



Australian Government

MEM29003 Apply CAD and CAM technologies in an Industry 4.0 workplace

Release: 1

MEM29003 Apply CAD and CAM technologies in an Industry 4.0 workplace

Modification History

Release 1. New unit.

Application

This unit defines the skills and knowledge required to assess computer aided design (CAD) and computer aided manufacturing (CAM) processes and equipment for integration into a broader Industry 4.0 workplace.

While the unit requires skills in preparing, creating, and producing components using CAD and CAM technologies, the emphasis is on using these skills in an Industry 4.0 working environment. The unit includes examining the flow and efficiency of data from CAD to CAM to manufacturing equipment and assessing measures to improve the integration of CAD/CAM processes into the Industry 4.0 manufacturing environment. The unit may be applied to additive or subtractive manufacturing processes. The unit does not include the design of CAD/CAM systems nor does it provide full competency in programming and operating CAD or CAM systems and equipment. Appropriate MEM units and qualifications should be undertaken where full competency in programming and/or operation of CAD and CAM systems is required.

The unit scope includes reviewing the capability of current CAD and CAM hardware and software to receive and communicate data, produce prototypes and components, and integrate into digital quality and control systems.

Where applying or interpreting technical drawings or models to Australian Standard AS 1100 Technical drawing or AS 1102 Graphical symbols for electrotechnical documentation: General information and general index or their equivalents is required, unit MEM09229 Read and interpret technical engineering drawings should be selected.

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

Pre-requisite Unit

Nil

Competency Field

Applied technologies

Elements and Performance Criteria

Elements	Performance Criteria
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Elements describe the essential outcomes.	Performance criteria describe the performance needed to demonstrate achievement of the element.
1. Identify current CAD and CAM workplace environment	1.1 Review products and manufacturing processes and establish the extent of CAD and CAM use in current production systems 1.2 Identify CAD and CAM equipment and software being used 1.3 Establish extent of current networking and file transfer between design, prototyping and production processes 1.4 Establish extent of CAD and CAM links to supervisory control and data acquisition (SCADA) and enterprise resource planning (ERP) systems and software
2. Assess CAD system through creation of drawings and 3D models	2.1 Review features and functions of CAD system 2.2 Import data from other software applications into CAD system 2.3 Use CAD functions to create technical drawings and 3D models 2.4 Check and validate technical drawings and 3D models against job requirements, standard operating procedures and imported data 2.5 Save and output CAD files in the required format for job requirements 2.6 Identify the range of data currently captured by CAD system 2.7 Evaluate current CAD system for ease of use, data importing and exporting, and modification and customisation features
3. Assess CAM system through creation of 3D code files	3.1 Import models from CAD system using appropriate file formats 3.2 Manipulate 3D models in accordance with job requirements 3.3 Link 3D model entities to database attributes to suit job requirements 3.4 Develop manufacturing data from the 3D model and verify for logical sequencing and correct manufacturing procedures 3.5 Save and output 3D CAM code files in the required format for post processing 3.6 Identify the range of data currently captured by CAM system 3.7 Evaluate current CAM system for ease of use, data importing and exporting capability, and modification and customisation features
4. Test component production using 3D CAM code files	4.1 Identify and follow workplace health and safety procedures (WHS) procedures for producing components on manufacturing equipment 4.2 Check material is consistent with job and machine requirements 4.3 Transfer files from computer to specified manufacturing equipment in accordance with organisational procedures, operating instructions and job requirements

Elements	Performance Criteria
Elements describe the essential outcomes.	Performance criteria describe the performance needed to demonstrate achievement of the element.
	4.4 Ensure equipment is set and adjusted ready for production 4.5 Produce components using digital manufacturing equipment and check against specification 4.6 Identify production data captured and exported by the component manufacturing equipment
5. Assess CAD, CAM and manufacturing equipment for Industry 4.0 integration	5.1 Evaluate potential for improved networking, data capture and reporting by CAD, CAM, and linked manufacturing equipment and systems 5.2 Prepare recommendation for improvements to CAD and CAM workplace systems to facilitate integration into wider Industry 4.0 workplace systems and technologies

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.

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| Industry 4.0 systems include one or more of the following: | <ul style="list-style-type: none"> • industrial internet of things (IIoT) devices • collaborative robots • networked and cloud connected traditional robots and other industrial automation • networked and cloud connected supervisory control and data acquisition systems (SCADA) • networked and cloud connected enterprise resource planning (ERP) systems • networked and cloud connected CAD and CAM systems • digital twins |
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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.

	• augmented and virtual reality systems • networked and cloud connected CNC and additive manufacturing machines • networked and cloud connected data storage and processing facilities • networked and cloud connected edge devices • other networked and cloud connected digital devices and systems relevant to the workplace.
Job requirements include one or more of the following:	• timeframe for completion • hardware and software requirements • information to be included in drawing or model • drawing and model approval procedures • drawing and model exporting instructions and parameters
Required information in technical drawings and 3D CAD models includes one or more of the following:	• drafting standards • measurements of components, sub-assemblies and products • workplace-accepted tolerances • approval date and approving authority/person • legend • bill of materials • references to other data files.
Drawing protocols include one or more of the following:	• abbreviations • commonly used symbols • dimensions • hierarchy • legends • lettering standards • numbering • paper size • scale • standard units of measurement.
Products, parts and components include:	• prototypes • production items.
Linked manufacturing equipment and systems include one or more of:	• SCADA • ERP system • machine vision • traditional and collaborative robots • additive manufacturing machines

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.

- CNC machining centres
- robotic welders and automated thermal cutting machines
- automated materials receiving, storage and retrieval systems and facilities
- other onsite or remote automated equipment and data processing facilities.

Unit Mapping Information

No equivalent unit

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 MEM29003 Apply CAD and CAM technologies in an Industry 4.0 workplace

Modification History

Release 1. New unit.

Performance Evidence

There must be evidence the candidate has demonstrated the ability to:

- source required information for at least two CAD 3D models from technical drawings, job specifications and other computer programs
- test features and functions of a CAD system by:
 - creating, modifying and deleting attributes using drawing tools for at least two products, components or parts
 - creating specified geometrical shapes comprising points, lines and arcs
 - retrieving, saving and outputting at least two products, components or parts files in appropriate formats
- check and validate accuracy of required information for at least one technical drawing and two 3D CAD models
- test features and functions of a CAM system by:
 - linking at least two 3D models to database in accordance with job requirements
 - developing manufacturing data from at least two 3D models
 - saving and outputting 3D code files in required format from manufacturing data for at least two 3D models
- identify and map workplace data flow from CAD job requirements to subtractive or additive manufacturing equipment including flows to and from ERP and SCADA systems if present
- produce products, components, or parts using digital additive or subtractive manufacturing equipment to test CAM code files
- assess extent that current CAD operations use CAD system and software capability
- assess extent that current CAM operations use CAM system and software capability
- identify options to improve data flow and networking of CAD and CAM hardware and software.

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

Knowledge Evidence

There must be evidence the candidate has knowledge of:

- types and uses of drawings and models commonly used in manufacturing, including the relationship between the views contained in drawings
- terms and conventions used in technical drawings and modelling

- basic navigation procedures for CAD and CAM systems including:
 - system operations including
 - start
 - shut down
 - access and security
 - updating
 - display adjustments
 - creating and manipulating 3D models
 - modifying existing 3D models
 - saving drawing files
 - extracting data with respect to the physical properties of models created in 3D space
- formats in which CAD drawing files can be saved and reasons for using different formats when saving drawing files
- workplace drawing protocols
- principles of computer aided manufacturing (CAM) for manufacturing processes including for:
 - additive manufacturing (metallic and non-metallic)
 - subtractive manufacturing (laser cutting, plasma cutting)
- methods for importing and exporting data and files to and from CAD and CAM systems
- operating procedures for additive or subtractive manufacturing equipment sufficient to test CAM code files
- actual and potential data integration between CAD and CAM systems and other Industry 4.0 systems
- purpose of SCADA and ERP systems and methods of importing and exporting data to and from these systems
- advantages of increased networking and data including:
 - faster prototyping
 - increased speed to market
 - increased data capture.
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Assessment Conditions

- Assessors must:
 - have vocational competency in applying CAD and CAM technologies 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.
- There must be 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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