Module Definition Form (MDF)

Module code: MOD009171	**Version:** 1 **Date Amended:** 07/Feb/2023

1. Module Title
Advanced Dynamics and Control Systems

2a. Module Leader
Shabnam Sadeghi Esfahlani

2b. School
School of Engineering and the Built Environment

2c. Faculty
Faculty of Science and Engineering

3a. Level
7

3b. Module Type
Standard (fine graded)

4a. Credits
30

4b. Study Hours
300

5. Restrictions

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

LEARNING, TEACHING AND ASSESSMENT INFORMATION

6a. Module Description

This module aims to provide you with advanced dynamics and control theory. In the dynamics, the module will cover the fundamentals of kinematics and its application in robotics design. In the control area, the module will include the design and modelling of the control system with the state space method. The module will explore the system's dynamic characteristics and examine its stability and observability. The module will analyse the stability and the linearity of systems and explore the feedback response.

6b. Outline Content

• Analytical descriptions of state-determined dynamic physical systems

• Analysis of dynamics systems for robotics applications

• Time and frequency domain representations

• System characteristics - controllability, observability, stability;

• Linear and nonlinear system responses

• Modification of system characteristics using feedback

• State observers, Kalman filters

• Modelling/performance trade-offs in control system design

• Basic optimization tools

6c. Key Texts/Literature

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

6d. Specialist Learning Resources

Specialist laboratory equipment MATLAB/SIMULINK

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	Apply comprehensive knowledge of mathematics and engineering principles to the solution of complex dynamics and control systems.
2	Knowledge and Understanding	Formulate and analyse complex dynamics and control problems to reach substantiated conclusions, using mathematics and engineering principles.
3	Intellectual, practical, affective and transferrable skills	Make engineering judgement when experiencing uncertainty and incomplete information in dynamics and control system design.
4	Intellectual, practical, affective and transferrable skills	Select and apply appropriate control theory to model complex dynamic systems, discussing the limitations of the techniques.

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	48	1-4	Lecture 6 hrs for 8 weeks
Other teacher managed learning	24	3-4	Lab 6 hrs for 4 weeks
Student managed learning	224	1-4	Self-study
TOTAL:	296		

9. Assessment for the above Module Occurrence					
Assessment No.	**Assessment Method**	**Learning Outcomes**	**Weighting (%)**	**Fine Grade or Pass/Fail**	**Qualifying Mark (%)**
010	Coursework	2-4	60 (%)	Fine Grade	40 (%)
Report (max 4000 words), maps to Engineering Council Learning Outcomes C2, C3					
Assessment No.	**Assessment Method**	**Learning Outcomes**	**Weighting (%)**	**Fine Grade or Pass/Fail**	**Qualifying Mark (%)**
011	Examination	1	40 (%)	Fine Grade	40 (%)
Exam (2 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]