UNIVERSITY of BRADFORD

Module Descriptor

Module Details	
Module Title:	Sensors and Instrumentation
Module Code:	MAE6016-B
Academic Year:	2019-20
Credit Rating:	20
School:	Department of Mechanical and Energy Systems Engineering
Subject Area:	Mechanical and Automotive Engineering
FHEQ Level:	FHEQ Level 6
Pre-requisites:	
Co-requisites:	

Contact Hours	
Type	**Hours**
Lectures	36
Tutorials	12
Directed Study	152

Availability	
Occurrence	**Location / Period**
BDA	University of Bradford / Semester 2 (Feb - May)

Module Aims

To provide knowledge of a wide range of sensors and actuators for general use. To provide the analytical skills and knowledge to specify and design simple sensor and actuator applications. To provide a critical evaluation of how computers can be used to monitor and control real world processes, and the application of Engineering principles to the basic design of computer systems, instrumentation, data acquisition and control systems.

Outline Syllabus

Measurement systems: purpose; structure. Static characteristics: accuracy; repeatability; non-linearity; hysteresis Dynamic characteristics: transfer function; frequency response. Noise: sources and solutions. Example active and passive sensors: optical; temperature; pressure; flow;

strain; position; velocity; acceleration; sound; image; tactile; range. Actuators: linear; rotary. Signal conversion and processing: filters; deflection bridges; amplifiers; ADC; SAH; smart sensors. Application to closed loop control systems.Transducer to computer signal conditioning including; ADC`s, DAC`s, multiplexing, sample and hold devices, filters, amplifiers and conditioning electronics.
Arrangement of interface components for real time measurement, sampling rate and dynamic range issues, component selection and matching.
Simple applications of instrumentation and advanced techniques including time domain and frequency domain condition monitoring, non-destructive testing through computerised tomography, wireless sensor networks.
Introduction to real time computing (embedded systems) via computer hardware and software requirements leading to an understanding of the operation of simple computer systems, assemblers, linkers and loaders. Interfacing to the outside world via basic data acquisition and control systems and the processing of analogue and digital signals.
An introduction to field programmable gate arrays (FPGAs)
The use of the personal computer for real time work including plug-in data acquisition boards, serial data systems analysis.

Learning Outcomes	
1	1. demonstrate knowledge of the range of general purpose sensors and actuators and evaluate their relative merits sufficient to generate ideas in the resolution of well defined or abstract problems; 2. understand and critically evaluate computer hardware, interfacing techniques and instrumentation systems.
2	1. design effective real-time instrumentation systems; 2. analyze, specify and design simple sensor based measurement systems and sensor and actuator based control systems.
3	1. demonstrate enhancement of analytical skills, problem solving skills and technical presentation skills. 2. demonstrate skills in data management and interpretation, scientific method, and systematic problem solving.

Learning, Teaching and Assessment Strategy

Concepts, principles and theory are explored in formal lectures and seminars, practiced in tutorials and demonstrated in laboratory classes. The laboratory classes provide hands-on experience and develop practical skills. A group project assessment examines the wider learning outcomes expressed in the descriptor and student's ability to apply the principles and knowledge learnt to a practical engineering task, and the formal examination assesses the knowledge base and its use.

Mode of Assessment

Type	Method	Description	Length	Weighting
Summative	Examination - closed book	Examination - closed book	2 hours	70%

Referral	Examination - closed book	Supplementary: Examination - closed book	2 hours	100%
Summative	Coursework	Group project related to the design of a real-time monitoring and/or control system	0 hours	30%

Reading List
To access the reading list for this module, please visit https://bradford.rl.talis.com/index.html.

Please note:

This module descriptor has been published in advance of the academic year to which it applies. Every effort has been made to ensure that the information is accurate at the time of publication, but minor changes may occur given the interval between publishing and commencement of teaching. Upon commencement of the module, students will receive a handbook with further detail about the module and any changes will be discussed and/or communicated at this point.