Electric Machines

Module Information

2022.01, Approved

Summary Information

Module Code	5511USST
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
University of Shanghai For Science and Technology

Learning Methods

Learning Method Type	Hours
Lecture	33
Practical	6
Tutorial	22

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 intended to achieve the following programme aims within the field of Electrical EngineeringTo 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.

After completing the module the student should be able to:

Learning Outcomes

Code	Number	Description
MLO1	1	Analyse balanced three-phase circuits and power factor correction.
MLO2	2	Assess and apply the laws of electromagnetism to engineering problems.
MLO3	3	Appraise the principles of electromechanical energy conversion.
MLO4	4	Apply standard tests on electrical machinery and analyse the results.
MLO5	5	Discuss, analyse and evaluate steady-state operating characteristics of transformers, dc, induction and synchronous machines

Module Content

Outline Syllabus	1 Single-phase and three-phase AC circuit theorySingle 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 transformersFundamentals 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 machinesElectromechanical 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 machinesSteady-state analysis of induction machines: operating principle, equivalent circuit, phasor diagram, torque speed curve, losses and efficiency.
Module Overview	
Additional Information	It is expected that students undertaking this modules have a solid understanding of basic circuit theory

Assessments

Assignment Category	Assessment Name	Weight	Exam/Test Length (hours)	Module Learning Outcome Mapping

Exam	Exam	70	2	MLO1, MLO2, MLO3, MLO5
Report	Practical lab report	30	0	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