Module Definition Form (MDF)

Module code: MOD007954	**Version:** 3 **Date Amended:** 07/Feb/2023

1. Module Title
Automation and Control

2a. Module Leader
Alireza Sanaei

2b. School
School of Engineering and the Built Environment

2c. Faculty
Faculty of Science and Engineering

3a. Level
6

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

This module emphasises the underlying unity of apparently different physical systems (electrical, thermal, mechanical, fluid, chemical, biological etc.) by developing the concept of the system model and using the method of analogy. The module is focussed on simple 'lumped parameter' models with particular reference to instrumentation and control systems. The module starts by contrasting signal types and discusses methods of characterisation. The module concentrates on linear systems, developing the use of the Laplace transform, system block diagrams and the system transfer function as key tools. The difference between static and dynamic system models is explored and practical dynamic models are developed. The use of computer tools and packages is integral to the module. This module introduces the principles and practices of modern control systems. Although a basic grounding in maths is required, the approach of the course will be that certain mathematical skills are essential tools for the analysis and design of instrumentation and control systems, hence the module will emphasise the ability to use the tools effectively rather than treat them with mathematical rigour. The problems of instability in feedback and control systems are evaluated with a mixture of case studies and methods for determining the absolute and relative limits of stability in practical systems. The module will cover the specification of the complete system in terms of performance criteria. It will then consider a variety of design approaches both analytical and heuristic.

6b. Outline Content

• Introduction: terminology, the concept of control, closed-loop vs. open-loop systems;

• Dynamic models of mechanical, electrical and process systems;

• Block diagram representation

• Standard time-domain test inputs, impulse, step, ramp

• Laplace transforms transfer functions, poles and zeros, characteristic equation

• First and 2nd order systems; transient, rise/settling time, overshoot/damping ratio, time delay

• Stability: Routh-Hurwitz Criterion; System type, steady-state error, error constants

• Final Value Theorem; Root Locus Techniques; Nyquist stability criterion; Gain & phase margins; Bode diagrams, Time delays; PID controller and tuning methods; Lead/Lag compensation; Sensitivity, disturbance rejection

• Control system simulation using Matlab and Simulink

• Control Engineering applications and context will be explored at every opportunity

6c. Key Texts/Literature

The reading list to support this module is available at: https://readinglists.aru.ac.uk/

6d. Specialist Learning Resources

PLC programming software - Siemens PLC Programming Software 4.0, For Use With SIMATIC S7-200
Programmable Logic Controller – Siemens S2-700 PLC
Input and Output devices & wireless embedded microprocessor based module MX30

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	Understand the design process and applications of Automation & control systems.
2	Knowledge and Understanding	Apply knowledge of mathematics and engineering principles to the solution of a complex control system problem
3	Intellectual, practical, affective and transferrable skills	Select and evaluate technical literature and other sources of information to address complex control design problems.
4	Intellectual, practical, affective and transferrable skills	Use practical laboratory to investigate modelling and designing complex control systems.

8a. Module Occurrence to which this MDF Refers				
Year	**Occurrence**	**Period**	**Location**	**Mode of Delivery**
2025/6	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	12	1-3	Lecture 1 hr x 12 weeks
Other teacher managed learning	24	4	Lab 2 hrs x 12 weeks
Student managed learning	114	1-3	Self-directed learning
TOTAL:	150		

9. Assessment for the above Module Occurrence					
Assessment No.	**Assessment Method**	**Learning Outcomes**	**Weighting (%)**	**Fine Grade or Pass/Fail**	**Qualifying Mark (%)**
010	Coursework	3-4	50 (%)	Fine Grade	30 (%)
Coursework (1500 words) maps to Engineering Council Learning Outcomes C4, C12.					
Assessment No.	**Assessment Method**	**Learning Outcomes**	**Weighting (%)**	**Fine Grade or Pass/Fail**	**Qualifying Mark (%)**
011	Examination Chelmsford	1-2	50 (%)	Fine Grade	30 (%)
Exam (1.5 hours) 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]