



Australian Government

MEM23109 Apply engineering mechanics principles

Release: 1

MEM23109 Apply engineering mechanics principles

Modification History

Release 1. Supersedes and is equivalent to MEM23109A Apply engineering mechanics principles.

Application

This unit of competency defines the skills and knowledge required to apply the principles of mechanics and strength of materials to devices, machines and systems and their components, to identify key mechanical properties. It includes a range of basic analyses of static and dynamic loads and moments, stresses and deflections, velocities and accelerations.

The unit applies to engineering or related activities requiring the application of the principles of mechanics and strength of materials and is suitable for people giving technical support to design, operations or maintenance activities and those pursuing technical qualifications and careers at paraprofessional or technician level.

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

Pre-requisite Unit

MEM23004 Apply technical mathematics

Competency Field

Engineering science

Elements and Performance Criteria

Elements	Performance Criteria
<i>Elements describe the essential outcomes.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element.</i>
1. Identify scope of required analysis	1.1 Identify device, machine or system, and component parts for analysis 1.2 Assess engineering mechanics principles, skills and techniques required by tasks 1.3 Review functions and features of device, machine or system 1.4 Assess software techniques required for basic analysis and graphics required by the task 1.5 Identify stakeholders to be consulted on analysis tasks

Elements	Performance Criteria
<i>Elements describe the essential outcomes.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element.</i>
	1.6 Confirm work health and safety (WHS) and regulatory requirements, and risk management and organisational procedures 1.7 Review sustainability implications of tasks 1.8 Determine available sources for technical and professional assistance
2. Apply engineering mechanics principles and techniques	2.1 Identify appropriate engineering mechanics principles and analytical, graphical and software-assisted techniques applicable to task 2.2 Validate software results using analytical and graphical methods 2.3 Ensure clear and logical process of analysis and compatibility of units in calculations 2.4 Apply resultant loads and reactions on machines, support frames and beams due to parallel and oblique, concentrated and distributed loads and moments 2.5 Apply the torque and power required to drive translation screws and winding drums against inclined and vertically suspended loads subject to gravitation, acceleration and friction resistance loads 2.6 Select standard hardware to meet specifications 2.7 Analyse bending and shear stresses in beams subject to static point and distributed loads
3. Report results	3.1 Record results of investigation, evaluation and application 3.2 Provide documentation including calculations, diagrams, programs and files

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.	
Motion is 2D plane motion only and includes one or more of the following:	• constant velocity • constant acceleration • sinusoidal accelerations (sprung bodies) • other non-uniformly accelerated motions.
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 and regulations • 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.
Analysis includes:	• static and dynamic analysis of loads • the stresses and deformations resulting • the transmitted power, torque and speed • graphical and mathematical methods and software options.

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Unit Mapping Information

Release 1. Supersedes and is equivalent to MEM23109A Apply engineering mechanics principles.

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 MEM23109 Apply engineering mechanics principles

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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:

- determining parameters and context of tasks
- applying work health and safety (WHS), regulatory requirements, risk management and organisational procedures
- reviewing sustainability implications and functions and features of devices, machines and systems
- assessing and applying engineering mechanics principles, including use of software basic analysis and graphics skills and techniques, on at least two occasions
- ensuring compatibility of units in calculations
- reporting and documenting results in accordance with procedures.

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:

- engineering mechanics tasks
- mathematical techniques including arithmetic, algebra, trigonometry and geometry
- definition of typical applications of mechanics, statics, dynamics, kinematics, kinetics and strength of materials
- analytical, graphical, semi-graphical and software-assisted techniques for tasks
- physical quantities and dimensions including international system of units (SI) and fundamental dimensions and units
- 2D plane motion (only)
- basic principles of statics applicable to mechanical devices and systems
- application of force systems applied to bodies, frames and beams
- friction laws and applications in mechanical devices and systems
- stress and strain:
 - axial stress
 - shear stress
 - bolted and welded joints

- torsional stress
- bending of beams
- dynamics applicable to mechanical devices and systems, including:
 - kinematics of rectilinear motion:
 - displacement, velocity and acceleration
 - equations of rectilinear motion
 - equations of simple harmonic motion
 - uniform acceleration and sinusoidal acceleration
 - kinetics of rectilinear motion including:
 - force, mass and acceleration
 - freely falling bodies
 - acceleration against resistance (accelerating force = unbalanced force)
 - acceleration against gravity and terminal velocity
 - acceleration against dry sliding friction and air resistance
 - forces diagrams
 - curvilinear motion including:
 - normal acceleration in curvilinear motion
 - centrifugal force
 - circular motion as a case of curvilinear motion
 - kinematics of rotation including:
 - rotational motion
 - angular displacement
 - angular velocity
 - angular acceleration
 - conversions of units of angular motion
 - equations of rotation with uniform acceleration
 - relation between linear and angular motion
 - kinetics of rotation including:
 - moment of inertia, second moment of mass, concept and units
 - torque due to inertia compared with torque due to winding drum rope force
- law of a machine
- work, energy and power
- specifications for engineering hardware applicable to mechanical devices and systems.
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Assessment Conditions

- Assessors must:
 - have vocational competency in applying engineering mechanics principles in engineering situations 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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