Liverpool John Moores University

Title:	Electric Machinery and Transformers
Status:	Definitive
Code:	**5002ENGFRI** (117010)
Version Start Date:	01-08-2016
Owning School/Faculty:	Electronics and Electrical Engineering
Teaching School/Faculty:	Electronics and Electrical Engineering

Team	Leader
Martin Jones	Y
Russell English	

Academic Level:	FHEQ5	**Credit Value:**	20	**Total Delivered Hours:**	48
Total Learning Hours:	200	**Private Study:**	152		

Delivery Options
Course typically offered: Standard Year Long

Component	Contact Hours
Lecture	46

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Exam	Exam		60	2
Test	Test		40	

Aims

This module is intended to achieve the following programme aims within the field of Electrical Engineering:

To introduce three-phase circuits and to further develop circuit analysis skills relating to ac circuits.
To enhance knowledge and understanding of the broad scientific and technological principles underpinning operation of rotating electrical machinery and transformers.

To introduce power electronic converters for variable speed drives.
To rehearse practical skills in the use of mathematical methods for modelling and analysing problems.

Learning Outcomes

After completing the module the student should be able to:

1	Analyse balanced three-phase circuits and single phase series parallel ac circuits
2	State and apply to problems the laws of electromagnetism
3	Define the principles of electromechanical energy conversion
4	Present, analyse and evaluate steady-state operating characteristics of transformers.
5	Present, analyse and evaluate steady-state operating characteristics of dc, induction and synchronous machines.
6	Discuss the operating principles of basic power electronic converters

Learning Outcomes of Assessments

The assessment item list is assessed via the learning outcomes listed:

Exam	4	5	6
Tutorial based quizzes	1	2	3

Outline Syllabus

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.
Fundamentals of electromagnetics: 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 a 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, voltage drop, losses and efficiency; three-phase transformers, winding connections.
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.
Steady-state analysis of induction machines: operating principle, equivalent circuit, phasor diagram, torque speed curve, losses and efficiency.
Steady-state analysis of synchronous motors/generators: operating principles, active and reactive power, phasor diagrams, equivalent circuits, power and torque versus load angle curves.
Introduction to power electronics: power electronic components, and basic power

electronic topologies.
Complex waveforms: introduction to Fourier series, determining the average power and rms of complex wave-forms.

Learning Activities

Lectures with integrated tutorials. Private study supported by tutorials.

Notes

This module introduces basics of electromagnetics, transformers, principles of electromechanical energy conversion and principles of operation of the most common types of rotating electrical machinery (dc, induction and synchronous).