MODULE SPECIFICATION

Module Title:	**Robotics**	**Level**:	5	**Credit Value**:	20

Module code:	ENG53D	**Is this a new module?**	YES	**Code of module being replaced**:	ENG52H

Cost Centre:	GEAA	JACS3 **code**:	H730

Trimester(s) in which to be offered:	1 & 2	**With effect from:**	September 18

School:	Faculty of Arts, Science and Technology	**Module Leader:**	Andrew Sharp

Scheduled learning and teaching hours	60 hrs
Guided independent study	140 hrs
Placement	0 hrs
Module duration (total hours)	200 hrs

Programme(s) in which to be offered	Core	Option
BEng (Hons) Automation Engineering	✓	☐
BEng (Hons) Mechanical Manufacturing	✓	☐

Pre-requisites
None

Office use only
Initial approval February 17
APSC approval of modification Sept 18 Version 1
Have any derogations received Academic Board approval? Yes ✓ No ☐

Module Aims
To develop a fundamental understanding of the principles of operation of automated equipment with particular reference to industrial robots and their application in a variety of industries. Understand that robots are mechatronic machines that can perform tasks by acquiring its own inputs from sensors make decision through pre-programmed instructions.

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	Create machine designs to implement Robotic Kinematics and Dynamics	KS1	KS6
		KS3	KS10
		KS4	
2	Select appropriate sensors for a given automation application. Introduction to sensors, vision systems and end effector design.	KS2	KS9
		KS4	
		KS6	
3	Use Robot programming languages: Including use of methods of programming through having the opportunity to programme and deploy an industry standard robot.	KS1	KS6
		KS3	KS9
		KS4	KS10
4	Apply a systematic approach to analyse robotic problems and to design robotic systems, and develop the basic knowledge and skills to build and operate industrial robotic systems and to state the advantages and disadvantages of their deployment.	KS1	KS10
		KS2	
		KS3	
		KS6	

Derogations

A derogation from regulations has been approved for this programme 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:

Assessment is 50% examination 50% report. The examination will assess the student on robotic design, kinematics and dynamics. The report will analyse either the systems sensor, drive or end effectors, inclusive of the practical element which will be the design and implementation of software to control a robotic system.

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)	Duration (if exam)	Word count (or equivalent if appropriate)
1	1	Examination	50%	2 hrs	
2	2, 3 & 4	Report	50%		2000

Learning and Teaching Strategies:

The module will be presented to students through a specified series of lectures assisted by notes given to students. Demonstrations will also be arranged to show the operation of a robotic system. Develop software using industrial standard software to control an industrial robot. A practical assignment exercise will be devised to enhance the students' learning.

Syllabus outline:

- Introduction to robotics: types and applications and robotic design i.e. Degrees of freedom; actuators and power transmission and robot accuracy.
- Robotics in automation: classification of robots; fixed and flexible automation; safety issues and risk assessment.
- Robotic Kinematics and Dynamics: Positions, Orientations and frames, Mappings: Changing descriptions from frame to frame, Operators: Translations, Rotations and Transformations. Forward and inverse Kinematics of Six Degree of Freedom Robot Arm and Robot Arm dynamics.
- Sensors: Transducers, tactile and proximity sensors; cameras; force sensing and Kinetiq Teaching.
- Drives used in robotic arms i.e. Stepper, Brushed DC Servo and Brushless DC Servo.
- Machine control: feedback control; servomechanisms and embedded controllers.
- Construction of Manipulators, Manipulator Dynamic and Force Control, Electronic and Pneumatic manipulators
- Robot End Effectors: drive system for grippers-Mechanical adhesive, vacuum, magnetic grippers.
- Analysis of robotic design problems and development of problem statements. Systematic and integrated robotic system design.

Bibliography:
Essential reading
Glaser, A. (2008) Industrial Robotics: How to Implement the Right System for Your Plant, Industrial Press, Inc;
Other indicative reading
Deb, Sankha (2009) Robotics Technology and Flexible Automation, Tata4 McGraw Hill Craig, John (2013) Introduction to Robotics: Mechanics and Control, Pearson 3rd Edition