Liverpool John Moores University

Title:	Electric Machines
Status:	Definitive
Code:	**5302SBC** (124872)
Version Start Date:	01-08-2021
Owning School/Faculty:	Engineering
Teaching School/Faculty:	The Sino-British College

Team	Leader
Martin Jones	Y

Academic Level:	FHEQ5	**Credit Value:**	20	**Total Delivered Hours:**	63
Total Learning Hours:	200	**Private Study:**	137		

Delivery Options
Course typically offered: Semester 2

Component	Contact Hours
Lecture	33
Practical	6
Tutorial	22

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Exam	Exam	Examination	70	2
Report	Report	Practical lab report	30	

Aims

This module is intended to achieve the following programme 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.

Learning Outcomes

After completing the module the student should be able to:

1	Analyse balanced three-phase circuits and power factor correction.
2	Identify and apply to problems the laws of electromagnetism.
3	Outline the principles of electromechanical energy conversion.
4	Use standard tests on electrical machinery and analyse the results.
5	Discuss, analyse and evaluate steady-state operating characteristics of transformers, dc, induction and synchronous machines

Learning Outcomes of Assessments

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

Exam	1	2	3	5
Practical lab report	4			

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.

Learning Activities

A series of lectures tutorials and practical lab sessions

Notes

It is expected that students undertaking this modules have a solid understanding of basic circuit theory