

Title:	Electrical Machines APPROVED
Long Title:	Electrical Machines
Module Code:	ELEC6016
Credits:	5
NFQ Level:	Fundamental
Field of Study:	Electrical Engineering
Valid From:	Semester 1 - 2014/15 (September 2014)
Module Delivered in	3 programme(s)
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Module Description:	This module develops the underlying energy conversion theory between electrical and mechanical systems by introducing electromechanical energy conversion principles and three-phase systems, transformers, DC, induction, and synchronous machines and the power systems employing these devices.
Learning Outcomes	
<i>On successful completion of this module the learner will be able to:</i>	
LO1	appraise electrical supply equipment and be able to make selections from theoretical considerations.
LO2	analyse and describe aspects of the construction, principle of operation, applications, methods of speed control, and methods of direction reversal of d.c. machines
LO3	analyse and describe aspects of the construction, principle of operation, applications, methods of speed control, and methods of direction reversal of a.c. machines
LO4	describe the construction, application and operation of single phase and three phase transformers
Pre-requisite learning	
Module Recommendations	
<i>This is prior learning (or a practical skill) that is strongly recommended before enrolment in this module. You may enrol in this module if you have not acquired the recommended learning but you will have considerable difficulty in passing (i.e. achieving the learning outcomes of) the module. While the prior learning is expressed as named CIT module(s) it also allows for learning (in another module or modules) which is equivalent to the learning specified in the named module(s).</i>	
No recommendations listed	
Incompatible Modules	
<i>These are modules which have learning outcomes that are too similar to the learning outcomes of this module. You may not earn additional credit for the same learning and therefore you may not enrol in this module if you have successfully completed any modules in the incompatible list.</i>	
No incompatible modules listed	
Co-requisite Modules	
No Co-requisite modules listed	
Requirements	
<i>This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed. You may not enrol on this module if you have not acquired the learning specified in this section.</i>	
No requirements listed	
Co-requisites	
No Co Requisites listed	

Module Content & Assessment

Indicative Content

Transformers

Transformer principles, ideal transformer calculations. Magnetising current, iron and copper losses, equivalent circuit. Use of per unit or per cent impedance. Regulation and efficiency. Construction of power transformer. Three phase transformers. Use of transformer for impedance matching at high frequencies. Instrument transformers

AC Generators

Construction and use of salient pole and cylindrical rotor types. Principle of operation, relationship between speed, number of poles and frequency. Description of voltage regulator and governor action. Use of synchronous motor to control reactive consumption.

Three phase induction motor

Principle of operation, rotating field, produced by stator windings, resulting torque on rotor, concept of slip. Torque / slip curves. Construction of stator and squirrel cage rotor. Effect of rotor resistance and reactance on torque. Description and use of wound rotor induction motor. Power factor, efficiency, starting torque and current. Direct-on, star-delta and rotor resistance starters. Speed control; inverters.

Single Phase Motors

Construction and principle of operation of different types of single phase induction motors. Split phase, Capacitor start, Universal motor. Typical ratings and application of single phase motors.

DC Machines

Commutating devices, interpoles, armature reaction. Equation for generated emf. Comparison of lap and wave windings. Equation of motor torque and speed. Characteristics of series, shunt and compound connections and applications. Use for speed control. Thyristor control. Inverter driven DC machines and braking.

Assessment Breakdown	%
Course Work	40.00%
End of Module Formal Examination	60.00%

Course Work

Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date
Performance Evaluation	Weekly assessment through laboratory-based experiments.	1,2,3,4	30.0	Every Week
Multiple Choice Questions	Assessment of lecture material covered in weeks 1-6.	1,3,4	10.0	Week 7

End of Module Formal Examination

Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date
Formal Exam	End-of-Semester Final Examination	1,2,3,4	60.0	End-of-Semester

Reassessment Requirement

Repeat examination

Reassessment of this module will consist of a repeat examination. It is possible that there will also be a requirement to be reassessed in a coursework element.

The institute reserves the right to alter the nature and timings of assessment

Module Workload

Workload: Full Time

<i>Workload Type</i>	<i>Workload Description</i>	<i>Hours</i>	<i>Frequency</i>	<i>Average Weekly Learner Workload</i>
Lecture	Lecture on electrical machine theory.	3.0	Every Week	3.00
Lab	Laboratory demonstration with students utilising raw data to determine characteristics of machine under test	1.0	Every Week	1.00
Independent & Directed Learning (Non-contact)	Further study of class notes and recommended resources.	3.0	Every Week	3.00
Total Hours				7.00
Total Weekly Learner Workload				7.00
Total Weekly Contact Hours				4.00

This module has no Part Time workload.

Module Resources
<i>Recommended Book Resources</i>
<ul style="list-style-type: none"> • John Bird 2010, <i>Electrical Circuit Theory and Technology</i>, 4th Ed., Routledge [ISBN: 978-1856177702]
<i>Supplementary Book Resources</i>
<ul style="list-style-type: none"> • Austin Hughes (Author) & Bill Drury (Author) 2013, <i>Electric Motors and Drives: Fundamentals, Types and Applications</i>, 4th Ed., Newnes [ISBN: 978-0080983325] • Edward Hughes, Dr John Hiley et al 2012, <i>Electrical & Electronic Technology</i>, 11th Ed., Pearson [ISBN: 978-0273755104]
<i>This module does not have any article/paper resources</i>
<i>This module does not have any other resources</i>

Module Delivered in			
Programme Code	Programme	Semester	Delivery
CR_EEPSY_8	<u>Bachelor of Engineering (Honours) in Electrical Engineering</u>	4	Mandatory
CR_EELEC_7	<u>Bachelor of Engineering in Electrical Engineering</u>	4	Mandatory
CR_EELEC_6	<u>Higher Certificate in Engineering in Electrical Engineering</u>	4	Mandatory