MODULE DESCRIPTOR

Module Title

Electrical Machines and Drives

Reference	EN4562	Version	2
Created	November 2022	SCQF Level	SCQF 10
Approved	June 2022	SCQF Points	15
Amended	August 2023	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 drive systems.

Learning Outcomes for Module

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

1	Examine the steady-state characteristics of induction machines.
2	Execute the 2-axis method to analyse the performance of 3-phase synchronous machines.
3	Operate power electronic converters to AC and DC drive systems.
4	Argue the operation of AC drive systems as applied to 3-phase induction motors.
5	Critique the design and analysis of the induction motor and DC drive characteristics in the laboratory and/or simulation 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 operation modes, slip energy recovery, variable-voltage, variable-frequency supplies. DC motor drives; 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 source inverters, Output voltage control of single-phase inverters, quasi square-wave inverters, sinusoidal PWM control. Single and three-phase AC voltage controllers, thyristor-based static VAR compensators, harmonics, the effects of harmonics, and harmonic mitigation methods.

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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	40	40
Non-Contact Hours	110	110
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:	40%	Outcomes Assessed:	5
Description:	Laboratory experiments supplemented with quizzes and submitted research work.				

Component 2

Type:	Examination	Weighting:	60%	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 40% and C2 is worth 60%.

		Coursework:						
		A	**B**	**C**	**D**	**E**	**F**	**NS**
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	Electrical Power (EN2560) or equivalent
Corequisites for module	None.
Precluded Modules	None.

INDICATIVE BIBLIOGRAPHY

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	MOORTHI, 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