MODULE SPECIFICATION

Module Code:	ENG5AH

Module Title:	Mechatronics Application & Manufacturing Systems

Level:	5	**Credit Value:**	20

Cost Centre(s):	GAME	JACS3 **code**: HECoS code:	H730&H710 100170

Faculty	FAST	**Module Leader:**	Dr. M. Soufian

Scheduled learning and teaching hours	30 hrs
Guided independent study	170 hrs
Placement	0 hrs
Module duration (total hours)	200 hrs

Programme(s) in which to be offered (not including exit awards)	Core	Option
BEng (Hons) Production Engineering	✓	☐
FdEng Industrial Engineering	☐	✓

Pre-requisites
None

Office use only

Initial approval: 11/09/19 Version no:1

With effect from: 11/09/19

Date and details of revision: Version no:3

30/01/20 admin update of derogation

5/8/20 Addition to FdEng as optional module

Module Aims
This module aims to develop knowledge of electro-mechanical interfacing and the use of microcontroller/microprocessors to control sensor/actuator systems. Students will be given the opportunity to apply their knowledge by completing practical design and implementation tasks. Integrated manufacturing systems will be discussed and students will learn how machining cells are integrated into factory wide operations.

Intended Learning Outcomes

Key skills for employability

KS1	Written, oral and media communication skills
KS2	Leadership, team working and networking skills
KS3	Opportunity, creativity and problem solving skills
KS4	Information technology skills and digital literacy
KS5	Information management skills
KS6	Research skills
KS7	Intercultural and sustainability skills
KS8	Career management skills
KS9	Learning to learn (managing personal and professional development, self-management)
KS10	Numeracy

	At the end of this module, students will be able to	Key Skills	
1	Apply principles of Business finance and accounting to justify the value of engineering technology investments and apply benefits management.	KS1	KS2
		KS3	KS9
2	Explain and analyse the stages of planning and implementing integrated manufacturing systems besides the basic principles of machine tool operation and fixture design for automated operations and be able to design simple fixtures and robot end effectors.	KS7	KS3
		KS6	
3	Apply the underlying concept in how to design functional electronic systems and analogue/digital circuits from component level, and how to wire, assemble and test electronic circuits and equipment in line with organisational standards.	KS1	KS4
		KS6	KS8
		KS7	
4	Recognise the different types of sensor used in automation and how control systems can be used to model production cells, mitigate errors in machining and integrate machines, and their importance in designing robust systems.	KS1	KS3
		KS6	KS7
5	Develop a machine vision solution to a practical problem of sensory-motor control system, configure hardware/software tools, and test, analyse and evaluate its behaviour.	KS1	KS3
		KS6	KS7

Transferable skills and other attributes

Communication skills
Decision making and Information handling
Evaluation and analysis skills
Networking
Research skills
Management and organisation
Reflective practice skills and problem solving

Derogations

A derogation from regulations has been approved for this module which means that whilst the pass mark is 40% overall, each element of assessment (where there is more than one assessment) requires a minimum mark of 30%.

Assessment:

Indicative Assessment Tasks:

Assessment One: A single case-study to cover outcomes 1, 2 and 3. An example would be an investigation into the specific integrated manufacturing systems within the students workplace, the value of engineering technology investments in it and role of data science in decision making.

Assessment Two: A practical investigation to cover outcomes 4 and 5.
The assessment is about solving a practical problem of sensory-motor control by using vision system and demonstrate a working system.
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Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)	Duration or Word count (or equivalent if appropriate)
1	1, 2, 3	Coursework	50	2500
2	4, 5,	Coursework	50	2500

Learning and Teaching Strategies:

The module will be presented to students through a specified series of detailed presentations combined with intermittent interactive sessions to enhance students' learning and assisted by notes given to the student at the start of each lecture. The learning experience will be further supported by tutorials and self-study work.

Case studies will be the backbone of the learning experience. Wherever possible real industrial problems will be used as an analysis subject.
Presentations and reports are designed to develop the involvement of the students in the module and develop their sense of inquisition.

Syllabus outline:

1. Business finance and accounting
The engineering technology investments and benefits management

2. Manufacturing systems engineering
Planning and implementing integrated manufacturing systems, principles of machine tool operation (including maintenance, repair and condition monitoring), principles of tool and fixture design for automated operations, robotics in automation, the different types of sensor used in automation, control strategies of machining processes (errors mitigation), machining cells integration, production machines management and planning.

3. Industry 4.0
Principles of Data Science, data-driven decision making and automation, the role of data science in industry 4.0 and manufacturing.

4. Mechatronics
Types and range of signals, A-D and D-A convertors, Signal conditioning, Microprocessor systems, Embedded systems, Design functional electronic systems and circuits, Assemble, wire and test electronic circuits and electrical equipment, in line with organisational standards, Artificial Intelligence, Concepts of software design methods, Electromechanical devices, Vision Systems (hardware and software), Analysis of existing mechatronic systems

Indicative Bibliography:

Essential reading

Groover, M.P. (2015), *Automation, Production Systems and Computer-Integrated Manufacturing*. Harlow: Pearson.

Other indicative reading

Karnop, D. (2012) *System Dynamics of Mechatronic Systems, John Wiley & Sons*

Alciatore, D. (2018), *Introduction to Mechatronics and Measurement Systems.* New York: McGraw-Hill.

Alasdair Gilchrist (2016) *Industry 4.0: The Industrial Internet of Things;* Apressa

Slack, N. and Johnston, R. (2019), *Operations Management*. 9th ed. Harlow: Pearson.

AppuuKuttan. (2007) *Introduction to Mechatronics,* Oxford Higher Education

Devdas Shetty, Kolk Richard; (2012); *Mechatronics System Design;* CL Engineering

Bolton, W. (2018), *Mechatronics: Electronic Control Systems in Mechanical Engineering*. 7th ed. Harlow: Pearson.

Miltenburg, J. (2005) *Manufacturing Strategy: How to Formulate and Implement a Winning Plan,* 2nd Edn., Productivity Press.