

Electric Machines

Module Information

2022.01, Approved

Summary Information

Module Code	5302CIT
Formal Module Title	Electric Machines
Owning School	Engineering
Career	Undergraduate
Credits	20
Academic level	FHEQ Level 5
Grading Schema	40

Teaching Responsibility

LJMU Schools involved in Delivery
LJMU Partner Taught

Partner Teaching Institution

Institution Name
Changshu Institute of Technology

Learning Methods

Learning Method Type	Hours
Lecture	40
Practical	8

Module Offering(s)

Display Name	Location	Start Month	Duration Number Duration Unit
JAN-PAR	PAR	January	12 Weeks

Aims and Outcomes

Aims	This module is designed to achieve the following program aims within the field of Electrical Engineering: To further develop circuit analysis skills relating to three-phase ac circuits. To introduce the three-phase power system and transmission lines. To enhance knowledge and understanding of the broad scientific and technological principles underpinning operation of rotating electrical machinery and transformers. To develop understanding of the steady-state operating principles of single-phase, three-phase transformers, DC and AC machines rotating machines. To rehearse practical skills in the use of mathematical methods for modelling and analysing problems, and the use of relevant test and measurement equipment by undertaking experimental laboratory work.
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After completing the module the student should be able to:

Learning Outcomes

Code	Number	Description
MLO1	1	Demonstrate the calculation method of magnetic circuit and the performance of the iron core coil of AC and DC magnetic circuit.
MLO2	2	Describe the basic structure of the transformer and a variety of typical motors (AC and DC motor).
MLO3	3	Know the analysis method, energy relationship and operating principle of the common motor and establish the basic equation correctly.
MLO4	4	Use the equivalent circuit of the motor to calculate the performance and main data of the motor.

Module Content

Outline Syllabus	1 Single-phase and three-phase AC circuit theory Single phase AC circuits: Phasors, real, apparent and reactive power, power factor. Balanced three-phase systems: phase sequence, types of connection, powers, star-delta and delta-star transformations. Three-phase power factor correction. 2 Fundamentals of Electromagnetism and transformers Fundamentals of electromagnetism: force and torque in magnetic field, induced electromotive force. Inductance and magnetic circuits: self-inductance, mutual and leakage inductance; magnetic circuits and reluctance of the magnetic path, B-H curve of magnetic material, cores with air-gap. Induced electromotive force: induction in stationary systems with time varying fields and in systems with movable parts in time dependent and time independent fields. Losses in ferromagnetic materials. Transformers: non-ideal single-phase transformer, equivalent circuit, tests to determine equivalent circuit parameters, losses and efficiency; three-phase transformers, winding connections. 3 Electromechanical energy conversion and steady-state analysis of DC machines Electromechanical energy conversion: motoring and generating, time-domain modelling, torque and average torque, types of machines, rotating field. Steady-state analysis of dc machines: types, circuits and equations, speed-torque curve. 4 Steady-state analysis of AC machines Steady-state analysis of induction machines: operating principle, equivalent circuit, phasor diagram, torque speed curve, losses and efficiency.
Module Overview	
Additional Information	The modules expected that students undertaking this modules have a solid understanding of basic circuit theory Reports are 2500 maximum word count. Examinations are 2 hour duration.

Assessments

Assignment Category	Assessment Name	Weight	Exam/Test Length (hours)	Module Learning Outcome Mapping
Exam	Exam	60	2	MLO1, MLO2, MLO3, MLO4
Technology	Programming	40	0	MLO3, MLO4

Module Contacts

Module Leader

Contact Name	Applies to all offerings	Offerings
Martin Jones	Yes	N/A

Partner Module Team

Contact Name	Applies to all offerings	Offerings
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