Prifysgol Wrecsam
Wrexham University

Module specification

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Module Code	ENG5AP
Module Title	Industrial Electronics and Applications
Level	5
Credit value	20
Faculty	FACE
HECoS Code	100165
Cost Code	GAME
Pre-requisite module	None

Programmes in which module to be offered

Programme title	Core/Optional/Standalone
BEng (Hons) Mechatronics Engineering	Core

Breakdown of module hours

Learning and teaching hours	60 hrs
Placement tutor support hours	0 hrs
Supervised learning hours e.g. practical classes, workshops	0 hrs
Project supervision hours	0 hrs
Active learning and teaching hours total	**0** hrs
Placement hours	0 hrs
Guided independent study hours	140 hrs
Module duration (Total hours)	200 hrs

Module aims

1. To develop knowledge and awareness of microprocessor capabilities both as the central processing element in a computer system and as an embedded element in an electronic system.
2. To develop knowledge and skills of the programming languages and the software used for programming microcontrollers.
3. To develop critical skills of interfacing microcontrollers, as part of an embedded system, to sensors and actuators for engineering applications.

Module Learning Outcomes

At the end of this module, students will be able to:

1	To develop critical understanding of microprocessor capabilities both as the central processing element in a computer system and as an embedded element in an electronic system.
2	To apply a systematic approach to design industrial electronics systems to address the application needs, to develop the in-depth knowledge and skills to build, debug, test, evaluate and electronics systems and to design appropriate hardware interfacing.
3	To develop, test and evaluate computer language programs for practical engineering applications.

Assessment

Indicative Assessment Tasks:
This section outlines the type of assessment task the student will be expected to complete as part of the module. More details will be made available in the relevant academic year module handbook.

Assessment is by means of producing a portfolio of evidence gathered throughout the duration of the course demonstrating a knowledge of embedded systems and their application in engineering situations.

Such evidence may include writing a correctly documented and structured microcontroller programme to enable a microprocessor to respond to inputs and control outputs to external hardware.

For example designing an algorithm and using a suitable programming language to write clearly commented code plus designing an interface to connect the microcontroller to external hardware such as sensors and actuators.

The assessment should also give the student the opportunity to provide evidence of underpinning knowledge such as digital logic operations, transducers and computer architecture.

The portfolio will cover all learning outcomes.

Assessment number	Learning Outcomes to be met	Type of assessment	Duration/Word Count	Weighting (%)	Alternative assessment, if applicable
1	1, 2, 3	Portfolio	4000	100%	

Derogations

None

Learning and Teaching Strategies

This module will be presented to the students through a series of lectures, tutorials, practical lab work and ECAD investigations.

Learning materials will include in-class and on-line lecture notes, exercises and tutorials.

Access to practical Laboratory facilities and ECAD will be available to students. It is preferred that students study both the hardware and software elements in parallel, throughout the year, so that students are exposed the programming elements of industrial electronics systems while considering the challenges of interfacing to external hardware.

Analysis of industrial electronics system design problems and development of problem statements. Systematic and integrated industrial electronics system design.

Extensive use will be made of VLE to supplement learning materials.

Formative assessment takes place throughout the module during tutorials and feedback is given during these tutorials.

Welsh Elements

Programme is delivered in English and Chinese, however students can submit assessments in Welsh.

Indicative Syllabus Outline

System architecture: Clock, CPU, memory, interfaces, bus systems and controlling logic; CPU internal architecture; Van Neumann model - fetch/execute cycle; instruction set, timing. Pipeline and multi-processing architectures.

Memory structures: Main memory address, access and structures; device types and parameters, memory map.

Interfaces: Functional treatment of parallel ports, serial ports - UARTs etc, ADC/DACs. Dedicated interfaces eg to drive 'power' equipment. Memory-mapped I/O and I/O mapping. Communication: polling and interrupts. Bus systems e.g. VME, STE, I²C.

Design, writing and testing: of assembly language programs for a microcontroller (eg PIC) or a personal computer processor. Development tools (editor, assembler, ICE), use of subroutines, functions, to carry out an engineering task.

D/A and A/D conversions.

Introduction to FPGA/CPLD: Hardware description language (HDL): VHDL basic concepts, main elements, top-down design, data types, subprograms, VHDL operators, concurrent and sequential assignments, etc.

Hardware: structural description, behavioural description, design organization and parameterization.

Practical examples of VHDL design of digital systems.

Practical/IT session includes: comparison types of FPGA/CPLD, introduction to EDA software, VHDL coding practices, further programs, working towards digital system design assignment.

Indicative Bibliography

Please note the essential reads and other indicative reading are subject to annual review and update.

Essential Reads:

Bates, M. (2011) The PIC Microcontroller: An Introduction to Microelectronics, 3rd Edn, Newnes.

Other indicative reading:

Kafig, W. (2011) VHDL 101: Everything you Need to Know to Get Started, Newnes.

Hughes, E. et al. (2012) Electrical and Electronic Technology, 11th Edn., Pearson.

Wakerly, J.F. (2005) Digital Design: Principles and Practices, 4th Edn., Prentice-Hall.

Administrative Information

For office use only	
Initial approval date	24/092020
With effect from date	24/09/2020
Date and details of revision	22/07/2025 revalidated, module aims and outcomes reworded, indicative syllabus updated, updated template, derogation removed
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