



Australian Government

Department of Education, Employment and Workplace Relations

MEM14082A Apply mechatronics fundamentals to support design and development of engineering projects

Release: 1

MEM14082A Apply mechatronics fundamentals to support design and development of engineering projects

Modification History

Not Applicable

Unit Descriptor

Unit descriptor	This unit defines the competencies required to apply AQF 5 engineering fundamentals to enable the selection and implementation of appropriate test equipment, materials, components and systems, support structures, power supply, control, data collection and supervisory systems in support of the design and development of engineering projects.
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Application of the Unit

Application of the unit	Competency in this unit requires significant application of mechatronic engineering fundamentals in support of the design, development or significant improvement of mechatronic, maintenance, electrical-electronic or instrumentation and control engineering applications. The candidate should have provided significant support to the design and development process as a member of a design and development team. Design, development and improvement activities include choice and implementation of software, test equipment, materials, components and systems, support structures, power supply, control, data collection and supervisory systems based on engineering functional or performance specifications. This unit only has application in qualifications that are not points based. Band: 0 Unit Weight: 0
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Licensing/Regulatory Information

Not Applicable

Pre-Requisites

Prerequisite units		
Path 1	MEM16008A	Interact with computing technology
	MEM23041A	Apply basic mechanical scientific

Prerequisite units		
		principles and techniques in engineering situations
	MEM23051A	Apply basic electro and control scientific principles and techniques in engineering situations
	MEM30012A	Apply mathematical techniques in manufacturing, engineering or related situations

Employability Skills Information

Employability skills	This unit contains employability skills.
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Elements and Performance Criteria Pre-Content

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

ELEMENT	PERFORMANCE CRITERIA
1. Research, evaluate, support implementation and report on designing and development processes within an industrial context	1.1. Research and evaluate applications for problem solving, implementation and improvement processes, philosophies and techniques including Problem solving, Brain Storming, decision-tree, trade-off tables, Kaizen, TQM and Tools of TQM. 1.2. Support implementation and report on engineering projects incorporating problem solving, improvement processes, philosophies and techniques. 1.3. Research, evaluate and report on case studies involving continuous, mass, batch, jobbing or prototype production processes, competitive (lean) manufacturing including sequential and cellular manufacture and assembly, Just In Time (JIT), Group Technology, design for reliability, optimum maintenance, computer managed maintenance.
2. Identify resources, skills, knowledge and techniques required by engineering applications	2.1. Identify resources, skills, knowledge and techniques for mechatronic engineering applications. 2.2. Identify functional attributes of components and systems of engineering projects.
3. Identify and use sources of information on resources, skills, knowledge and techniques required by engineering applications	3.1. Appropriate sources of information for engineering projects are identified and used. Trade language and descriptions of resources and techniques are used as appropriate. 3.2. Appropriate computing techniques are applied to source, categorise, catalogue and report on resources search results for engineering applications.
4. Apply engineering fundamentals in support of selection of resources for engineering applications based on functional or performance specification of system and components	4.1. Appropriate basic scientific principles and techniques are applied to select resources for engineering applications. 4.2. Appropriate calculations and assumptions are used to enable choices of resources for engineering applications. 4.3. Appropriate materials properties, methods and processes knowledge is applied in support of selection of resources for engineering applications. 4.4. Appropriate resources have been chosen for the engineering application. Selections should be based on functional or performance specification of system and components of application.

ELEMENT	PERFORMANCE CRITERIA
5. Specify resources, and technical support for engineering applications sufficient to facilitate their identification and supply	5.1.Specify resources, and technical support for engineering applications sufficient to facilitate their identification and supply 5.2.Suppliers of resources and technical support are identified.
6. Assist with design specifications and development procedures for engineering applications	6.1.Contribute significantly to the creation of design, implementation, installation, commissioning and maintenance procedures and documents for resources required by specific engineering applications. 6.2.Implement appropriate computing and programming techniques in the process of development of design specifications and documentation for specific engineering applications. 6.3.Create and file design graphics and documentation suitable to the design and development process of the application or project in accordance with organisational and contractual requirements.
7. Assist with implementation of design and development specifications and documentation for engineering applications	7.1.Assist significantly with design, development, installation, commissioning and maintenance for specific mechatronic engineering applications. 7.2.Assist significantly with installation, programming, commissioning and maintenance of computer and control hardware and software.
8. Review design implementation.	8.1.Design implementation is reviewed and reported on in terms of design, investigation, selection, specification and implementation, installation, commissioning and maintenance processes.

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

Required skills

Look for evidence that confirms skills in:

REQUIRED SKILLS AND KNOWLEDGE

- research, evaluation and implementation of specific mechatronic engineering projects using problem solving, implementation and improvement processes, philosophies and techniques including Problem solving, Brain Storming, decision-tree, trade-off tables, Kaizen, TQM and Tools of TQM.
- research, evaluation and implementation of specific mechatronic engineering projects within continuous, mass, batch, jobbing or prototype production processes, sequential and cellular manufacture and assembly, Just In Time (JIT), competitive (lean) manufacturing, design for reliability, optimum maintenance and computer managed maintenance.
- selecting test and analysis equipment, materials, components and systems, support structures, power supply and control systems appropriate to particular engineering applications
- identifying functional attributes of test and analysis equipment, materials, components and systems, support structures, power supply and control systems
- identifying essential attributes and desirable attributes in preparation for investigation, research and sourcing
- establishing provision for control systems from expert advice
- using computer hardware and software for gathering and analysing information.
- applying scientific principles in the choice of test and analysis equipment, materials, components and systems, support structures, power supply and control systems.
- making assumptions and calculations to justify choice of test and analysis equipment, materials, components and systems, support structures, power supply and control systems.
- selecting materials properties for the engineering application.
- selecting test and analysis equipment, materials, components and systems, support structures, power supply and control systems appropriate for the engineering application.
- using relevant "trade language"
- specifying appropriate technical support
- specifying implementation, installation, commissioning and maintenance documentation and procedures
- providing for control system requirements.
- using computer hardware and software and effectively in the design&development process of the engineering applications.
- preparing design graphics and documentation to satisfy application and contractual requirements.
- giving feedback on variations
- ensuring provision for control systems
- completing reports, records and design documentation

REQUIRED SKILLS AND KNOWLEDGE

Required knowledge

Look for evidence that confirms knowledge of:

- problem solving, implementation and improvement processes, philosophies and techniques including Problem solving, Brain Storming, decision-tree, trade-off tables, Kaizen, TQM and Tools of TQM
- implementation of specific mechatronic engineering projects incorporating problem solving, improvement processes, philosophies and techniques
- continuous, mass, batch, jobbing or prototype production processes, sequential and cellular manufacture and assembly, Just In Time (JIT), and competitive (lean) manufacturing
- implementation of specific mechatronic engineering projects within continuous, mass, batch, jobbing or prototype production processes, sequential and cellular manufacture and assembly, Just In Time (JIT), competitive (lean) manufacturing, design for reliability, optimum maintenance and computer managed maintenance
- significance and characteristics of software, test and analysis equipment, materials, components and systems, support structures, power supply, methods and processes, principles and techniques, control and supervisory systems to the application can be explained.
- functional attributes of resources
- relationship of essential attributes to application function
- classification of attributes as essential Vs desirable
- the value of desirable attributes
- methods of accessing and using alternative information sources
- appropriate sources of information
- trade language and descriptions
- reasons for using particular hardware and software
- methods of using hardware and software
- the reasons for using particular scientific principles
- reasons for using particular calculations and assumptions
- reasons for providing for particular materials properties in the engineering application
- reasons for selecting resources with reference to functional or performance specification of system and components of application.
- trade language descriptions used in specification
- procedural steps for implementation, commissioning and maintenance purposes
- reasons for using particular hardware and software
- methods of using hardware and software
- graphical and documentary options
- rationale for graphics and documents raised can be explained in the context of application, project and contractual requirements
- implementation of design, development, installation, commissioning and

REQUIRED SKILLS AND KNOWLEDGE
maintenance procedures in the context of the specific application • installation, programming, commissioning and maintenance of computer and control hardware and software in the context of the specific application • design implementation review procedures

Evidence Guide

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Overview of assessment

A person who demonstrates competency in this unit must be able to apply mechatronics fundamentals to support design and development of projects for a range of engineering applications. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

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 criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

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.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying mechatronics fundamentals to support design and development of projects or other units requiring the exercise of the skills and knowledge covered by this unit.

Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes,

EVIDENCE GUIDE	
	standards, manuals and reference materials.

EVIDENCE GUIDE

Guidance information for assessment

Range Statement

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, if used in the performance criteria, is detailed below. 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) may also be included.

Total Quality Management (TQM)

A customer driven amalgamation of quality assurance, quality control and quality improvement

Tools of TQM

Flow charts, Pareto, Ishikawa (cause and effect), Process Capability Analysis, Sampling and Control Charting, Run Charts, Correlation Analysis.

Kaizen as applied to engineering

Gradual and continual improvement to products, processes, systems and services.

Competitive (lean) Manufacturing Principles and Techniques

Includes sequential and cellular manufacture and assembly with multi-skilling of work-teams, work-place improvement, Total Quality Management including use of TQM tools, Just In Time (JIT), Group Technology (GT), quick change-over, process and productivity improvement, cost reduction, supply and demand chain management, quality optimisation, design for reliability, optimum maintenance, computer managed maintenance.

Resources, skills, knowledge and techniques for engineering applications.

Human resources, software, test and analysis equipment, materials, components and systems, support structures, power supply, methods and processes, principles and techniques, control, data collection and supervisory systems. Technique includes those required to select, manufacture,

RANGE STATEMENT	
	install, commission, test and maintain components and systems.
Mechatronic engineering	• Mechatronics is usually defined as the integration of mechanical, electronics, programming, electrical and fluid power in an engineering product. The definition of Mechatronics is here broadened to include general automation. • Mechatronics engineering is concerned with the conceptual development, research, design, manufacture and/or implementation and/or installation, commissioning and maintenance of automated products, processes, systems or services for converting energy into power and motion, materials into product and components into machines and systems for domestic, commercial, industrial, civil, entertainment, medical or military applications.
Components and systems	Pumps and pumping equipment, system control equipment, heating equipment, pollution control / waste processing equipment, heat exchangers, materials processing equipment, HVAC equipment, product moulding equipment, refrigeration equipment, product forming equipment, hydraulic equipment, welding , fastening and bonding equipment, pneumatic equipment, materials handling equipment, electrical equipment, transportation vehicles and equipment, system monitoring equipment, packaging equipment, sensors and transducers, controllers, interfaces
Sources of information	Manufacturer catalogues, websites, texts and technical journals, use of phone, email and fax information gathering. Information sought includes human resources, software, test and analysis equipment, materials, components and systems, support structures, power supply, methods and processes, principles and techniques, control and supervisory systems.

Unit Sector(s)

Unit sector	
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Co-requisite units

Co-requisite units		

Competency field

Competency field	Planning
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