



Australian Government

Department of Education, Employment and Workplace Relations

MEM14062A Plan and design mechatronic engineering projects

Release: 1

MEM14062A Plan and design mechatronic engineering projects

Modification History

Not Applicable

Unit Descriptor

Unit descriptor	This unit defines the competencies required to systematically plan and design within mechatronic engineering.
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Application of the Unit

Application of the unit	Competency in this unit includes significant contribution to the planning and design process for mechatronic, maintenance, electrical-electronic or instrumentation and control engineering applications. Planning and design should be implemented systematically within the context of market or customer requirements and prevailing industrial environment in accordance with planning and design parameters such as performance, financial, legal, resource and scheduling. Applications of planning and design in mechatronic engineering may include the conceptual development, design, project management, manufacture, implementation, 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, entertainment, civil, medical or military applications. 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	MEM14082A	Apply mechatronic fundamentals to support design and development of engineering projects
	MEM16008A	Interact with computing technology
	MEM23041A	Apply basic mechanical scientific principles and techniques in engineering situations
	MEM23051A	Apply basic electro and control scientific principles and techniques in engineering situations
	MEM23062A	Select mechatronic engineering materials
	MEM23072A	Select and apply mechatronic methods and processes
	MEM23082A	Apply scientific principles and techniques in mechatronics engineering situations
	MEM23092A	Apply automated system design 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 and report the context and parameters of the planning and design process for mechatronic engineering applications	1.1. Research and report on the context and parameters of the planning and design process for engineering applications. 1.2. Identify, and report on the market and industrial context and parameters of the planning and design process for a significant and particular mechatronic engineering application. Parameters may include performance, financial, legal, resource and scheduling.
2. Interpret the brief and clarify client's requirements	2.1. Interpret the client's requirements for an application in an engineering environment. 2.2. Develop the design requirements and parameters with client.
3. Prepare concept proposal	3.1. A range of different, innovative and creative approaches to achieve design requirements is generated. 3.2. Check feasibility of a range of design solutions against design parameters. Assess opportunities for concurrent design activities. Assess design solutions for conformity to OHS&E requirements. 3.3. Seek opinions of colleagues and a range of creative and technical experts/specialists. 3.4. Prepare plan and design concept proposal that includes results of feasibility study consideration of expert opinion, initial calculations and modelling and the use of judgment and discretion. 3.5. Concept proposal reviewed with client to improve outcomes and overcome possible problems.
4. Implement the planning and design process for particular applications	4.1. Select and manage resources and processes to develop the plan or design. 4.2. Document management processes. 4.3. Appropriate components and systems have been incorporated in the planning and design process. 4.4. Perform engineering activities and manage self to implement the planning and design process. 4.5. Appropriate calculations and assumptions are used in implementing the planning and design process. 4.6. Appropriate computing hardware and software and programming techniques have been implemented in the planning and design process.

ELEMENT	PERFORMANCE CRITERIA
	4.7. Appropriate scientific principles are applied to implement planning and design process. 4.8. Appropriate materials properties knowledge is implemented in the planning and design process. 4.9. Appropriate engineering methods and processes knowledge is implemented in the planning and design process. 4.10. Where elective competencies have been used in the planning and design process, implementation is appropriate and efficiently carried out in the planning and design process.
5. Review the design and implementation plan	5.1. Review the design and implementation plan to ensure conformity with current specification, contract and organisational procedures, OHS&E and regulatory standards, that it addresses feedback from stakeholders and meets client expectation. 5.2. Client acceptance of the design is achieved and documented.
6. Maintain design documentation	6.1. All design documentation is completed in accordance with organisational requirements.
7. Review design outcomes	7.1. Design outcomes are reviewed in terms of the intended and actual use.

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:

- researching and reporting context and parameters of the planning and design process for a comprehensive range of engineering applications
- planning and designing a significant and particular engineering application within the market and industrial context and in conformance with project parameters such as financial, legal, resource and scheduling.
- documenting and confirming the client's requirements in accordance with organisational procedures and practices.
- informing client of known OHS, regulatory, ethical, environmental, physical and

REQUIRED SKILLS AND KNOWLEDGE

- cost limitations.
- identifying design parameters
- establishing scope of design brief
- writing specifications to meet design requirements.
- documenting and agreeing on acceptance criteria with the client
- reviewing different approaches technical feasibility, innovation, creativity, and acceptance to client
- documenting possible design concepts
- analysing, comparing and contrasting the relative merits of possible design concepts
- documenting an objective analysis of each approach (eg. Weighted "trade-off" table)
- organising design activities into sequential and concurrent design activities
- discussing proposals with colleagues and specialists
- clarifying creative and technical aspects of the proposals
- documenting concept proposal in accordance with organisational procedures
- establishing the design and planning team in accordance with organisational procedures
- identifying resources and establishing management procedures
- controlling documentation in accordance with established procedures
- selecting components and systems
- addressing professional indemnity and ethical issues
- negotiating, documenting and monitoring outcomes and performance measures
- developing work instructions
- monitoring and correcting project progress
- performing risk analysis and corrective action
- assumptions and calculations for implementation of the planning and design process
- preparing design diagrams and calculations
- applying scientific principles in the implementation of the planning and design process.
- selecting materials
- selecting engineering methods and processes
- creating demonstration models
- confirming the design solution and plan
- authorising modifications to the engineering specification in accordance with organisational procedures.
- incorporating corrections and improvements to the design into the revised design solution and plan
- applying OHS&E and regulatory standards
- completing design documentation

REQUIRED SKILLS AND KNOWLEDGE

- documenting changes to the design and implementation plan
- obtaining and reviewing feedback from the commissioning process
- monitoring the project outcomes or performance in the user's environment
- addressing deficiencies in project outcomes or performance as measured against current specification

Required knowledge

Look for evidence that confirms knowledge of:

- context and parameters of the planning and design process for a comprehensive range of engineering applications
- market and industrial context and parameters such as financial, legal, resource and scheduling of the planning and design process for a significant and particular engineering application
- the procedures for documenting and confirming client requirements
- the client's requirements
- appropriate codes, standards, specifications and legislative and regulatory requirements
- implications for sustainability and options for improved environmental outcomes
- issues of sustainability and environmental impact were examined
- constraints and risks associated with the development and implementation of the design
- the scope of the design
- sources of information on standard and innovative or creative project solutions
- issues of sustainability, environmental and/or community impact
- design parameters or constraints
- process of analysis, comparison and contrasting
- sequential and concurrent design activities
- input and effects of advice from colleagues, experts and specialists
- features of concept proposal in the context of design brief, feasibility study and expert opinion
- concept proposal review process
- human and physical resources available to carry out the design task
- the most appropriate process to develop the plan and design to meet the agreed outcomes and cost structure
- the reasons for establishing and maintaining a document management process
- the engineering fundamentals affecting selection of components and systems
- the relevance of defined engineering activities to successful project completion and career enhancement
- the reasons for using particular design approach, calculations and assumptions
- the reasons for using particular hardware and software and programming technique
- the reasons for considering or using particular scientific principles

REQUIRED SKILLS AND KNOWLEDGE

- the reasons for providing for particular materials properties knowledge in the implementation of the planning and design process
- the reasons for providing for particular methods and processes in the implementation of the planning and design process
- graphical and documentary options
- rationale for graphics and documents raised in the context of application, project and contractual requirements
- the reasons for use of elective competencies in the implementation of the planning and design process
- key aspects of the design and implementation plan in the context of current specification, contract and organisational procedures, OHS and regulatory standards
- effect of design team, expert input and client feedback on design and implementation plan
- the procedures for gaining client endorsement and documenting client acceptance of the design solution and implementation plan
- the significance of the document control process
- the procedures for initiating and gaining approval for design changes
- the procedures for updating issued documents
- appropriate tests and testing schedules to monitor the outcomes or performance of the project
- the reasons for selecting the chosen tests and schedules
- variations in measured performance from design specifications
- corrective action to return the design outcome or project performance to specification

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 plan and design mechatronic engineering 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 planning and design of mechatronic engineering 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, 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.

Mechatronic engineering

- Mechatronics is usually defined as the integration of mechanical, electronics, programming, electrical and fluid power in an engineering product. The skills and underpinning knowledge of mechatronics are common with general automation of processes, systems and services. 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.

Design process

The consideration and identification of a problem or opportunity to improve an existing design. The conceptual process used to bring together innovation, aesthetics and functionality to plan and create an artefact, a product, a process or a system including programming and scheduling to meet an artistic or industrial requirement of an individual or group.

RANGE STATEMENT	
Concurrent design activities	The process of involvement of all stakeholders from initial planning and design to implementation and commissioning. May include product or project data management system with graded access privileges.
OHS&E requirements	Occupational Health Safety and Environment recognizes that stakeholders in workplace activity include the workforce exposed to worksite conditions, materials and processes of the activity and the broader community exposed to environmental effects of the activity. Apply in accordance with organisational policies and statutory and regulatory requirements.

Unit Sector(s)

Unit sector	
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Co-requisite units

Co-requisite units		

Competency field

Competency field	Planning
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