

## Liverpool John Moores University

Title: Mechatronics  
Status: Definitive  
Code: **5508USST** (126440)  
Version Start Date: 01-08-2021

Owning School/Faculty: Engineering  
Teaching School/Faculty: University of Shanghai For Science and Technology

Team	Leader
Frederic Bezombes	Y

**Academic Level:** FHEQ5      **Credit Value:** 20      **Total Delivered Hours:** 44  
**Total Learning Hours:** 200      **Private Study:** 156

### Delivery Options

Course typically offered: Semester 2

Component	Contact Hours
Practical	33
Tutorial	11

**Grading Basis:** 40 %

### Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Practice	AS1	Practical - lab based exercises	100	

### Aims

*To develop a practical understanding of how sensors and actuators may be used, along with embedded systems, to control and monitor mechanical engineering systems.*

### Learning Outcomes

After completing the module the student should be able to:

- 1 Propose appropriate sensors for an application and analyse their characteristics, and practical interfacing requirements
- 2 Propose appropriate actuators for an application and analyse their characteristics, and drive requirements
- 3 Design an appropriate control system structure for an engineering application and determine the characteristic dynamic response of a system.
- 4 Critically appraise a range of hardware interfaces and their methods of programming.

## Learning Outcomes of Assessments

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

Practical assessments in a lab      1      2      3      4

## Outline Syllabus

*The list below provides an overview of topics which may be covered in this module:*

### *Sensors*

- *Measured Physical Quantity*
  - o *Temperature*
  - o *Position, Displacement and Velocity*
  - o *Acceleration*
  - o *Pressure & Force*
  - o *Fluid Flow Rates*
- *Signal Type*
  - o *Analogue*
  - o *Digital*
- *Characteristics*
  - o *Range & Span*
  - o *Sensitivity*
  - o *Precision, Accuracy, Repeatability*

### *Actuators and Indicators*

- *Electro-mechanical Actuators*
  - o *Motors*
  - o *Solenoids*
- *Indicators and Displays*
  - o *LED Lights*
  - o *LED Displays*

### *Embedded Systems Hardware*

- *Micro-controllers*
- *Characteristics of I/O*
  - o *Analogue Voltage (e.g. Typical Ranges: 0-5v, +/-10v)*
  - o *Digital (e.g. Typical Voltages: 3.3v, 5v, 12v, 24v)*
- *Serial Interfaces*
  - o *i2c and UART*
- *Signal Conditioning & Filtering*
  - o *Amplifiers*
  - o *Filters*
  - o *Protection*

### *Programming Embedded Systems*

- *Common programming design patterns using While loops and conditional statements*
- *Reading from, and writing to hardware ports.*

### *Control*

- *Control Objectives*
  - o *Set-point*
  - o *Tracking*
  - o *Stabilisation*
- *Closed-loop Control*
- *Feed-forward control*
- *ON/OFF (Bang-Bang) Control*

### **Learning Activities**

Tutorial and Practical activities supported by on-line resources.

### **Notes**

This model incorporates elements of flipped delivery. The source of primary knowledge for this module will be via material made available through the VLE, while understanding will be developed through a tutorial and significant practical content.