Liverpool John Moores University

Title: Control and Instrumentation
Status: Definitive
Code: **5111MSE**   (120717)
Version Start Date: 01-08-2018

Owning School/Faculty: Maritime and Mechanical Engineering
Teaching School/Faculty: Maritime and Mechanical Engineering

Team	Leader
Barry Gomm	Y

Academic Level:	FHEQ5	**Credit Value:**	20	**Total Delivered Hours:**	50
Total Learning Hours:	200	**Private Study:**	150		

Delivery Options
Course typically offered: Standard Year Long

Component	Contact Hours
Lecture	32
Tutorial	16

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Exam	AS2	Examination	70	2
Test	AS1	Coursework - VLE Based Tests	30	

Aims

To enable students to develop an understanding of how sensors and actuators may be used in engineering systems to provide the facility to monitor their state (instrumentation) and to effect changes which regulate their behaviour (control).

Learning Outcomes

After completing the module the student should be able to:

1   Select appropriate sensors for an application and demonstrate an understanding of their characteristics, and practical interfacing requirements
2   Select appropriate actuators for an application and demonstrate an understanding of their characteristics, and drive requirements
3   Determine an appropriate control system structure for an engineering application and demonstrate an understanding of the characteristic dynamic response of a system under different types of control
4   Select appropriate control hardware for an application and demonstrate an understanding of hardware interfaces and methods of programming

Learning Outcomes of Assessments

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

Examination	1	2	3	4
VLE Tests	1	2	3	4

Outline Syllabus

The list below provides an indicative list 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*
- *Transducer Types*
    - o *Resistive*
    - o *Capacitive*
    - o *Inductive*
    - o *Piezo Electric*
- *Signal Type*
    - o *Analogue*
    - o *Digital*
- *Characteristics*
    - o *Range & Span*
    - o *Sensitivity*
    - o *Precision, Accuracy, Repeatability*

Actuators

- *Electro-mechanical*
  - o *Motors*
  - o *Solenoids*
- *Pneumatic & Hydraulic*
- *Mechanisms (for connecting loads to actuators)*
  - o *Screws*
  - o *Racks*
  - o *Gears*
  - o *Linkages*
- *Pumps*
- *Heating & Cooling*
  - o *Peltier & Thermo-electric devices*
  - o *Resistive Heaters*
- *Loading*
  - o *Mechanical loads on electro-mechanical, pneumatic and hydraulic actuators*
  - o *Thermal loads on heaters/coolers*
  - o *Fluid loads on pumps*

Control: Hardware & Software

- *Programmable Logic Controllers (PLC)*
- *Data Acquisition (DAQ)*
- *Microcontrollers*
- *Characteristics of I/O*
  - o *Analogue*
- ☐ *Voltage (e.g. Typical Ranges: 0-5v, +/-10v)*
- ☐ *Current (e.g. 4-20mA)*
  - o *Digital*
- ☐ *Typical Voltages (e.g. 3.3v, 5v, 12v, 24v)*
- ☐ *Transistor-Transistor Logic (TTL)*
- ☐ *Threshold Level*
- ☐ *Threshold Hysteresis*
- ☐ *Active High & Low*
- ☐ *Pull-up/down*
  - o *Counter/Encoder Interfaces*
- *Signal Conditioning & Filtering*
  - o *Amplifiers*
  - o *Filters*
  - o *Protection*

Control: Signals & Systems

- *Control Objectives*
  - o *Set-point*
  - o *Tracking*
  - o *Stabilisation*

- *Open-loop Control*
- *Closed-loop Control*
- *Feed-forward control*
- *Characteristics of 1st and 2nd order systems*
- *Actuator Power/Saturation*
- *ON/OFF (Bang-Bang) Control*
- *PID Control*
- *Logic & State-Machines*
- *Ladder Logic (for PLC)*

Learning Activities

Lectures and tutorials

Notes

This module is taught in common with the Electrical and Electronic Engineering programme at the same level.