Australian Government

Department of Education, Employment and Workplace Relations

MEA272A Apply basic scientific principles and techniques in avionic engineering situations

Release: 1

MEA272A Apply basic scientific principles and techniques in avionic engineering situations

Modification History

Not applicable.

Unit Descriptor

Unit descriptor	This unit covers applying basic scientific principles and techniques to appropriate avionic engineering situations.

Application of the Unit

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

Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Prerequisite units		

Employability Skills Information

Employability skills	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. 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.

Elements and Performance Criteria

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

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 avionic scientific principles to suit specific applications
- selecting appropriate basic avionic techniques and associated technologies, software and hardware to suit specific applications
- applying basic avionic 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 avionic 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:

- Physics for electronics - complete tasks requiring analysis and application of:
  - units and measurements
  - magnetic force
  - vectors
  - electric fields and potential
  - electric current and resistance
  - capacitance
  - work, power and energy
- Analogue electronics - complete tasks requiring analysis and application of:
  - negative feedback amplifiers
  - differential amplifiers
  - operational amplifiers
  - amplifier frequency response
  - thermal circuits/heat exchangers

REQUIRED SKILLS AND KNOWLEDGE

- active filters
- fault finding

- Digital electronics - complete tasks requiring analysis and application of:
  - 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 - complete tasks requiring analysis and application of:
  - 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 - complete tasks requiring analysis and application of:
  - DC and AC circuit design principles
  - generators and motors
  - inverters
  - power supply, transformer, rectifier, filter, regulator
  - solenoids
- 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)
- Thermodynamics - complete tasks requiring analysis and application of heat transfer principles (conduction, convection, radiation)
- Instruments - complete tasks requiring analysis and application of:
  - airspeed measurement
  - altitude measurement

REQUIRED SKILLS AND KNOWLEDGE

- attitude indication
- measurement of quantity, flow, temperature, pressure and position

- Control concepts and data communications - complete tasks requiring analysis and application of:
  - servo and synchronous systems and components
  - data communication definitions and terminology
- Communications - complete tasks requiring analysis and application of:
  - radio transmission and modulation
  - radio reception
  - microphones, amplifiers and speakers
  - transmission lines and antennas
- Pulse - complete tasks requiring analysis and application of:
  - antennas
  - waveguides
  - transmitters/receivers
  - displays
- Light, sound and vibration - complete tasks requiring analysis and application of:
  - Wave behaviour - standing vs traveling waves, transverse, longitudinal
  - Light - reflection, absorption, refraction, diffraction, spectrum, infrared, visible, ultraviolet, transmission medium, engineering applications
  - Sound - pitch, frequency, intensity (power), decibel scale, "noise dose", spectrum, infrasound, audible, ultrasound, speed, natural frequency, resonance, transmission medium, engineering applications
  - Vibration - sources, balancing, shaft alignment, measurement, damping, engineering applications.
- appropriateness of calculations
- fundamental and derived quantities
- 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

Evidence Guide

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 apply basic scientific principles and techniques in avionic engineering situations. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
Critical aspects for assessment and evidence required to demonstrate competency in this unit	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.
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, 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.
Method of assessment	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 avionic engineering situations or other units requiring the exercise of the skills and knowledge covered by this

EVIDENCE GUIDE	
	unit.
Guidance information for assessment	

Range Statement

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.	
Sources of information	Reference texts, manufacturer's catalogues and industrial magazines, international aerospace organisation publications, websites, use of phone, email and fax information gathering.
Avionic engineering	The engineering discipline concerned with the conceptual development, research, design, manufacture, implementation, installation, commissioning and maintenance of aerospace electrical, instrument, radio and electronic systems and components and related test equipment for civil and military applications
Basic avionic scientific techniques and principles	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: • 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, position) and components; • electronic systems and components (communications, radio navigation, pulse, display, automatic flight control, flight management, and engine management); and • automatic test stations, adapters and software. The applications may require the use of one or two basic avionic scientific principles together with a fundamental mathematical calculation leading to process, resources and system choices from a

RANGE STATEMENT	
	limited range of options. Basic techniques include basic hand and power tool operations, machining, fitting, welding, moulding, fabricating, wiring and programming techniques.

Unit Sector(s)

Unit sector	

Competency field

Competency field	Engineering science

Co-requisite units

Co-requisite units		