



Australian Government

MEAENG0002 Apply basic scientific principles and techniques in avionic engineering situations

Release: 1

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Modification History

Release 1. Application changed. Elements and Performance Criteria changed. Foundation Skills made explicit. Range of Conditions removed, and relevant information moved to Assessment Requirements. Assessment Requirements clarified. Supersedes and is equivalent to MEA706 Apply basic scientific principles and techniques in avionic engineering situations.

Application

This unit describes the skills and knowledge required to identify and apply basic avionic scientific principles and techniques to avionic engineering situations. This includes identifying the range of basic avionic scientific principles and techniques, selecting avionic principles and techniques for particular applications, applying avionic principles and techniques to engineering tasks, and quoting results appropriately.

This unit applies to members of a design and development team or similar who support the design and development of avionic applications, or to those working within a maintenance organisation engineering department.

The unit is used in workplaces that operate under the airworthiness regulatory systems of the Civil Aviation Safety Authority (CASA) and the Defence Aviation Safety Authority (DASA).

Any other relevant legislation, industry standards and codes of practice within Australia must be applied.

Pre-requisite Unit

MEM23004A Apply technical mathematics

Competency Field

Avionic engineering

Elements and Performance Criteria

Elements	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	1.1 Research appropriate sources of information relating to avionic engineering 1.2 Examine applications and report on the basic scientific principles relating to avionic engineering

Elements	Performance Criteria
Elements describe the essential outcomes.	Performance criteria describe the performance needed to demonstrate achievement of the element.
	1.3 Identify basic avionic techniques and associated technologies, software and hardware required to implement scientific principles relating to avionic engineering situations
2. Select avionic scientific principles and techniques	2.1 Select the relevant basic avionic scientific techniques and principles for particular avionic engineering situations 2.2 Select the associated technologies, software and hardware for particular avionic engineering situations
3. Apply the basic avionic scientific principles and techniques	3.1 Apply the basic avionic scientific principles in a consistent and appropriate manner to obtain 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 avionic 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 avionic scientific principles and basic techniques	4.1 Quote the solution for applications involving engineering calculations in accordance with organisation style requirements 4.2 Quote the solution for applications not involving engineering calculations in accordance with organisation style requirements

Foundation Skills

This section describes those language, literacy, numeracy and employment skills that are essential to performance but not explicit in the performance criteria.

- Numeracy skills to quote solutions and use engineering calculations.

Other foundation skills essential to performance are explicit in the performance criteria of this unit.

Unit Mapping Information

Release 1. Supersedes and is equivalent to MEA706 Apply basic scientific principles and techniques in avionic engineering situations.

Links

Companion Volume implementation guides are found in VETNet -

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

Assessment Requirements for MEAENG0002 Apply basic scientific principles and techniques in avionic engineering situations

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Performance Evidence

There must be evidence the candidate has completed the tasks outlined in the elements and performance criteria of this unit and demonstrated the ability to apply basic scientific principles and techniques in design, manufacturing, commissioning and maintenance-related tasks and projects on at least one of the following avionic systems and equipment:

- electrical systems and related wiring and components (power generation, distribution, control interfaces with hydraulic and pneumatic systems, and caution and warning systems)
- mechanical and electro-mechanical flight instruments and indication systems (quantity, pressure, temperature and position) and components
- electronic systems and components (communications, radio navigation, pulse, display, automatic flight control, flight management and engine management)
- automatic test stations, adapters and software
- apply and manipulate appropriate formulas for applications involving engineering calculations
- apply appropriate calculations to engineering situations
- check the validity of equations using dimensional analysis
- 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

There must be evidence the candidate has knowledge of:

- sources of information, including:
 - reference texts
 - manufacturer catalogues and industry magazines
 - international aerospace organisation publications
 - websites
 - use of phone, email and fax information gathering

- quotation style requirements
- basic techniques of avionic engineering, including:
 - basic hand and power tool operations
 - machining
 - fitting
 - soldering
 - welding
 - moulding
 - fabricating
 - wiring
 - programming techniques
- physics for electronics:
 - units and measurements
 - magnetic force
 - vectors
 - electric fields and potential
 - electric current and resistance
 - capacitance
 - work, power and energy
- analogue electronics:
 - negative feedback amplifiers
 - differential amplifiers
 - operational amplifiers
 - amplifier frequency response
 - thermal circuits/heat exchangers
 - active filters
 - fault-finding
- digital electronics:
 - characteristics of digital systems
 - number systems
 - Boolean algebra
 - logic circuits
 - logic families
 - construction and testing techniques
 - flip flop circuits
 - analogue to digital conversion
 - digital to analogue conversion
 - timing and control
 - combinational logic circuits
- circuit theory:

- Kirchhoff's Current and Voltage Laws
- Thevenin's Network Theorem
- Norton's Network Theorem
- Superposition Network Theorem
- inductance, capacitance and resistance (LCR) series circuit analysis
- LCR parallel circuit analysis
- series and parallel resonance
- electrical systems:
 - direct current (DC) and alternating current (AC) circuit design principles
 - generators and motors
 - inverters
 - power supply, transformer, rectifier, filter and regulator
 - solenoids
 - circuit protection
 - wiring cables and looms
- 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)
- thermodynamics – heat transfer principles (conduction, convection and radiation)
- instruments:
 - airspeed measurement
 - altitude measurement
 - attitude indication
 - measurement of quantity, flow, temperature, pressure and position
- control concepts and data communications:
 - servo and synchronous systems and components
 - data communication definitions and terminology
- communications:
 - radio transmission and modulation
 - radio reception
 - microphones, amplifiers and speakers
 - transmission lines and antennas
- pulse:
 - antennas
 - waveguides
 - transmitters/receivers
 - displays
- light, sound and vibration:

- wave behaviour – standing versus travelling waves, transverse and longitudinal
- light – reflection, absorption, refraction, diffraction, spectrum, infrared, visible, ultraviolet (UV), 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
- calculations, including when to use
- fundamental and derived quantities
- the concept of significant figures
- the uncertainty of computations based on experimental data
- procedures for:
 - carrying out dimensional analysis
 - determining the significance of figures in calculations
 - estimating errors in derived quantities
 - researching and reporting.

Assessment Conditions

The following conditions of assessment represent the requirements of the regulators (DASA and CASA) and maintenance stakeholders and must be rigorously observed.

Skills must have been demonstrated under routine supervision in the workplace or in a simulated environment that reflects workplace conditions and contingencies encountered in avionic engineering situations. The following conditions must be met for this unit:

- use of suitable facilities, equipment and resources.

Evidence of tasks demonstrating competency must be recorded in a log of industrial experience and achievement. Assessors must satisfy the NVR/AQTF mandatory competency requirements for assessors.

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