Australian Government

MEM23122A Evaluate computer integrated manufacturing systems

Release 1

INDUSTRY SKILLS COUNCILS
Creating Australia's Future

MEM23122A Evaluate computer integrated manufacturing systems

Modification History

Release 1 - New unit. Replaces MEM23092A, but not equivalent.

Unit Descriptor

This unit of competency covers the evaluation of computer integrated manufacturing (CIM) systems. It includes hardware, controllers, networks and data handling for business, planning and control, manufacturing operations, automation safety, work health and safety (WHS) and risk management compliance, software and system integration.

Application of the Unit

This unit applies to evaluation of computer integrated systems used in manufacturing. It is suitable for people working as manufacturing technicians or paraprofessionals and draftspersons and those pursuing manufacturing, engineering or related technical qualifications and careers.

Licensing/Regulatory Information

Not applicable.

Pre-Requisites

MEM23004A	Apply technical mathematics
MEM23111A	Select electrical equipment and components for engineering applications
MEM23112A	Investigate electrical and electronic controllers in engineering applications

Employability Skills Information

This unit contains employability skills.

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.

Elements and Performance Criteria

1	Determine scope of CIM application	1.1	Identify stakeholders to be consulted on the evaluation
		1.2	Confirm that appropriate support, including technical and professional assistance, is available
		1.3	Identify WHS and regulatory requirements, codes of practice, standards and risk assessment requirements for CIM systems with particular emphasis on automation safety
		1.4	Identify appropriate analysis techniques, software techniques and graphics required for evaluation
		1.5	Identify stakeholders to be consulted on evaluation tasks
		1.6	Investigate sustainability implications of CIM systems
2	Evaluate CIM components and systems	2.1	Evaluate parameters and requirements of manufacturing operations
		2.2	Evaluate machines, processes and data flow for machine and process control in CIM systems
		2.3	Evaluate system control, signal generation and conditioning, controller functions and actuator power interfacing
		2.4	Evaluate data collection, sharing and control software and programming for hardware integration
		2.5	Evaluate the data and communications protocols, standards and network topologies for the applications

		2.6	Evaluate system integration of hardware, controllers, human-machine interfaces (HMIs) and graphical user interfaces (GUIs) and network
		2.7	Evaluate system analysis and simulation software and validation techniques
		2.8	Evaluate automation safety and compliance with WHS, regulatory requirements, standards and risk management implementation
3	Report results	3.1	Record results of scoping, principles and techniques identification and evaluation of systems
		3.2	Provide documentation, such as layouts, programs, flow charts and files

Required Skills and Knowledge

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

Required skills

Required knowledge includes:

- relating manufacturing context and requirements to existing or planned CIM applications and continuous improvement requirements
- identifying WHS, regulatory requirements and risk management compliance
- evaluating CIM systems against automation safety requirements
- investigating sustainability implications of CIM systems
- evaluating features and functions of existing or planned CIM systems against:
  - components
  - processes and data flow
  - controller functions
  - signal and power interfacing
  - communications protocols
  - standards and network topologies
  - HMIs and software
  - automation safety
  - compliance with WHS and regulatory requirements
- applying CIM related software analysis, and software validation techniques
- reporting and documenting results of scoping, principles and techniques identification and evaluation of systems, layouts, programs and flow charts

Required knowledge

Required knowledge includes:

- types of manufacturing operations, their features and parameters and potential for CIM applications, for example:
  - continuous, mass, batch and jobbing
  - prototype manufacture
  - cellular manufacturing
  - jobbing
  - just-in-time (JIT) and other lean manufacturing systems and techniques
  - maintenance systems and techniques (e.g. condition monitoring)
- compliance requirements of WHS and regulatory requirements, codes of practice, standards, and risk assessment for CIM systems with particular emphasis on automation safety

- sustainability implications of CIM systems
- CIM hardware
- CIM principles and techniques required to evaluate systems and select and optimise components
- current options and trends in performance analysis and programming software, including underpinning program techniques and algorithms
- LAN and WAN network communications in CIM applications
- documentation, drawings, specifications, instructions required, process information and programming
- interdependencies and communications linkages between team members, support functional groups, and licensed technical and professional support

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 evaluate CIM systems for safety, economy and fitness for purpose. This includes working individually and as part of a team in accordance with organisational procedures.
Critical aspects for assessment and evidence required to demonstrate competency in this unit	Assessors must be satisfied that the candidate can competently and consistently: • evaluate compliance with WHS, regulatory requirements and risk management with particular emphasis on automation safety • investigate sustainability implications of CIM systems • review features and functions of CIM systems • identify CIM principles and techniques, analysis, software and software validation techniques • evaluate parameters of manufacturing operations and the features and suitability of CIM components and systems • report and document results.
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, then a simulated working environment 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. • Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability. • Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.
Method of assessment	• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package. • Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge. • Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application. • Assessment may be applied under project-related conditions (real or simulated) and require evidence of process. • Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances. • Assessment may be in conjunction with assessment of other units of competency where required.
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

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.

CIM	CIM uses mechatronic and manufacturing technologies integrated

	across an enterprise by the communication of data to control plant and operations, plan production, marketing, maintenance and feedback to the business planning process
Standards and codes	Standards and codes refer to all relevant Australian and international standards and codes applicable to CIM applications and systems
Automation safety	Automation safety refers to the reliance on emergency stop, failsafe design, redundancy, system interlocks and data integrity. Standards apply to general plant design and use as well as the 'functional safety of safety-related electrical, electronic and programmable electronic control systems'

Appropriate technical and professional assistance	Appropriate technical and professional assistance may include:
	• technical support and advice relating to elements which have intrinsic dangers, such as:
	  • high pressure
	  • energised fluid vessels
	  • high temperatures and heat energy capacity
	  • wiring with high current control voltages above extra low voltage
	• professional support for technologies, such as:
	  • specialist electric motor drives and controllers
	  • specialist materials, plastics, metal alloys and nano materials
	  • special processes, foundry, alloy welding, heat treatment, sealing and fastening

WHS, regulatory requirements and enterprise procedures	WHS, regulatory requirements and enterprise procedures may 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
CIM hardware	Hardware options for CIM systems may include: • robots • pick and place, materials handling, automated guided vehicles (AGVs) and transfer devices • fluid power components • pumping and wash equipment

	• boilers, heating and drying equipment • pasteurising, chilling and refrigeration equipment • welding equipment • moulding, casting and forging equipment • pressing, forming, drawing and cropping equipment • surface finishing, plating and painting • packaging equipment • mechanical linkages and support structures • pressure, temperature, proximity sensor/transducers, relative and absolute encoders, vision systems and smart cameras • controllers, programmable logic controllers (PLCs) and remote telemetry units (RTUs) • HMIs (e.g. touch screens) • power interfaces and signal processors for digital and analog control • stepper motors • servo motors, torque, speed and position control • special purpose equipment (e.g. package labelling equipment, logistics and warehousing requirements) • wired and wireless networking systems
Data and communications protocols and standards	Data and communications protocols and standards include the set of standardised rules for data and signal syntax, checking and error detection. Hardware and software generate data in accordance with a protocol that allows generators and receivers to understand or translate the data as information, control signals integrity and error checks. These may include the following or their current updates: • layered communications and networking protocols • Open Systems Interconnection Model (OSI Model) – 7 layers • TCP/IP Internet Protocol Suite {Transmission Control Protocol (TCP) and the Internet Protocol (IP)} – 4 or 5 layers • IEEE 802 LAN/MAN group of standards, including IEEE 802.3 Ethernet standard, IEEE 802.11 Wireless networking standard • Interface standards, such as: RS232 and RS485, Fieldbus, Modbus and DNP3.0
Network topology	Network topology refers to the arrangement of connected hardware. These include: • bus, ring, star, tree, mesh and in-line (2 way comms.) arrangements • wired and wireless options
Sustainability	Sustainability is used to mean the entire sustainable performance of the organisation/plant, including: • 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
Continuous improvement implementation	Continuous improvement implementation may relate to plant, products, processes, systems or services, including design, development, implementation or manufacture, commissioning, operation or delivery and maintenance. Improvement processes may include techniques, such as: • balanced scorecard • current and future state mapping • measuring performance against benchmarks • process improvement, problem solving and decision making • data management, generation, recording, analysing, storing and use of software • training for improvement systems participation • technical training

Unit Sector(s)

Competency field

Unit sector Engineering science

Custom Content Section

Not applicable.