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MODULE DESCRIPTOR

Module Title

Electrical Machines and Drives

Reference	EN4562	Version	1
Created	February 2022	SCQF Level	SCQF 10
Approved	June 2022	SCQF Points	15
Amended		ECTS Points	7.5

Aims of Module

To provide the student with the ability to analyse the steady-state operation and performance of AC and DC machines and drives.

Learning Outcomes for Module

On completion of this module, students are expected to be able to:

- 1 Analyse the steady-state characteristics of induction machines.
- 2 Apply the 2-axis analysis to analyse the performance of 3-phase synchronous machines.
- 3 Apply power electronic converters to DC drive systems.
- 4 Analyse the operation of AC drive systems as applied to 3-phase induction motors.
- 5 Demonstrate the design and analysis of the induction motor and dc drive characteristics in the laboratory setup.

Indicative Module Content

Induction machines: three-phase induction motor principles, derivation of equivalent circuit, torque-speed performance equations based on the equivalent circuit, determining equivalent circuit parameters, starting arrangements. Single-phase motors; analysis of the steady-state operation of single-phase induction motors, starting arrangements. Synchronous machines. Principles of operation, application, and analysis, motor and generator equivalent circuit and phasor diagrams, power & torque characteristics. AC Motor Drives: Induction motor speed control principles, principles of braking and regeneration, slip energy recovery, variable-voltage, variable-frequency supplies. DC motor drives; three-phase controlled rectifiers, application to speed control of dc motors, dc choppers, quadrant operation, braking, and reversing operations. Single and three-phase inverters, voltage and current sourced inverters, sinusoidal PWM control. Single and three-phase AC voltage controllers, thyristor-based static VAR compensators, harmonics.

Module Delivery

This is a lecture-based module supplemented by tutorials, laboratory work and student centred learning.

Indicative Student Workload

	Full Time	Part Time
Contact Hours	36	36
Non-Contact Hours	114	114
Placement/Work-Based Learning Experience [Notional] Hours	N/A	N/A
TOTAL	150	150
Actual Placement hours for professional, statutory or regulatory body		

ASSESSMENT PLAN

If a major/minor model is used and box is ticked, % weightings below are indicative only.

Component 1

Type:	Coursework	Weighting:	30%	Outcomes Assessed:	5
Description:	Laboratory experiments supplemented with quizzes and submitted research work.				

Component 2

Type:	Examination	Weighting:	70%	Outcomes Assessed:	1, 2, 3, 4
Description:	Closed book examination.				

MODULE PERFORMANCE DESCRIPTOR**Explanatory Text**

The module has 2 components, to gain an overall pass a minimum D grade must be achieved in each component. The component weighting is as follows: C1 is worth 30% and C2 is worth 70%.

		Coursework:						NS
		A	B	C	D	E	F	
Examination:	A	A	A	B	B	E	E	
	B	B	B	B	C	E	E	
	C	B	C	C	C	E	E	
	D	C	C	D	D	E	E	
	E	E	E	E	E	E	F	
	F	F	F	F	F	F	F	
NS		Non-submission of work by published deadline or non-attendance for examination						

Module Requirements

Prerequisites for Module	Mechatronics and Automation (EN3551) or equivalent.
Corequisites for module	None.
Precluded Modules	None.

INDICATIVE BIBLIOGRAPHY

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|---|---|
| 1 | FITZGERALD,A.E.,KINGSLEY,C. and UMANS,S.D., 2014. Electric Machinery. 7th ed. New York : McGraw-Hill. |
| 2 | WILDI, T., 2013. Electrical Machines, Drives and Power Systems. 6th ed. London: Prentice Hall. |
| 3 | GURU, B. S. and HIZIROGLU, H. R., 2001. Electrical Machinery and Transformers. 3rd ed. Oxford: Oxford University Press. |
| 4 | MOORTHY, V.R., 2010. Power Electronics - Devices, Circuits and Industrial Applications Power Electronics. Oxford University Press |
| 5 | MOHAN. N., UNDERLAND, T.M., ROBBINS, W.P., 2003, Power Electronics Converters, Applications, and Design, 3rd Edition, John Wiley & Sons, Inc. |
| 6 | BOSE, B. K., 2002. Modern power electronics and AC drives. Prentice Hall PTR |