Module Definition Form (MDF)

Module code: MOD007950	**Version:** 2 **Date Amended:** 09/Dec/2022

1. Module Title
Electric Machines, Sensors, and Actuators

2a. Module Leader
Kahtan Aziz

2b. School
School of Engineering and the Built Environment

2c. Faculty
Faculty of Science and Engineering

3a. Level
5

3b. Module Type
Standard (fine graded)

4a. Credits
15

4b. Study Hours
150

5. Restrictions

Type	Module Code	Module Name	Condition
Pre-requisites:	None		
Co-requisites:	None		
Exclusions:	None		
Courses to which this module is restricted:	None		

LEARNING, TEACHING AND ASSESSMENT INFORMATION

6a. Module Description

The module studies the principles, operation, and design of electrical drive systems for robotics and electrical applications. You will learn the basic structures of controlled electrical drives realised with DC and AC machines, and the investigation methods of the whole system and performances evaluation.

The module is designed to provide you with the skills for designing, developing, and maintaining electrical control systems, machinery, and equipment.

You will gain the fundamental knowledge and concept of sensors and actuator systems for robotics and mechatronics. The sensors are devices that measure variety of environmental parameters and though start programming, the actuators conduct specific tasks defined and prompted via the control system.

The skills gained in this module could be applied to a very wide range of sectors, including manufacturing, transport networks, power generation, transmission and distribution, building services, telecommunications as well as scientific and military research.

6b. Outline Content

- Introduction and status dynamics of electrical drives.
- Dynamics of electrical drives. Four quadrant representations, equivalent dynamics of loading of motors with different types of load. Thermal model of motor for heating and cooling
- DC motor drives, staring, braking, speed control. Controlled rectifier fed dc drives. Control of fractional hp motors.
- Chopper- controlled dc drives.
- Induction motor drives, starting braking, speed control.
- Cycle-converters Voltage Source inverters (VSI), Current Source Inverter (CSI).
- Current controlled VSI
- Synchronous motor drives, operation from fixed frequency supply, Synchronous motor variable speed drives.
- Starting large synchronous machines.
- Energy conservation in electrical drives. Energy efficient operation, improvement of power factor, improvement of quality of supply
- Electrical drive systems, components, and protection.
- Sensor types such as thermocouples, resistive, inductive, capacitive, and piezoelectric sensors, aw well as encoders and tachometers
- The actuators including fluidic, solenoids, and variety of electric motors

6c. Key Texts/Literature
The reading list to support this module is available at: https://readinglists.aru.ac.uk/

6d. Specialist Learning Resources
Electrical specialised equipment

7. Learning Outcomes (threshold standards)

No.	Type	On successful completion of this module the student will be expected to be able to:
1	Knowledge and Understanding	Demonstrate the basic structures of controlled electrical drives realized with electrical machines, sensors, and actuators.
2	Knowledge and Understanding	Select and apply appropriate computational and analytical techniques to model complex electric drive and dc motor problems, recognising the limitations of the techniques employed.
3	Intellectual, practical, affective and transferrable skills	Use practical laboratory and workshop skills to investigate complex electric drive, sensors, and actuator.
4	Intellectual, practical, affective and transferrable skills	Apply knowledge of mathematics and engineering principles to the solution of complex electric drive and dc motor problems.

8a. Module Occurrence to which this MDF Refers

Year	Occurrence	Period	Location	Mode of Delivery
2026/7	ZZF	Template For Face To Face Learning Delivery		Face to Face

8b. Learning Activities for the above Module Occurrence

Learning Activities	Hours	Learning Outcomes	Details of Duration, frequency and other comments
Lectures	24	1-4	Lecture 3 hrs for 8 weeks
Other teacher managed learning	12	3-4	Lab 3 hrs for 4 weeks
Student managed learning	114	1-4	Self-study
TOTAL:	150		

9. Assessment for the above Module Occurrence

The assessment for some modules includes a presentation (see below for details on how this particular module is assessed). We recognise that presenting, especially to a large group, can cause significant anxiety or distress for some students. If this may affect you, please contact your Module Leader or the Disability and Neurodiversity Service as early as possible. We will work with you to consider appropriate reasonable adjustments. Depending on your individual needs, these might include, for example, presenting to a smaller group or presenting only to a member of academic staff.

Assessment No.	Assessment Method	Learning Outcomes	Weighting (%)	Fine Grade or Pass/Fail	Qualifying Mark (%)
010	Coursework	1-3	60 (%)	Fine Grade	30 (%)
Report (1500 words), maps to Engineering Council Learning Outcomes C3 and C12					

Assessment No.	Assessment Method	Learning Outcomes	Weighting (%)	Fine Grade or Pass/Fail	Qualifying Mark (%)
011	Practical	1, 4	40 (%)	Fine Grade	30 (%)
In-Class Test (1500 words equivalent), maps to Engineering Council Learning Outcome C1					

In order to pass this module, students are required to achieve an overall mark of 40% (for modules at levels 3, 4, 5 and 6) or 50% (for modules at level 7*).

In addition, students are required to:
(a) achieve the qualifying mark for each element of fine graded assessment as specified above
(b) pass any pass/fail elements

[* the pass mark of 50% applies for all module occurrences from the academic year 2024/25 – see Section 3a of this MDF to check the level of the module and Section 8a of this MDF to check the academic year]