

Liverpool John Moores University

Title: ELECTRICAL MACHINES AND DRIVES
Status: Definitive
Code: **5509ICBT**EL (127022)
Version Start Date: 01-08-2021

Owning School/Faculty: Engineering
Teaching School/Faculty: ICBT, Colombo

Team	Leader
Alison Cotgrave	Y

Academic Level: FHEQ5
Credit Value: 15
Total Delivered Hours: 62
Total Learning Hours: 150
Private Study: 88

Delivery Options

Course typically offered: S2 and Non Std S2 (S2 for Jan)

Component	Contact Hours
Lecture	35
Practical	10
Tutorial	15

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Exam	AS1	Examination	70	2
Practice	AS2	Practical/Workshop	30	

Aims

This module introduces the student to basics of Electrical Machines and appropriate control techniques. In particular, student is introduced to steady state and transient modelling of synchronous machines.

Learning Outcomes

After completing the module the student should be able to:

- 1 Evaluate the single-phase equivalent circuit representations and operation of the transformer, induction and synchronous machine and perform load calculation.
- 2 Explain the operation and characteristics of step-up and step-down DC-DC converters and phase-controlled AC-DC converters, including switching losses.
- 3 Calculate the operating conditions and sketch the waveforms for set-up and step-down DC-DC converters and phase controlled AC-DC converters and analyze the input current of single-phase rectifiers and determine the power factor, input displacement factor and distortion factor.
- 4 Recognize harmonic distortion produced by power electronic circuits

Learning Outcomes of Assessments

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

Examination	3	1	4
Practical/Workshop	2		

Outline Syllabus

Single-Phase Transformers. Principles of operation. Equivalent circuit. Load calculations. Open- and short-circuit. Tests. Regulation. Loss mechanisms. Uses of transformers. Construction (including high-frequency). Basic design principles and example.

Induction Machines. Production of a rotating field. Induced EMF in the rotor, the concept of slip. Equivalent circuit. Performance calculations. Loss mechanisms. Efficiency. Torque/speed characteristics. Load curves and speed of operation. Speed control by classical means. The need for variable frequency.

Synchronous Machines. Machine topologies and construction. Equivalent circuit. Performance. Phasor diagrams. Simple operating charts. Stability.

DC-DC Converters. Principle of switched-mode power conversion. Power MOSFET and IGBT devices. Step-up and step-down chopper circuits. Inductive switching waveforms and switching losses.

AC-DC Converters. Single-phase, half and full-wave rectifier circuits with inductive DC filter. Thyristor characteristics. Single-phase, phase-controlled operation - rectification and inversion modes - applications. Power transfer to non-linear loads, harmonics, power factor, input displacement factor and distortion factor.

Learning Activities

Students will be supported in their learning, to achieve the above learning outcomes, in the following ways:

By a series of lectures and tutorials and through participation within practical sessions for problem solving.

Notes

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