Liverpool John Moores University

Title:	Electric Machines
Status:	Definitive
Code:	**5302CIT** (125304)
Version Start Date:	01-08-2021
Owning School/Faculty:	Engineering
Teaching School/Faculty:	Changshu Institute of Technology

Team	Leader
Martin Jones	Y

Academic Level:	FHEQ5	**Credit Value:**	20	**Total Delivered Hours:**	50
Total Learning Hours:	200	**Private Study:**	150		

Delivery Options
Course typically offered: Semester 2

Component	Contact Hours
Lecture	40
Practical	8

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Exam	Exam	Examination	60	2
Report	Prog	Programming	30	
Essay	Coursework	Coursework	10	

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.

Learning Outcomes

After completing the module the student should be able to:

1	Demonstrate the calculation method of magnetic circuit and the performance of the iron core coil of AC and DC magnetic circuit
2	Describe the basic structure of the transformer and a variety of typical motors (AC and DC motor).
3	Know the analysis method and operating principle of the common motor, establish the basic equation correctly and be familiar with the energy relation of the motor.
4	Use the equivalent circuit of the motor to calculate the performance and main data of the motor.
5	Discuss, analyse and evaluate steady-state operating characteristics of transformers, dc, induction and synchronous machines.
6	Analyse balanced three-phase circuits and power factor correction.

Learning Outcomes of Assessments

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

Exam	1	2	3	4	5	6
Programming	4					
Coursework	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, stardelta 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 with some practical lab sessions.

Notes

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