



Australian Government

MEM14086 Apply mechatronic engineering analysis techniques

Release: 1

MEM14086 Apply mechatronic engineering analysis techniques

Modification History

Release 1. Supersedes and is equivalent to MEM14086A Apply mechatronic engineering analysis techniques.

Application

This unit of competency defines the skills and knowledge required to undertake a range of mechatronic-related analyses that can relate to the design of mechatronic devices or automated plant or be used for other purposes. This includes fitness for purpose evaluations, installation and commissioning, system changes or improvements or other mechatronic engineering-related tasks and includes application of mechanical, fluid, electrical and controller design and analytical techniques. It is suitable for people working at a technician level in a mechatronic engineering work environment and applies to people working individually or as part of a team.

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

Pre-requisite Unit

MEM23004 Apply technical mathematics

MEM23111 Select electrical equipment and components for engineering applications

MEM23112 Investigate electrical and electronic controllers in engineering applications

MEM14090 Integrate mechatronic fundamentals into an engineering task

Competency Field

Planning

Elements and Performance Criteria

<i>Elements describe the essential outcomes.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element.</i>
1. Determine job requirements	1.1 Follow standard operating procedures (SOPs) 1.2 Comply with work health and safety (WHS) requirements at all times 1.3 Use appropriate personal protective equipment (PPE) in accordance with SOPs 1.4 Identify job requirements from specifications

<i>Elements describe the essential outcomes.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element.</i>
2. Investigate mechatronic analysis context and need	2.1 Negotiate parameters of the engineering design brief in consultation with stakeholders 2.2 Identify relevant engineering scientific principles and required analysis techniques 2.3 Investigate life cycle design and sustainability implications of mechatronic design or existing mechatronic systems, devices or equipment 2.4 Determine specification, documentation and graphical techniques required for analysis 2.5 Confirm WHS, regulatory requirements, codes of practice, standards and risk management relevant to mechatronic analysis task 2.6 Determine available sources for any required technical and professional assistance
3. Apply mechatronic analysis techniques	3.1 Plan, schedule and coordinate the analysis task 3.2 Create adequate and accurate calculations and preliminary graphics, and maintain design process records 3.3 Evaluate multiple solutions against analysis criteria 3.4 Integrate mechatronic techniques, hardware and software, including mechanical, fluid, electrical, electronic, controller and networking 3.5 Apply systems thinking, problem-solving and decision-making 3.6 Incorporate required professional and technical assistance 3.7 Apply agreed techniques to achieve or test solution
4. Report results	4.1 Record results of analysis 4.2 Provide supporting documentation that includes accurate and comprehensive details about analysis techniques used

Foundation Skills

This section describes those language, literacy, numeracy and employment skills that are essential to performance.

Foundation skills essential to performance are explicit in the performance criteria of this unit of competency.

Range of Conditions

This field allows for different work environments and conditions that may affect performance. Essential operating conditions that may be present (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) are included.	
Specifications include one or more of the following:	• drawings • job sheets • work instructions.
Mechatronic engineering analysis reasons include one or more of the following:	• design of automated devices and plant • design or evaluation of significant modifications, process changes or improvements • sustainability issues relevant to plant, equipment or processes • fitness for purpose evaluation • installation and commissioning of plant and equipment.
Planning processes include one or more of the following:	• establishing design parameters and design criteria • contributing to the negotiation and advice process • preliminary planning, design investigations and costing • identifying design, development, prototyping activities and skills requirements • planning and scheduling design activities • improving, adjusting and rescheduling as required by emergency contingencies and constraints.
Analysis process includes one or more of the following:	• establishing design parameters and criteria • research, measurement, experimentation and investigation • generating ideas • synthesis, problem-solving and decision-making, and addressing constraints • techniques: • scientific principles • calculation and graphics • prototyping • mock-up • evaluating solutions against design criteria • consultation, adjustments and agreement • finalise design and sign-off.
Analysis criteria includes one or more of the following:	• function • aesthetics • manufacturability and maintainability • marketability • sustainability • cost constraints • ergonomics, anthropometrics and physiology

	• manufacturability, maintainability • facilities, plant and skills available • safety and risk.
Sustainability includes:	• meeting all regulatory requirements • conforming to all industry covenants, protocols and best practice guides • minimising ecological and environmental footprint of process, plant and product • maximising economic benefit of process plant and product to the organisation and the community • minimising the negative WHS impact on employees, community and customer.
Life cycle analysis includes one or more of the following:	• improving sustainability of products and services • all aspects of manufacture of a single product • the entire operations of an organisation • a particular aspect of operations including environmental implications.
Prototyping includes:	• mock-ups • physical and virtual modelling with post-processing for computer numeric control (CNC) and rapid prototyping.
Appropriate licensed technical and professional assistance includes one or more of the following:	• technical support and advice relating to elements which have intrinsic dangers • professional support for technologies.
WHS, regulatory requirements and enterprise procedures include:	• WHS acts, regulations and relevant standards • codes of practice from Australian and overseas engineering and technical associations and societies • risk assessments • registration requirements • safe work practices • state and territory regulatory requirements.
Standards and codes include:	• Australian and international standards and codes applicable to a particular mechatronic analysis task.
Mechatronic hardware includes:	• mechanical, fluid and electric actuators • power transmission devices • pipes, conduits wires, fittings and connectors • controllers • power interfaces • signal conditioning interfaces.
Results to be reported and supporting documentation	• investigations • application of principles and techniques

include one or more of the following:	• calculations • specifications • diagrams • CAD files • mock-ups • prototypes.
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Unit Mapping Information

Release 1. Supersedes and is equivalent to MEM14086A Apply mechatronic engineering analysis techniques.

Links

Companion Volume implementation guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b7050d37-5fd0-4740-8f7d-3b7a49c10bb2>

Assessment Requirements for MEM14086 Apply mechatronic engineering analysis techniques

Modification History

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Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy the requirements of the elements and performance criteria and include:

- following work instructions, standard operating procedures (SOPs) and safe work practices
- communicating, negotiating and reviewing design brief with stakeholders and team or support functional group
- determining or confirming relevant scientific principles and analysis techniques
- determining or confirming work health and safety (WHS) and regulatory requirements
- evaluating multiple solutions
- investigating life cycle design and sustainability on at least two occasions
- planning, scheduling and coordinating the design task
- integrating mechatronic techniques, hardware and software
- solving problems and making decisions with systems thinking for contingencies, constraints and continuous improvement
- defining analysis
- specifying and documenting and applying analysis techniques
- creating and maintaining adequate and accurate calculations and design process records
- reporting and documenting results on at least two occasions.

Note: Where a volume and/or frequency is not specified, demonstration must be provided at least once.

Knowledge Evidence

Evidence required to demonstrate the required knowledge for this unit must be relevant to and satisfy the requirements of the elements and performance criteria and include knowledge of:

- safe work practices and procedures and use of personal protective equipment (PPE)
- reasons and planning processes for mechatronic engineering-related analysis
- implications of life cycle design, fitness for purpose evaluation and sustainability for mechatronic analysis process
- mechatronic analysis processes and techniques to investigate, synthesise and develop proposals, evaluate feasibility against design criteria, and review and revise in consultation with stakeholders, team or support functional group

- common model, mock-up and prototyping techniques relevant to mechatronic engineering
- systems thinking, problem-solving and decision-making and continuous improvement methods
- WHS and regulatory requirements, codes of practice, standards, risk management and registration requirements with particular emphasis on automation safety requirements
- sources of professional and technical assistance
- procedures for planning, scheduling and coordination of analysis
- hardware requirements for typical applications
- engineering mechatronic scientific principles and techniques required for analysis tasks:
 - mechanical
 - fluid power
 - fluid dynamics
 - thermodynamics
 - electrical and electronic fundamentals
 - controller and supervisory control and data acquisition (SCADA) or distributed control system (DCS) programming
 - engineering materials, properties and processes
 - techniques for integration of mechanical, fluid, electrical, electronic, controller and networking elements
- mechatronic analysis calculations techniques
- software for product planning and design including CAD, circuit design, controller programming and project management
- documentation and required information
- prototyping options, including mock-ups, physical and virtual modelling and rapid prototyping.
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Assessment Conditions

- Assessors must:
 - have vocational competency in applying mechatronic engineering analysis techniques at least to the level being assessed with relevant industry knowledge and experience
 - satisfy the assessor requirements in the Standards for Registered Training Organisations 2015 or its replacement and comply with the National Vocational Education and Training Regulator Act 2011, its replacement or equivalent legislation covering VET regulation in a non-referring state/territory as the case requires.
- Where possible, assessment must occur in operational workplace situations. Where this is not possible or where personal safety or environmental damage are limiting factors, assessment must occur in a sufficiently rigorous simulated environment that reflects realistic operational workplace conditions that cover all aspects of workplace performance, including environment, task skills, task management skills, contingency management skills and job role environment skills.

- Conditions for assessment must include access to all tools, equipment, materials and documentation required including relevant workplace procedures, product and manufacturing specifications.
- Assessment processes and techniques must be appropriate to the language, literacy and numeracy requirements of the work being performed and the needs of the candidate.
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