



Australian Government

MEA705 Apply basic scientific principles and techniques in aeronautical engineering situations

Release: 2

MEA705 Apply basic scientific principles and techniques in aeronautical engineering situations

Modification History

Release 1 - New unit of competency

Application

This unit of competency requires application of basic aeronautical scientific principles and techniques as a member of a design and development team or similar in support of the design and development of aeronautical applications, or within the engineering department of an aircraft maintenance organisation.

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 to engineering tasks and quoting results appropriately.

This unit is used in workplaces that operate under the airworthiness regulatory systems of the Australian Defence Force (ADF) and the Civil Aviation Safety Authority (CASA).

Pre-requisite Unit

MEM23004A Apply technical mathematics

Competency Field

Aeronautical engineering

Unit Sector

Elements and Performance Criteria

Elements describe the essential outcomes. Performance criteria describe the performance needed to demonstrate achievement of the element.

- | | |
|--|--|
| 1. Research and identify the range of basic scientific principles and techniques relevant to aeronautical engineering | 1.1 Research and report on the basic scientific principles relating to aeronautical engineering from appropriate sources of information and examination of applications |
| | 1.2 Identify the basic aeronautical techniques and associated technologies, software and hardware |

			required to implement scientific principles relating to aeronautical engineering situations
2.	Select basic aeronautical scientific principles and techniques relevant to particular aeronautical engineering applications	2.1	Select the relevant basic aeronautical scientific techniques and principles for particular aeronautical engineering situations
		2.2	Select the relevant basic aeronautical techniques and associated technologies, software and hardware for particular aeronautical engineering situations
3.	Apply the relevant basic aeronautical scientific principles and techniques appropriately	3.1	Apply the basic aeronautical scientific principles in a consistent and appropriate manner to obtain any required solution
		3.2	Use appropriate calculations and coherent units in the solution of engineering calculations
		3.3	Use significant figures in engineering calculations
		3.4	Apply the basic aeronautical techniques and associated technologies, software and hardware in a consistent and appropriate manner to obtain required solutions
4.	Quote the results of the application of the basic aeronautical scientific principles and basic techniques correctly	4.1	Quote the solution for applications involving engineering calculations in an appropriate style
		4.2	Quote the solution for applications not involving engineering calculations in an appropriate style

Foundation Skills

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.

Sources of information include:

- Reference texts
- Manufacturer catalogues and industry magazines
- International aerospace organisation publications
- Websites

Aeronautical engineering refers to:

- Use of phone, email and fax information gathering
- 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

Relevant basic aeronautical scientific techniques and principles involves:

- The application of appropriate basic techniques (see below) supported by 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 pressurisation systems and related components
 - power plant systems and components
 - the application and interfacing of electrical and electronic system control
- 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
- Basic techniques include:
 - basic hand and power tool operations
 - machining
 - fitting
 - welding
 - moulding
 - fabricating
 - wiring
 - programming techniques

Unit Mapping Information

Release 1 – supersedes and is equivalent to MEA349B Apply basic scientific principles and techniques in aeronautical engineering situations

Links

Companion Volume implementation guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=ce216c9c-04d5-4b3b-9bcf-4e81d0950371>

Assessment Requirements for MEA705 Apply basic scientific principles and techniques in aeronautical engineering situations

Modification History

Release 1 - New unit of competency

Performance Evidence

Evidence required to demonstrate competency in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria under the specified conditions of assessment, and must include:

- 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 manipulate appropriate formulas for applications involving engineering calculations
- applying appropriate calculations to engineering situations
- checking the validity of equations in 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.

Knowledge Evidence

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

- basic aeronautical scientific principles, including:
 - statics, including analysis and application of:
 - forces and moments of forces
 - systems of concurrent and non-concurrent forces
 - dry sliding friction
 - dynamics, including 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
- strength of materials:
 - 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:
 - Bernoulli's Theorem
 - the atmosphere
 - aerodynamic forces (lift, drag, weight and 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:
 - properties of fluids, including mineral and synthetic hydraulic fluids
 - fluid statics, Archimedes' Principle and Pascal's Principle
 - fluid flow – continuity and energy conservation
 - fluid power – pumps
- thermodynamics:
 - heat transfer principles (conduction, convection and radiation)
 - perfect gas laws
 - kinetic theory of gases
 - laws of thermodynamics
- control concepts including closed and open loop control
- electricity and electronics:
 - basic electrical concepts
 - Ohm's Law
 - Kirchhoff's Current and Voltage Laws
 - basic DC circuits
 - basic power supply, transformer, rectifier, filter and regulator
 - PLC concepts – I/O, timing, counting, programming
 - electronic devices (discrete) – resistors, diodes, capacitors, inductors, transistors and rectifiers
 - microprocessor concepts
- light, sound and vibration:
 - wave behavior – standing vs travelling waves, transverse and longitudinal

- light – reflection, absorption, refraction, diffraction, spectrum, infrared, visible, ultraviolet, transmission medium and engineering applications
- sound – pitch, frequency, intensity (power), decibel scale, ‘noise dose’, spectrum, infrasound, audible, ultrasound, speed, natural frequency, resonance, transmission medium and engineering applications
- vibration – sources, balancing, shaft alignment, measurement, damping and engineering applications
- basic aeronautical techniques and related technologies, software and hardware associated with implementing scientific principles in aeronautical engineering solutions
- the applicability and limitations of basic aeronautical scientific principles
- the applicability and limitations of basic aeronautical techniques and associated technologies, software and hardware
- appropriateness of calculations
- fundamental and derived quantities
- common systems of units
- the procedure for converting between systems of units
- common prefixes used with units and their values
- the procedure for carrying out dimensional analysis
- the concept of significant figures
- the uncertainty of computations based on experimental data
- the procedures for determining the significance of figures in calculations
- the procedures for estimating errors in derived quantities.

Assessment Conditions

- 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 a simulated working environment must be used that reflects realistic workplace situations and conditions.
- 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.
- Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its 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 able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.
- Assessors must be satisfied that the candidate can competently and consistently:
 - identify and explain the application of basic scientific principles and engineering techniques to aeronautical engineering situations

- for given aeronautical engineering situations, identify and apply the relevant basic scientific principles and techniques
- perform necessary calculations using appropriate applications and evaluate solutions
- document appropriately the outcome of application of basic scientific principles and techniques to given aeronautical engineering situations.
- Assessment may be in conjunction with assessment of other units of competency where required.
- Assessors must satisfy the requirements of the National Vocational Education and Training Regulator (Australian Skills Quality Authority, or its successors).

Links

Companion Volume implementation guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=ce216c9c-04d5-4b3b-9bcf-4e81d0950371>