 Stages and activities required for implementation are identified and documented according to ***enterprise procedures.***
	2.4 ***Resources, components and equipment*** needed for the installation are selected and sourced according to design specification and enterprise procedures.
	2.5 Mechatronics principles and associated calculations are applied as required to plan the installation.

		2.6	Procedures for the operation of mechatronics system are developed.
		2.7	Plan is reviewed to improve outcomes and overcome possible problems.
3.	Construct mechatronics systems	3.1	Relevant OHS/WHS requirements for carrying out the work are followed.
		3.2	Resources, components and equipment are obtained and coordinated in accordance with enterprise procedures.
		3.3	Component set-up and location is checked to ensure conformance to specifications.
		3.4	Implementation activities are managed/coordinated in accordance with implementation plan and enterprise procedures.
		3.5	Machines and equipment are set up/configured to meet specifications.
		3.6	Unexpected situations are resolved with appropriate personnel and with reference to applicable documentation and enterprise procedures.
4.	Program system controllers	4.1	Relevant OHS/WHS requirements for carrying out the work are followed.
		4.2	Sensors and actuators are interfaced to PLC and checked for correct operation.
		4.3	Logic sequence for the integrated system is prepared, indicating all actions and decision points.
		4.4	Programming requirements are analysed and documented.
		4.5	Program is constructed in accordance with manufacturer guidelines and enterprise procedures.
		4.6	Program is downloaded and tested for conformance with operational specifications.
5.	Commission mechatronics system	5.1	Relevant OHS/WHS requirements for carrying out the work are followed.
		5.2	Compliance of system is checked against operational specification.
		5.3	Faults are diagnosed and rectified using appropriate testing equipment and techniques.
		5.4	Final adjustments to components and control systems, including program editing are performed as necessary.
6.	Monitor implementation of mechatronics system	6.1	Relevant OHS/WHS requirements for carrying out the work are followed.
		6.2	Implementation results are compared against the expected outcomes and performance differences identified.

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6.3 Adjustments are made to improve outcomes, where required.

6.4 Procedures are documented to reflect the change

6.5 Changes are audited at agreed period/cycle and actions taken to correct any deviations.

6.6 Documentation is completed and work completion notified according to enterprise procedures.

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills:

- consulting and communicating with other team member involved with the project
- identifying and following relevant OHS/WHS procedures
- developing a plan for mechatronics system implementation
- setting up and configuring machines and equipment to meet specific requirements
- commissioning a mechatronics system
- diagnosing and rectifying faults in a mechatronics system

Required knowledge:

- digital sensors
  - optical
  - capacitive
  - inductive & magnetic
  - electromagnetic
- actuation (non-proportional)
  - mechanical actuators
  - electrical actuators
  - energisers & accumulators
  - linkages & transmissions
- cabling and connectors
  - cable types, colour codes, specification
  - shielding requirements
  - connector systems & terminations
- signal conditioning
  - use of switching transistors
  - resistor & capacitor calculations
  - simple DC amplification
  - buffers & operational amplifiers
- logic analysis
  - broad description of task
  - flow charts
  - detailed step analysis

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- programming
  - input/output designators
  - latching
  - timers & counters
  - special functions
  - illegal functions
  - program structure
- commissioning
  - mechanical adjustment
  - pre-commissioning tests
  - housekeeping precautions
  - accumulated energy safety awareness
  - desirable start sequence
- troubleshooting
  - problem solving techniques
  - during commissioning
  - under time pressure
- sourcing components
  - buy/manufacture split
  - selecting supply source
  - manufacturing in-house items
- planning
  - manual or computer techniques
  - select progress display type
  - continued progress monitoring
  - Project construction
  - assemble base or foundation
  - preliminary layout
  - complete sub-assemblies
  - full assembly
  - check for functionality
  - finishing
- feedback
  - for design correction
  - for component supplier

RANGE STATEMENT

The Range Statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold / italicised wording in the Performance Criteria is detailed below.

OHS/WHS requirements may include, but are not limited to:	- legislation - protective equipment - material safety management systems - hazardous substances and dangerous goods code - local safe operation procedures - awards provisions

Specifications, installation and set-up requirements may include, but are not limited to:	- system design and features - layout - space - components - operational capabilities - mechanical, electrical and other environmental performance requirements - materials - cost/budget/economy - required/available resources - timeframe - specific customer requirements - hazards and risks - enterprise requirements - quality standards - any other project limitations
Appropriate personnel may include:	- supervisor - leading hand - foreman - manager - site engineer - trainer - mentor - teacher - team member
Enterprise procedures may include, but are not limited to:	- the use of tools and equipment - instructions, including job sheets,, plans, drawings and designs - reporting and communication - manufacturers' specifications and operational procedures
Resources, components and equipment may include, but are not limited to:	- sensors and actuators - programmable logic controllers - electrical and fluid power sources - cabling and connectors - equipment, parts and components - high profile desktop PC's with Turbo CAD or similar - plotter and printer - machine shop equipment - hand and power tools - drawings and reference documents

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EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Elements, Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment section in Section B of the Accreditation Submission.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	• Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the associated performance criteria, including required skills and knowledge. Specifically they must be able to:
	  – implement OHS/WHS procedures and practices including the use of risk control measures as specified in the performance criteria
	  – demonstrate the ability to plan and construct a mechatronics engineering system and interface it with a standard industrial programmable controller for a complete operating system.

Context of and specific resources for assessment	• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.
	• Resources required for assessment include:
	  – OHS/WHS policy and work procedures and instructions.
	  – access to workplace or work real environment and a variety of conditions
	  – operational access to relevant machines, tools, equipment, materials and consumables
	  – access to relevant plans, drawings and instructions and manufacturer's specifications/manuals.

Methods of assessment	• For valid and reliable assessment of this unit, evidence should be gathered through a range of methods to indicate consistent performance.
	• Evidence must involve demonstration of practical skills and may also include:
	  – observation of processes and procedures
	  – oral and/or written questioning on required knowledge and skills
	  – testimony from supervisors, colleagues, clients and/or other appropriate persons
	  – inspection of the final product or outcome
	  – a portfolio of documented evidence.
	• Where performance is not directly observed any evidence should be authenticated by colleagues, supervisors, clients or other appropriate persons.
	• Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.

VU22963	Build and implement a basic network
Unit Descriptor	This unit of competency describes the performance outcomes, knowledge and skills required to investigate the structure, functions, protocols and components of a computer network in order to build a basic network for a small enterprise and establish end-to-end connectivity.
	The unit also includes the application of basic trouble shooting tools and techniques and data security fundamentals
	No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication
Employability Skills	This unit contains Employability Skills
Application of the Unit	This unit applies to a person who wishes to gain employment as an Information Technology (IT) practitioner and is required to build and maintain small networks using a range of client server applications and services.

ELEMENT	PERFORMANCE CRITERIA	
. 4. Examine the function and role of components and devices that ensure connectivity of a computer network	1.1	Concepts of how data is accessed from a remote site computer network is examined
	1.2	Methods of connecting multiple computer end points to a network are examined
	1.3	The function and role of switches in a small computer network are explored
	1.4	Connecting computer end points to a switch is investigated
	1.5	Internet Protocol (IP) IPv4 addresses for the Network Interface Card (NIC) are examined and configured
	1.6	The function and structure of a switch **Network Operating System (NOS)** is examined
	1.7	Open Source Interconnection (OSI) and Transmission Control Protocol/Internet Protocol (TCP/IP) layered models of data communication are compared
2. Examine the function and operation of the physical and data link layers in a computer network	2.1	Physical Layer technologies and connection mechanisms for computer networks are examined
	2.2	The function and operation of the data link layer to support communication across a data network is investigated
	2.3	Data link Layer media access control techniques are examined
	2.4	The operation of the media access mechanism and Ethernet frames are examined

3. Explain and demonstrate the function and operation of the network layer	3.1	The operation of network layer protocols to support data communication across a network is explained
	3.2	The function and role of the Address Resolution Protocol (ARP) and Reverse Address Resolution Protocol (RARP) that enable communication on a network is explained and demonstrated
	3.3	The features of a router to support end to end connectivity is explained and demonstrated
	3.4	Function and structure of a router Network Operating System (NOS) is explained and demonstrated
	3.5	Relevant commands of an NOS that facilitate connection to a Local Area Network (LAN) are explained and demonstrated
	3.6	***Basic configurations for a router*** are implemented and tested for functionality
	3.7	Connecting computer end points to a router is demonstrated
	3.8	Methods used by network devices to route data traffic is explained
4. Explain and implement IPv4 and IPv6 network addressing	4.1	Binary and Hexadecimal number systems are compared
	4.2	Conversion between Binary and Hexadecimal number systems is performed
	4.3	Network addressing scheme utilising IPv4 is explained and implemented
	4.4	Subnetting IPv4 network is explained and implemented
	4.5	Subnetting IPv4 network utilising Variable Length Subnet Mask (VLSM) is explained and implemented
	4.6	Network addressing scheme utilising IPv6 is explained and implemented
	4.7	Subnetting IPv6 network is explained and implemented
	4.8	The function and operation of Internet Control Message Protocol (ICMP) and ICMPv6 are explained
	4.9	The use of ***key ICMPv4 and ICMPv6 packets*** are explained
5. Examine the function and operation of transport and application layers in network communications	5.1	The function and operation of transport layer protocols and services that support data communication across a network are examined
	5.2	Operation of the Transmission Control Protocol (TCP) and User Datagram Protocol (UDP) transport layer protocols are compared
	5.3	Transport layer port numbers are identified

		5.4	Function and operation of *application layer protocols* that facilitate end to end data communication across a network are investigated
		5.5	The process for retrieving data from an external web site using the http application layer protocol is examined
6.	Construct a basic network for a small enterprise and verify end to end operation	6.1	Physical network devices and components are identified from a network topological drawing and sourced
		6.2	Network routers and switches are selected and configured to establish end to end connectivity
		6.3	The *basic network topology* is cabled
		6.4	Addressing scheme for the network is designed
		6.5	Relevant commands of an network operating system that facilitate connection to a LAN are selected and configured
		6.6	*Base level troubleshooting* skills and procedures are utilised to establish or re-establish network connectivity
		6.7	Network router and switch base level security functionality is configured
		6.8	*Network resources* are set up, configured and shared between network devices
		6.9	The completed configurations for the networking devices are copied to storage media
		6.10	Fundamentals of securing personal data are investigated and applied
		6.11	Fundamentals of data security for a small enterprise are implemented

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills:

- Planning and organising skills to investigate:
  - translating network topological drawing to determine required physical devices and connections
  - cabling LANs
  - identifying networking components f
  - sourcing devices and components to build a basic computer network

- Technical skills to demonstrate:
  - programming basic features of a switch to enable network connectivity
  - programming basic features of a router to enable network connectivity
  - the operation of ARP and RARP protocols
  - applying IP addresses to a basic network
  - subnetting IPv4 and IPv6 Networks
  - using internetworking operating systems commands
  - building a basic computer network

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- using base level troubleshooting skills and procedures to establish network connectivity
- applying security fundamentals to secure personal and small network data

- Literacy skills to explain:
  - The function and operation of network components and devices
  - The concept of layered data transmission
  - The use of typical UDP and TCP ports in a computer network
  - The operation of TCP to establish computer point to point communication
  - Network troubleshooting methodology
  - The difference between the use of UDP and TCP in a network
  - The function and operation of application layer protocols that facilitate data communication in a network

Required knowledge:

- setting IP addresses on end points, switches and routers
- types of physical layer technologies
- Ethernet frame operation
- Internet Control Message Protocol, (ICMP) including key ICMPv4 and ICMPv6 packets
- Address Resolution Protocol (ARP) protocol
- Reverse Address Resolution Protocol (RARP) protocol
- routing protocols
- Transport layer protocols:
  - User Datagram Protocol (UDP)
  - Transmission Control Protocol (TCP)
  - Internet Protocol (IP)
- Application Layer Protocols
- Network Operating System (NOS) commands
- Open Source Interconnection (OSI) layered communication model
- Transmission Control Protocol/Internet Protocol (TCP/IP) layered communication model
- Binary and hexadecimal number systems
- Variable Length Subnet Mask (VLSM) network addressing schemes
- Internet Protocol IPv4 and IPv6 addressing
- base level troubleshooting procedures (Ping, Traceroute)
- securing concepts for personal data
- network security fundamentals

RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording in the Performance Criteria is detailed below. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts.

Network Operating System (NOS) includes but not limited to:	• Cisco IOS • Huawei VRP • Palo Alto PAN-OS
Basic configurations for a router includes but not limited to:	• configuring an IP address to an ethernet interface • enabling the interface • checking the interface address

Key ICMPv4 and ICMPv6 packets includes but not limited to:	• Echo Request • Echo Reply • Destination unreachable • Traceroute • Timestamp • Timestamp reply • Time exceeded
Application layer protocols includes but not limited to:	• Hyper Text Transfer Protocol (HTTP) • Hyper Text Transfer Protocol Secure (HTTPS) • Domain Name System (DNS) • Simple Mail Transfer Protocol (SMTP) • Post Office Protocol (POP) • File Transfer Protocol (FTP)
Basic network topology includes but not limited to:	• routers • switches • end points

Base level troubleshooting includes but not limited to:	• ping
	• traceroute
	• examination of router routing table
	• examination of Address Resolution Protocol (ARP) table
	• inspection of interface configuration:
	   – IP Configure
	   – show IP interface brief
	   – show interface

Network resources includes but not limited to:	• files • software • Trivial File Transfer Protocol (TFTP) Server • Wireshark

EVIDENCE GUIDE

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.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	To be considered competent in this unit assessors must be satisfied the candidate can demonstrate the achievement of all the elements of the competency to the level defined by the associated performance criteria
	Specifically they must be able to:
	• examine and describe the function and role of the devices and protocols used to facilitate an interconnected computer network
	• examine and explain the operation of Ethernet frames in a computer network
	• explain the function and operation of the network layer for a computer network
	• implement IPv4 and IPv6 addresses and subnets for a small sized network
	• explain the function and operation of the transport layer protocols and services that facilitate data transmission
	• configure routers and switches and assign IP addresses to end points for a small sized network
	• utilise base level troubleshooting commands and procedures for a small to medium sized computer network.
Context of and specific resources for assessment	This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The candidate will have access to all tools, equipment, materials and documentation required. The candidate will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
	The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.
Method of assessment	Evidence can be gathered through a variety of ways including:
	– observation of processes and procedures
	– oral and/or written questioning
	– testimony from supervisors, clients and/or other appropriately qualified persons
	– inspection of the final product or outcome
	– portfolio of documented evidence.
	Where performance is not directly observed and/or is required to be demonstrated over a period of time and/or in a number of locations, any evidence should be authenticated by a supervisor, client or other appropriately qualified person.

VU22964

Configure a small to medium network for an organisation

Unit Descriptor

This unit of competency describes the performance outcomes, knowledge and skills required to configure and implement a small to medium network comprising Virtual Local Area Network (VLAN), routers, switches and end points.

The unit includes the application of Spanning Tree Protocol (STP), and Dynamic Host Routing Protocol (DHCP) network features. The unit also introduces Local Area Network (LAN) security concepts and practises for an organisation.

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

Employability Skills

This unit contains Employability Skills.

Application of the Unit

The unit applies to an Information Technology (IT) practitioner required to analysis, configure and troubleshoot routers and switches in small to medium sized business network.

ELEMENT	PERFORMANCE CRITERIA
1. Investigate and implement basic switch and router network settings	1.1 The manner by which frames are forwarded on a switched network is investigated
	1.2 Broadcast and collision domains are examined
	1.3 Layer 2 (L2) switch to meet network connection specifications is configured
	1.4 Network segmentation using VLANs is examined
	1.5 The manner by which a switch forwards frames in a multi switch VLAN environment is investigated
	1.6 Basic device security features for a network router and switch are investigated and configured
	1.7 Router commands to connect end points to network router are configured and verified
	1.8 Switch access and trunk ports are investigated and configured
	1.9 Dynamic Trunking Protocol (DTP) is investigated
	1.10 Inter VLAN routing using router on a stick is implemented
	1.11 Inter VLAN routing using Layer 3 switches is implemented
	1.12 ***Standard troubleshooting techniques*** to solve common inter-VLAN configuration issues are applied
2. Examine Layer 2 (L2) redundant network design concepts	2.1 Spanning Tree Protocol (STP) function and operation is examined
	2.2 Common problems in a redundant L2 switched networks are examined

		2.3	The differences between Rapid Spanning Tree Protocol (RSTP) and Pre-VLAN Spanning Tree (PVST+) protocol are examined
		2.4	The function and operation of Ether Channel is investigated
		2.5	Standard troubleshooting methods for an Ether Channel implementation are investigated
3.	Configure and implement protocols and tools to enable a reliable network	3.1	Dynamic Host Control Protocol (DHCPv4) for Internet Protocol (IPv4) client and server features are configured and implemented
		3.2	The function and operation of DHCPv6 for (IPv6) is examined and configured
		3.3	State full and stateless implementations of DHCPv6 are configured and tested
		3.4	The function and operation of First Hop Redundancy Protocols (FHRP) is investigated and implemented
4.	Implement network security mitigating strategies for common Local Area Network (LAN) attacks	4.1	The requirements of end point security are determined
		4.2	***Access control methods*** for end points in a LAN are implemented
		4.3	L2 security threats and vulnerabilities are examined
		4.4	The manner in which network security is compromised via a LAN attacks is analysed
		4.5	Mitigating Media Access Control (MAC) address table attacks using switch port security is implemented
		4.6	Mitigating Virtual Local Area Network (VLAN) attacks using Dynamic Trunking Protocol (DTP) and Native VLANS is implemented
		4.7	Mitigating DHCP network attacks using DHCP Snooping is implemented
		4.8	Mitigating Address Resolution Protocol (ARP) network attacks using Dynamic ARP Inspection (DAI) is implemented
		4.9	Mitigating Spanning Tree Protocol (STP) network attacks using Portfast and Bridge Protocol Data Unit (BPDU) Guard is implemented
5.	Investigate and configure static and default routing	5.1	Router decision processes to forward data packets to a network are examined
		5.2	Methods used by a router to detect remote networks are investigated
		5.3	Router commands that facilitate communication between multiple directly connected networks are configured
		5.4	The structure and content of a routing table is examined
		5.5	IPv4 and IPv6 static and default routes are configured and implemented
		5.6	Floating static route to provide a backup connection is configured
		5.7	IPv4 and IPv6 static and default host routes are configured
		5.8	Troubleshooting methods for static and default routes are applied

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills:

- Planning and organising skills to investigate:
  - methods of securing end points from security attacks
  - methods used to protect a small to medium network from L2 security attacks
  - methods used to protect a small to medium network from MAC address security attacks
  - network troubleshooting methodology
- Technical skills to:
  - apply troubleshooting methodologies to ensure end to end connectivity for a small to medium network
  - configure switch access and trunk ports
  - implement VLANs
  - configure inter VLAN routing using router on a stick and using Layer 3 switches
  - implement DHCP on a router
  - implement port security for a switch
  - implement mitigation strategies for VLAN, DHCP, ARP and STP attacks
  - configure IPv4 and IPv6 default and static routes
- Literacy skills to explain the:
  - operation of STP including RSTP and PVST+
  - role and operation of a Ether Channel
  - the operation of HSRP
  - function of a static, default and a floating static route
  - function and operation of a Layer 2 (L2) switch
  - function and role of VLANs in a small to medium network

Required knowledge:

- STP implementations RSTP and PVST+
- Ether Channel
- Methods of securing end points from security attacks
- Methods used to protect a small to medium network from Layer 2 security attacks
- Methods used to protect a small to medium network from MAC address security attacks
- Router forwarding decisions based on the contents of a routing table
- Segmenting a small to medium network using VLANs
- Switch operation and configuration
- VLAN routing techniques, router on a stick and using Layer 3 switches
- DHCP for IPv4 and IPv6
- Router static, default and floating static routes
- Switch port security commands
- Mitigation strategies for VLAN, DHCP, ARP and STP attacks
- Dynamic Trunking Protocol (DTP) and Native VLANS
- First Hop Redundancy Protocols (FHRP)
- Access control methods used by end points to secure connection to a network

RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording in the Performance Criteria is detailed below. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts.

Standard troubleshooting techniques include but not limited to:	- ping - traceroute - interface configuration: - ipconfig - show cisco discovery protocol (CDP) neighbours - show ip interface brief - show interface
Access control methods include but not limited to:	- AAA (Authentication, Authorisation and Accounting) - Radius

EVIDENCE GUIDE

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.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	To be considered competent in this unit assessors must be satisfied the candidate can demonstrate the achievement of all of the elements of the competency to the level defined by the associated performance criteria. Specifically they must be able to: - configure and implement basic switch and router network settings for a small to medium network and ensure end to end connectivity - explain Layer 2 (L2) network design concepts - configure and implement DHCPv4 and DHCPv6 server and client services for a network - configure and implement the following features to mitigate LAN attacks: - switch port security for MAC Address table attacks - Dynamic Trunking Protocol (DTP) and Native VLANS for VLAN attacks - DHCP Snooping for DHCP network attacks - Address Resolution Protocol (ARP) and Dynamic ARP Inspection (DAI) for ARP network attacks - Portfast and BPDU Guard for Spanning Tree Protocol (STP) network attacks - configure static and default routing - apply troubleshooting commands and procedures.

Context of and specific resources for assessment	The candidate will have access to all tools, equipment, materials and documentation required. The candidate will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
	This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations.
	This competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.
Method of assessment	Evidence can be gathered through a variety of ways including:

- observation of processes and procedures
- oral and/or written questioning
- testimony from supervisors, clients and/or other appropriately qualified persons
- inspection of the final product or outcome
- portfolio of documented evidence.

Where performance is not directly observed and/or is required to be demonstrated over a period of time and/or in a number of locations, any evidence should be authenticated by a supervisors, clients or other appropriate qualified persons.

| **VU22965** | **Secure and monitor the performance of a small to medium network** |

Unit Descriptor	This unit describes the performance outcomes, knowledge and skills required to secure and monitor the performance of a small to medium network.
	The unit includes implementing routing protocols, implementing Access Lists (ACL's) to block common security threats, implementing Network Address Translation (NAT) on an edge router, selecting a WAN technology for an organisation and using tools to monitor the network for performance and potential security threats.
	The unit also includes the application of systematic troubleshooting tools and techniques to ensure correct network operation and performance.
	No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.
Employability Skills	This unit contains Employability Skills.
Application of the Unit	The unit applies to an Information Technology (IT) practitioner required to analysis, configure and troubleshoot routers and switches in small to medium sized business network.

ELEMENT

PERFORMANCE CRITERIA

1. Investigate and configure a dynamic routing protocol to a small to medium network

1.1 The function and operation of the single area Open Shortest Path First (OSPF) version 2 (v2) dynamic routing protocol is investigated

1.2 OSPFv2 for a point to point and broadcast multi-access networks are configured

1.3 The election of specific routers to be the Designated Router (DR) and Backup Designated Router (BDR) is configured

1.4 Propagating a default route into an OSPFv2 network is investigated and implemented

1.5 ***OSPFv2 standard troubleshooting tools and techniques*** are applied to verify operation

2. Secure a network using Access Control Lists (ACL's)

2.1 The use of ACL's to support the protection of a computer network is examined

2.2 The differences between standard and extended ACL's are compared

2.3 The structure and operation of Standard ACL's is examined

2.4 Control measures to protect the security risks utilising standard ACL's are implemented

2.5 A Standard ACL to secure Virtual Teletype (VTY) access is implemented

2.6 The structure and operation of Extended ACL's is examined

2.7 Control measures to protect the security risks utilising extended ACL's are investigated and implemented

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	2.8	*Standard and Extended ACL's troubleshooting techniques* are deployed
3. Implement and verify Network Address Translation (NAT)	3.1	The function and operation of Network Address Translation (NAT) is investigated
	3.2	*Different types of NAT* implementations are compared
	3.3	Static NAT on an edge router is implemented and verified for correct operation
	3.4	Dynamic NAT on an edge router is implemented and verified for correct operation
	3.5	Port Address Translation (PAT) on an edge router is implemented and verified for correct operation
	3.6	*Troubleshooting methods for NAT* are implemented
	3.7	NAT operation for IPv4 and IPv6 is implemented
4. Investigate Wide Area Network (WAN) options for an organisation	4.1	Different WAN technologies are investigated
	4.2	Private and public WAN technologies are compared
	4.3	WAN Protocols for service implementation are investigated and selected
	4.4	Point to Point serial communication across a WAN is examined
	4.5	Remote broadband connection options for a small to medium enterprise are investigated
5. Optimise and monitor network performance	5.1	Differing requirements for end to end quality of Voice, Video and Data are investigated
	5.2	Queuing algorithms used by networking devices are investigated
	5.3	Different models of Quality of Service (QoS) are examined and compared
	5.4	Mapping network topologies utilising Cisco Discovery Protocol (CDP) and Link Layer Discovery Protocol (LLDP) is performed
	5.5	Network Time Protocol (NTP) is implemented
	5.6	The function and operation of the Simple Network Management Protocol (SNMP) is applied and monitored
	5.7	The function and operation of System Logging (SYSLOG) is investigated
	5.8	*Methods to maintain Router and Switch configuration files* are implemented
	5.9	An Internetworking Operating System (IOS) upgrade for a Router or Switch is performed and monitored
6. Investigate and apply troubleshooting techniques and tools	6.1	The importance of network documentation for network operation and troubleshooting is investigated
	6.2	Network troubleshooting methodologies are identified investigated
	6.3	Network troubleshooting tools are investigated

6.4 **_Troubleshooting tools and techniques_** are applied to verify operation

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills:

- Planning and organising skills to investigate:
  - o operation of OSPFv2 dynamic routing protocol
  - o use of standard and extended ACL's to support the protection of a computer network
  - o different requirements and methods of QoS for different data types in an organisation
  - o methods to maintain router and switch configuration files
  - o function and operation of SYSLOG files
- Technical skills to:
  - o implement single area OSPFv2 on a router
  - o propagate default routes into an OSPFv2 network
  - o utilise OSPFv2 standard troubleshooting tools and techniques
  - o apply a dynamic routing protocol to a network
  - o secure a network using ACLs
  - o perform network topologies mapping using CDP and LLDP
  - o performing an IOS upgrade for a router
  - o configure static and dynamic NAT and PAT on an edge router
  - o configure and interpreting SYSLOG files
  - o configure and interpreting SNMP files
- Problem solving skills to:
  - o apply troubleshooting tools and techniques

Required knowledge:

- OSPF dynamic routing protocol
- routing troubleshooting methodologies and tools
- application of:
  - o WAN technologies
  - o QoS methods
  - o Queuing algorithms
  - o CDP
  - o LLDP
  - o NTP
  - o IOS Commands
  - o SNMP operation
  - o SYSLOG files
  - o Static and Dynamic NAT
  - o PAT
  - o Standard and extended ACL's
- network troubleshooting tools and techniques

RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording in the Performance Criteria is detailed below. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts.

OSPFv2 standard troubleshooting tools and techniques include but not limited to:	- ping - show Internet Protocol (IP) route - inspection of interface configuration: - ipconfigure - show CDP Neighbours - show IP interface brief - show interface
Standard and Extended Access Lists troubleshooting techniques include but not limited to:	- access list interface placement - access list structure - access list configuration - show access list
Different types of NAT include but not limited to:	- Static Network Address Translation (NAT) - Dynamic Network Address Translation (NAT) - Port Address Translation (PAT)
Troubleshooting methods for NAT include but not limited to:	- Network Address Translation (NAT) configuration - using test commands: - clear ip nat translation - show ip nat translation - debug ip nat translations - ping - show ip route
Methods to maintain Router and Switch configuration files include but not limited to:	- copy and paste the configuration file to a text file - copy to a Trivial File Transfer Protocol (TFTP) server
Troubleshooting tools and techniques include but not limited to:	- ping - traceroute - router routing table - Address Resolution Protocol (ARP) table - interface configuration: - ip configure - show CDP Neighbours - show IP interface brief - show interface

EVIDENCE GUIDE

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.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	To be considered competent in this unit assessors must be satisfied the candidate can demonstrate the achievement of all of the elements of the competency to the level defined by the associated performance criteria. Specifically they must be able to:
	- implement a single area Open Shortest Path First OSPFv2 - configure, implement and verify standard and extended Access Control List ACL function and operation for common security threats - implement Network Address Translation NAT for Internet Protocol IPv4 - Select an appropriate Wide Area Network (WAN) technology to meet the requirements of an organisation - apply network test and troubleshooting techniques.
Context of and specific resources for assessment	The candidate will have access to all tools, equipment, materials and documentation required. The candidate will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
	This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations.
	The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.
Method of assessment	Evidence can be gathered through a variety of ways including:
	- observation of processes and procedures - oral and/or written questioning - testimony from supervisors, clients and/or other appropriately qualified persons - inspection of the final product or outcome - portfolio of documented evidence.
	Where performance is not directly observed and/or is required to be demonstrated over a period of time and/or in a number of locations, any evidence should be authenticated by colleagues, supervisors, clients or other appropriate person.

VU22966	**Investigate design concepts of an accessible and secure network**

Unit Descriptor	This unit describes the performance outcomes, knowledge and skills to investigate design concepts of an accessible and secure network suitable for a small to medium size enterprise (SME).
	The unit includes features and operation of a Wireless Local Area Network (WLAN), an introduction to network security concepts, configuring secure network remote access, network design features, virtualisation concepts, network automation concepts and the use of systematic troubleshooting tools and techniques to ensure correct network operation and performance.
	No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.
Employability Skills	This unit contains Employability Skills.
Application of the Unit	The unit applies to an Information Technology (IT) practitioner required to oversee the operation of a small to medium sized business network.

ELEMENT	**PERFORMANCE CRITERIA**	
1. Investigate and configure features for a WLAN network	1.1	WLAN technology standards are examined
	1.2	The function and operation of WLAN devices are investigated
	1.3	The tools used to control multiple Access Points (APs) are investigated
	1.4	Configure and verify the operation of a wireless Access Point (AP)
	1.5	Methods of channel management in a WLAN system are investigated
	1.6	WLAN security threats and mitigation strategies are examined
	1.7	WLAN troubleshooting tools and techniques are examined and demonstrated
2. Investigate security options to minimise network compromises	2.1	Threat actors and threat actor tools used to exploit an organisations network are investigated
	2.2	Different types of current malware are examined
	2.3	Strategies and methods used by intruders to infiltrate an organisations network are investigated
	2.4	Methods used to exploit Transmission Control Protocol (TCP) and User Datagram Protocol (UDP) are investigated
	2.5	Methods used to exploit IP service vulnerabilities of an organisation are investigated
	2.6	Best practices for protecting a network are investigated and compared
	2.7	Common cryptographic processes used to protect data from end to end are investigated and compared

3. Examine and demonstrate the operation of secure remote access connections	3.1	Different types of Virtual Private Network (VPN) tools and techniques are examined
	3.2	The process by which the IPsec framework is used to secure network traffic is examined
	3.3	A remote VPN connection utilising Internet Protocol Security (IPsec) is examined and demonstrate
4. Investigate network design features for an SME	4.1	Differing requirements for end to end quality of Voice, Video and Data in a converged network are investigated
	4.2	The function and operation of a switched based network is examined
	4.3	The function and role of a hierarchical network is examined
	4.4	The features of a scalable network are examined
	4.5	The features of switch hardware that support network requirements are investigated
	4.6	Routers to support small to medium organisation are investigated
5. Investigate and demonstrate network virtualisation design concepts and tools	5.1	The features of cloud computing infrastructure for an organisation are investigated and explained
	5.2	The role and function of network virtualisation in an organisation is investigated and demonstrated
	5.3	The use of virtualised devices and services for an organisation is investigated and demonstrated
	5.4	Software defined networking tools and techniques for an organisation are investigated
	5.5	The role of virtualised networked controllers for an organisation is investigated and explained
6. Investigate network automation concepts tools and techniques	6.1	Automation tools and techniques that support the development of network infrastructure are investigated
	6.2	*Current data formats* used for network data exchange are investigated
	6.3	The function and operation of *Common Application Programming Interfaces (API's)* to enable network data communication are investigated and explained
	6.4	The function and operation of Representational State Transfer (REST) when used in network data communication are investigated and explained
	6.5	*Common configuration management tools* are investigated
	6.6	The function and operation of Digital Network Architecture (DNA) when used to automate network design is identified

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills:

- Planning and organising skills to investigate:
  - the operation of a WLAN
  - different types of current malware
  - Strategies and methods used to infiltrate organisations
  - network virtualisation operation
  - automation tools and techniques
  - function and operation of DNA
  - security options to minimise network compromises
  - current data formats for network data exchange
  - Current API's used to enable network data communication

- Technical skills to demonstrate:
  - methods to exploit IP, TCP and UDP vulnerabilities
  - implement a scalable network
  - WLAN troubleshooting tools and techniques
  - Remote VPN connection

- Literacy skills to explain:
  - methods of channel management in a WLAN system
  - the operation of REST when used in network data communication
  - best practices for protecting a network
  - function and role of a hierarchical network
  - role of virtualised networked controllers
  - features of a scalable network

Required knowledge:

- WLAN design techniques and operation
- WLAN threats
- Security threat actors and tools
- Malware types
- Common network attack strategies
- IP vulnerabilities
- TCP & UDP vulnerabilities
- Fundamentals of best practise for network security
- Cryptographic basics
- Configuration of secure remote users
- Operation of a switched network for a SME
- Designing scalable networks
- Network virtualisation tools and techniques
- Software design networking tools
- Function and operation of network controllers
- Network Automation overview
- Standard data formats used for network data transfer
- Function and operation of API's
- Configuration management tools
- Function and operation of REST

RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording in the Performance Criteria is detailed below. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts.

Current data formats include but not limited to:	• Hyper Text Markup Language (HTML) • Extensible Markup Language (XML) • JavaScript Object Notation (JSON) • Ain't Markup Language (YAML)
Common Application Programming Interfaces (API's) include but not limited to:	• Simple Object Access Protocol (SOAP) • Representational State Transfer (REST) • Network Configuration (NETCONF) • Rest Configuration (RESTCONF)
Common configuration management tools include but not limited to:	• Ansible • Chef • Puppet • SaltStack

EVIDENCE GUIDE

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.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	To be considered competent in this unit assessors must be satisfied the candidate can demonstrate the achievement of all of the elements of the competency to the level defined by the associated performance criteria
	
	Specifically they must be able to:
	
	• investigate and explain:
	  – the features and operation of a WLAN network for an SME
	  – security options to minimise network compromises
	  – network design features for an SME to meet various requirements
	  – methods to minimise network attacks from IP, TCP, UDP and IP service vulnerabilities
	  – demonstrate a virtualised network infrastructure
	  – features and advantages of a switched based network for an organisation
	• demonstrate network test and troubleshooting techniques
	• demonstrate the operation of a WLAN network for an SME
	• demonstrate the operation of common tools used for network automation.

Context of and specific resources for assessment	The candidate will have access to all tools, equipment, materials and documentation required. The candidate will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
	This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations.
	The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.
Method of assessment	Evidence can be gathered through a variety of ways including:
	• observation of processes and procedures
	• oral and/or written questioning
	• testimony from supervisors, clients and/or other appropriately qualified persons
	• inspection of the final product or outcome
	• portfolio of documented evidence.
	Where performance is not directly observed and/or is required to be demonstrated over a period of time and/or in a number of locations, any evidence should be authenticated by supervisors, clients or other appropriately qualified person.

Appendix 1

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General knowledge and skills/unit matrix

Required skills:

Apply relevant WHS/OHS processes and procedures to electro-mechanical work environment	UEENEEE101A
Applying a range of mathematical skills in an integrated technology context	VU22333,VU22748
Applying computer tools and networking in an integrated technology context	Various ICT and VU units
Recognise and manage risk involving ICT systems and technology	VU21988,990,993,22257 and various ICT units
Ability to undertake an integrated technology project	VU22746
Use a range of equipment, plant and technologies in an electro–mechanical work environment	Various VU, UEE units
Install, set up maintain a range of electrotechnology equipment	Various VU, UEE & MEM units
Fault diagnosis and rectifying a range electrotechnology equipment	Various VU, UEE & MEM units
Read and interpert drawings and diagrams	MEM30031A, UEENEEE107A
Calibrating and using a range measuring devices and instruments	VU22754

Required knowledge:

Application of mathematics in integrated technology environment	VU22333, VU22748
Integrated technology applications in an engineering environment	MEM23064A, MEM30011A VU22746 & VU22747
Safe work practices in the electro –mechanical environment	All units and in particular UEENEEE101A
Inter-connectivity applications in the electrotechnology industry	ICT units, VU22324,325,326,327
Cyber security principles and devices	VU21988,990,993,22257
Working in a project team	VU22746
Handling and installing electrotechnology equipment	VU22747, VU22750, VU22751, VU22752, VU22753
Basic engineering principles and techniques	VU22757
Safe work practices in a electro – engineering environment	All units and in particular UEENEEE101A