



Australian Government

Department of Education, Employment and Workplace Relations

MEA349A Apply basic scientific principles and techniques in aeronautical engineering situations

Release: 1

MEA349A Apply basic scientific principles and techniques in aeronautical engineering situations

Modification History

Not applicable.

Unit Descriptor

Unit descriptor	This unit covers applying basic scientific principles and techniques to appropriate aeronautical engineering situations
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Application of the Unit

Application of the unit	This unit requires application of basic aeronautical scientific principles and techniques as a member of a design and development or similar in support of the design and development of aeronautical applications. Applications include identifying the range of basic aeronautical scientific principles and techniques relevant to aeronautical engineering, selecting aeronautical principles and techniques for particular applications, applying aeronautical principles and techniques appropriately to engineering tasks, quoting results appropriately
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Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Prerequisite units	

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
<p>1. Research and identify the range of basic scientific principles and techniques relevant to aeronautical engineering</p>	<p>1.1. The basic scientific principles relating to aeronautical engineering are researched and reported on from appropriate <i>sources of information</i> and examination of applications.</p> <p>1.2. The basic aeronautical techniques and associated technologies, software and hardware required to implement scientific principles relating to <i>aeronautical engineering</i> situations are identified.</p>
<p>2. Select basic aeronautical scientific principles and techniques relevant to particular aeronautical engineering applications</p>	<p>2.1. For particular aeronautical engineering situations, the <i>relevant basic aeronautical scientific techniques and principles</i> can be selected.</p> <p>2.2. For particular aeronautical engineering situations, the relevant basic aeronautical techniques and associated technologies, software and hardware can be selected.</p>
<p>3. Apply the relevant basic aeronautical scientific principles and techniques appropriately</p>	<p>3.1. The basic aeronautical scientific principles are applied in a consistent and appropriate manner to obtain any required solution.</p> <p>3.2. Appropriate calculations and coherent units are used in the solution of engineering calculations.</p> <p>3.3. Significant figures are used in engineering calculations.</p> <p>3.4. The basic aeronautical techniques and associated technologies, software and hardware are applied in a consistent and appropriate manner to obtain required solutions.</p>
<p>4. Quote the results of the application of the basic aeronautical scientific principles and basic techniques correctly</p>	<p>4.1. For applications involving engineering calculations the solution is quoted in an appropriate style.</p> <p>4.2. For applications not involving engineering calculations the solution is quoted in an appropriate style.</p>

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:

- selecting appropriate basic aeronautical scientific principles to suit specific applications
- selecting appropriate basic aeronautical techniques and associated technologies, software and hardware to suit specific applications
- applying basic aeronautical scientific principles to particular engineering situations
- applying and manipulating appropriate formulas for applications involving engineering calculations
- applying appropriate calculations to engineering situations
- checking the validity of equations is using dimensional analysis
- applying basic aeronautical techniques and associated technologies, software and hardware in a manner appropriate to the application and identified scientific principles.
- referring solutions to the original aim of the application
- quoting solutions in appropriate units, using appropriate significant figures.
- quoting limitations of solutions, due to assumptions, scientific principles and techniques used
- presenting solutions referring to the original aim of the application.

Required knowledge

Look for evidence that confirms knowledge of:

- basic aeronautical scientific principles including:
 - Statics - complete tasks requiring analysis and application of:
 - forces and moments of forces
 - systems of concurrent and non-concurrent forces
 - dry sliding friction
 - Dynamics - complete tasks requiring analysis and application of:
 - Newton's Laws
 - Kinematics and kinetics of uniformly accelerated linear motion
 - Kinematics and kinetics of uniformly accelerated rotation
 - Curvilinear motion and centrifugal force
 - Work, energy, power and torque
 - Mechanical advantage and efficiency

REQUIRED SKILLS AND KNOWLEDGE

- Strength of materials - using common aircraft structural materials complete tasks requiring analysis and application of:
 - Axial tension and compression
 - Direct shear
 - Bolted, riveted, bonded and welded connections
 - shear in beams
 - bending stresses and bending deflections (by standard formulas only)
 - Torsion

- Aerodynamics - complete tasks requiring analysis and application of:
 - Bernoulli's Theorem
 - The atmosphere
 - Aerodynamic forces (lift, drag, weight, thrust)
 - Stability and control (to a level not requiring the application of calculus)
 - Airscrews and propulsion (to a level not requiring the application of calculus)
 - Aircraft performance (to a level not requiring the application of calculus)

- Fluid mechanics - complete tasks requiring analysis and application of:
 - Properties of fluids including mineral and synthetic hydraulic fluids
 - Fluid statics, Archimedes' Principle, Pascal's Principle
 - Fluid flow - continuity and energy conservation
 - Fluid power - pumps

- Thermodynamics - complete tasks requiring analysis and application of:
 - Heat transfer principles (conduction, convection, radiation)
 - Perfect gas laws
 - Kinetic theory of gases
 - Laws of thermodynamics

- Control concepts - complete tasks requiring analysis and application of Closed and Open Loop Control

- Electricity and Electronics - complete tasks requiring analysis and application of:
 - Basic electrical concepts
 - Ohm's Law

REQUIRED SKILLS AND KNOWLEDGE

- Kirchhoff's Current and Voltage Laws
- Basic DC circuits
- Basic power supply, transformer, rectifier, filter, regulator
- PLC concepts - I/O, timing, counting, programming
- Electronic devices (discrete) - resistors, diodes, capacitors, inductors, transistors, rectifiers
- Microprocessor concepts

Evidence Guide

EVIDENCE GUIDE	
<p>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.</p>	
<p>Overview of assessment</p>	<p>A person who demonstrates competency in this unit must be able to apply basic scientific principles and techniques in aeronautical engineering situations. Competency in this unit cannot be claimed until all prerequisites have been satisfied.</p>
<p>Critical aspects for assessment and evidence required to demonstrate competency in this unit</p>	<p>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. 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.</p>
<p>Context of and specific resources for assessment</p>	<p>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. 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.</p>
<p>Method of assessment</p>	<p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying basic scientific principles and techniques in aeronautical engineering situations or other units requiring the exercise of the skills and knowledge</p>

EVIDENCE GUIDE	
	covered by this unit.
Guidance information for assessment	

Range Statement

RANGE STATEMENT	
<p>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.</p>	
<p><i>Sources of information</i></p>	<p>Reference texts, manufacturer's catalogues and industrial magazines, international aerospace organisation publications, websites, use of phone, email and fax information gathering.</p>
<p><i>Aeronautical engineering</i></p>	<p>The engineering discipline concerned with the conceptual development, research, design, manufacture, implementation, installation, commissioning and maintenance of aerospace mechanical, hydraulic, pneumatic, fuel and fire products, processes, systems or services for civil and military applications.</p>
<p><i>Basic aeronautical scientific techniques and principles</i></p>	<p>Candidates should apply appropriate basic techniques supported by their mathematical skills and introductory knowledge of scientific principles to design, manufacturing, commissioning and maintenance related tasks and projects relating to metal and composite structure, aerodynamic loads, stability, control and performance, mechanical systems and related components, hydraulic systems and related components, pneumatic systems and related components, air cycle air conditioning and pressurization systems and related components, power plant systems and components, and the application and interfacing of electrical and electronic system control.</p> <p>The applications may require the use of one or two basic aeronautical scientific principles together with a fundamental mathematical calculation leading to process, resources and system choices from a limited range of options.</p> <p>Basic techniques include basic hand and power tool operations, machining, fitting, welding, moulding, fabricating, wiring and programming techniques.</p>

Unit Sector(s)

Unit sector	
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Competency field

Competency field	Engineering science
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Co-requisite units

Co-requisite units		