

## Liverpool John Moores University

Title: Control System Design and Analysis  
Status: Definitive  
Code: **5305ELE** (121420)  
Version Start Date: 01-08-2021  
  
Owning School/Faculty: Engineering  
Teaching School/Faculty: Engineering

| Team       | Leader |
|------------|--------|
| Qian Zhang | Y      |
| Dingli Yu  |        |

**Academic Level:** FHEQ5      **Credit Value:** 20      **Total Delivered Hours:** 46  
**Total Learning Hours:** 200      **Private Study:** 154

### Delivery Options

Course typically offered: Semester 1

| Component | Contact Hours |
|-----------|---------------|
| Lecture   | 22            |
| Practical | 11            |
| Tutorial  | 11            |

**Grading Basis:** 40 %

### Assessment Details

| Category | Short Description | Description         | Weighting (%) | Exam Duration |
|----------|-------------------|---------------------|---------------|---------------|
| Exam     | Exam              | Exam                | 60            | 2             |
| Report   | Report            | PC Based Assignment | 40            |               |

### Aims

*To develop an understanding of components and the principles of control systems, basic design and analysis techniques, and practice some control applications to industrial systems.*

## Learning Outcomes

After completing the module the student should be able to:

- 1 Demonstrate an understanding of the basic concepts of dynamic system response and closed loop control.
- 2 Develop models for simple dynamic plant with appropriate software.
- 3 Demonstrate ability to design controllers and analyse system stability.
- 4 Simulate control systems with appropriate software and assess system performance.
- 5 Demonstrate understanding of system components and controller realisation.

## Learning Outcomes of Assessments

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

|        |   |   |   |   |
|--------|---|---|---|---|
| Exam   | 1 | 2 | 3 | 5 |
| Report | 2 | 4 |   |   |

## Outline Syllabus

*Introduction: control system structure including sensors, controllers, actuators and plants.*

*Matlab/Simulink*

*Modelling & Simulation: introduce transfer function models for different plants, how to use Matlab/Simulink to model a dynamic system, how to simulate a control system with Matlab/Simulink for system analysis and performance assessment.*

*Integration algorithms, State Space representation*

*Time response analysis: characteristics for first order and second order systems, response to step and ramp input.*

*Controller design: design specification in time domain, functions of P, I and D control, empirical controller parameter setting method.*

*Industrial control: implementation of PID controllers, proportional and derivative kicks, integral controller wind-up and anti-wind-up method.*

*Control system hardware design.*

*Block diagram analysis.*

*Stability: concept of absolute and relative stability, stability analysis.*

*Computer packages will be used to gain experience in applying and simulating techniques.*

## Learning Activities

By a series of lectures, tutorials and computer simulations.

## Notes

This level 5 module develops an understanding of the modelling, application, design

and analysis of control systems with Matlab/Simulink.