

Liverpool John Moores University

Title: ELECTRIC MACHINES
Status: Definitive
Code: **6026TECH** (105444)
Version Start Date: 01-08-2016

Owning School/Faculty: Electronics and Electrical Engineering
Teaching School/Faculty: Electronics and Electrical Engineering

Team	Leader
Emil Levi	Y

Academic Level: FHEQ6 **Credit Value:** 12 **Total Delivered Hours:** 38
Total Learning Hours: 120 **Private Study:** 82

Delivery Options

Course typically offered: Semester 2

Component	Contact Hours
Lecture	18
Practical	9
Tutorial	9

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Essay	AS1	Laboratory report (testing of DC and induction machines)	20	
Essay	AS2	Written assignment	20	
Exam	AS3	Examination: three out of four questions	60	2

Aims

To enhance knowledge and understanding of types of electric machinery, application areas, and selection criteria.

To develop practical skills in laboratory work through machinery testing and to extend transferable/key skills in the manipulation and sorting of data, graphical

presentation of data, and the use of general IT tools.

Learning Outcomes

After completing the module the student should be able to:

- 1 Select a correct motor type for a given application
- 2 Size the motor properly for the given duty cycle.
- 3 Perform standard tests on electric machines and interpret the obtained results using relevant performance characteristics.
- 4 Understand the implications of the 'repair or replace decision' and evaluate the potential economic benefits stemming from replacement of a standard efficiency motor with a premium efficiency motor.
- 5 Design basic motor protection

Learning Outcomes of Assessments

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

CW	3				
CW	4				
EXAM	1	2	4	5	

Outline Syllabus

Single-phase and three-phase AC systems, star and delta connection. Voltage, current and current angle in AC systems. Power factor of AC machines, active and reactive power, apparent power.

Types of electrical machinery (dc machines, single-phase ac machines, universal motor, three-phase induction machines, synchronous machines) and application areas for various machine types. Nameplates of electric machines.

Basics of electric machine design (stator and rotor, iron cores, windings, bearings, fans, etc.). Outlay of machine types and parts, assembling and disassembling of machines.

Load torque, types of load torques as related to major applications.

Operating characteristics of electric machines – torque, speed, current, voltage, efficiency. Capacitor excited single-phase induction machines, universal motor. DC machines (series and separately excited machines). Three-phase induction machines (squirrel-cage and slip-ring machines). Premium efficiency motors. Synchronous machines (permanent magnet and field excited).

Testing of electric machines (induction machines, DC machines).

Basics of variable speed drives – speed control methods, use of power electronic converters.

Standards: enclosures, dimensions and performance. Selection of electric machinery: protection, cooling, mounting, IP and IC codes. Frame sizes.

Performance criteria (speed, efficiency, starting, maximum and nominal torque, etc.). Temperature rise, insulation classes.

Duty cycle of an electric machine. Types of duty cycles, calculations of the correct motor size for a given duty cycle. Motor specification for ordering from a manufacturer. Motor selection guide.

Reasons for motor faults and types of faults. Repair or replace decision. Repair procedures. Replacement with a premium efficiency motor. Calculation of the energy saving in monetary terms.

Motor protection: overload protection, fault protection, unbalanced voltage protection, mechanical protection.

Learning Activities

Weekly lectures, combined with tutorials and practical laboratory sessions.

Notes

This module introduces the basics of electrical machinery as related to applications fields, selection criteria, operating characteristics, testing and protection.