



Australian Government

UEEEL0041 Develop engineering solution for synchronous machine and control problems

Release: 1

UEEEL0041 Develop engineering solution for synchronous machine and control problems

Modification History

Release 1. This is the first release of this unit of competency in the UEE Electrotechnology Training Package.

Application

This unit involves the skills and knowledge required to develop engineering solutions for synchronous machine and control problems.

It includes applying safe working practices; determining problems; obtaining synchronous machine operation, construction and application; gathering and analysing solutions; applying problem-solving techniques; and developing and documenting solutions.

No licensing, legislative or certification requirements apply to this unit at the time of publication.

Pre-requisite Unit

UEEEL0062 Provide engineering solutions to problems in complex polyphase power circuits

UEECD0036 Provide engineering solutions for problems in complex multiple path circuit

UEECD0039 Provide solutions to basic engineering computational problems

UEECD0007 Apply work health and safety regulations, codes and practices in the workplace and

UEECD0041 Solve electrotechnical engineering problems

or

UEECD0043 Solve problems in direct current circuits

UEEEL0019 Solve problems in direct current (d.c.) machines

UEEEL0021 Solve problems in electromagnetic devices

or

UEECD0044 Solve problems in multiple path circuits

UEECD0046 Solve problems in single path circuits

UEEEL0019 Solve problems in direct current (d.c.) machines

UEEEL0021 Solve problems in electromagnetic devices

or

UEEEEC0074 Troubleshoot resonance circuits in an electronic apparatus

and

UEECD0043 Solve problems in direct current circuits

or

UEECD0044 Solve problems in multiple path circuits

UEECD0046 Solve problems in single path circuits

or

UEEEEC0065 Solve problems in basic electronic circuits

Competency Field

Electrical

Unit Sector

Electrotechnology

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 Prepare to develop engineering solution for synchronous machine problems

1.1 Work health and safety (WHS)/occupational health and safety (OHS) processes and workplace procedures for a given work area are identified, obtained and applied

1.2 WHS/OHS risk control measures and workplace procedures in preparation for the work are followed

1.3 Scope of synchronous machine problem is determined from performance specifications and/or documentation and in consultation with relevant person/s

1.4 Activities are planned to meet scheduled timelines in consultation with others involved in the work

1.5 Effective strategies are formed to ensure solution development and implementation is carried out efficiently

2 Develop engineering

2.1 WHS/OHS risk control measures and workplace

solution	procedures for carrying out the work are followed
	2.2 Synchronous machine construction, operation, characteristics and applications are applied to developing solutions to synchronous machine problems
	2.3 Parameters, specifications and performance requirements for each machine problem are obtained in accordance with workplace procedures
	2.4 Approaches to resolving synchronous machine problems are analysed to provide most effective solutions in accordance with relevant industry standards and workplace procedures
	2.5 Unplanned events are dealt with safely and effectively in accordance with relevant industry standards and workplace procedures
	2.6 Quality of work is monitored in accordance with relevant industry standards and workplace procedures
3 Implement engineering solution and complete documentation	3.1 Solutions to machine problems are tested to determine their effectiveness and modified as required
	3.2 Adopted solutions are documented, including instruction for their implementation with risk control measures
	3.3 Relevant person/s required to implement solutions to synchronous machine problems is coordinated in accordance with relevant industry standards and workplace procedures
	3.4 Justification for solutions used to solve synchronous machine problems is documented in work/project records in accordance with relevant industry standards

Foundation Skills

Foundation skills essential to performance are explicit in the performance criteria of this unit of competency.

Range of Conditions

Range is restricted to essential operating conditions and any other variables essential to the work environment.

Non-essential conditions may be found in the UEE Electrotechnology Training Package Companion Volume Implementation Guide.

Developing engineering solutions must include the following:

- at least four synchronous machine problems

Unit Mapping Information

This unit replaces and is equivalent to UEENEEG143A Develop engineering solution for synchronous machine and control problems.

Links

Companion Volume implementation guides are found in VETNet - -
<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b8a8f136-5421-4ce1-92e0-2b50341431b6>

Assessment Requirements for UEEEL0041 Develop engineering solution for synchronous machine and control problems

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Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions on at least one occasion and include:

- understanding the extent of the machine problem
- forming effective strategies for solution development and implementation
- obtaining machine parameters, specifications and performance requirements appropriate to each problem
- testing and applying solutions to machine problems
- documenting instruction for implementation of solutions that incorporate risk control measure to be followed
- documenting justification of solutions implemented in accordance with professional standards
- dealing with unplanned events
- analysing approaches to solutions
- applying relevant work health and safety (WHS)/occupational health and safety (OHS) requirements, including using risk control measures
- applying synchronous machine construction operation characteristics and applications to developing solutions
- determining the scope of synchronous machine problem
- monitoring quality of work
- planning activities to meet timelines.

Knowledge Evidence

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

- synchronous machine diagnostics and engineering solutions for synchronous machine problems, including:
 - alternating current (a.c.) generators – construction, types and cooling encompassing:
 - construction of stator and rotor windings

- rotor construction (cylindrical and salient pole)
- advantages of rotating field construction
- excitation methods
- cooling methods
- prime movers
- a.c. generators – operating principles and characteristics encompassing:
 - a.c. generator equivalent circuits (synchronous reactance and resistance components)
 - tests – open circuit, short circuit and stator impedance
 - voltage regulation, island generator's terminal voltage load power factor
 - determination of excitation voltage and load angle
- synchronising a.c. generators encompassing:
 - conditions for synchronising (infinite bus)
 - methods for synchronising (lamp methods and synchroscope)
 - alternator load sharing, parallel operation
- a.c. generators power, torque and efficiency encompassing:
 - power input, input torque and speed
 - power losses
 - output power, load power factor, rotor angle and pu power
 - efficiency
 - performance chart interpretation
- automatic voltage regulation (AVR) encompassing:
 - need for AVRs
 - features of AVRs
 - effects of rotor inductance
 - connections of AVRs
 - operation of AVRs
- a.c. generator operational stability encompassing:
 - power output, variance (VAR) effects, rotor angle and excitation
 - control of VAR (on-load tap-changers (OLTC) transformers)
 - voltage dependant nature of stability
 - critical clearance angle of a.c. generator
 - stability limits
- a.c. generator protection encompassing:
 - restricted, unrestricted primary, back up and duplicated protection
 - overcurrent, short circuit, differential, reverse power, load unbalance, rotor overload, loss-of-field, rotor earth fault, station earth-fault and under-frequency protection
 - external fault protection
- induction generator encompassing:
 - types operating principles and characteristics
 - excitation methods

- losses and efficiency
- synchronising and paralleling
- three phase synchronous motors encompassing:
 - construction – rotor, stator and windings
 - excitation methods
 - operating principles (equivalent circuits and synchronous impedance)
 - hunting and stability limits
 - power factor correction
 - paralleling and synchronisation techniques
 - starting methods
 - braking methods
- problem-solving techniques
- relevant machine parameters, specifications and performance requirements
- relevant manufacturer specifications and operating instructions/manuals
- relevant job safety assessments or risk mitigation processes
- relevant WHS/OHS legislated requirements
- relevant workplace documentation
- relevant workplace quality, instructions, policies and procedures.

Assessment Conditions

Assessors must hold credentials specified within the Standards for Registered Training Organisations current at the time of assessment.

Assessment must satisfy the Principles of Assessment and Rules of Evidence and all regulatory requirements included within the Standards for Registered Training Organisations current at the time of assessment.

Assessment must occur in suitable workplace operational situations where it is appropriate to do so; where this is not appropriate, assessment must occur in simulated suitable workplace operational situations that replicate workplace conditions.

Assessment processes and techniques must be appropriate to the language, literacy and numeracy requirements of the work being performed and the needs of the candidate.

Resources for assessment must include access to:

- a range of relevant exercises, case studies and/or simulations
- relevant and appropriate materials, tools, facilities and equipment currently used in industry
- resources that reflect current industry practices in relation to developing engineering solution for synchronous machine problems
- applicable documentation, including workplace procedures, equipment specifications, regulations, codes of practice and operation manuals.

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