Module specification

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Refer to the module guidance notes for completion of each section of the specification.

Module code	ENG5AP
Module title	Industrial Electronics and Applications
Level	5
Credit value	20
Faculty	FAST
Module Leader	Dr Sultan Shoaib
HECoS Code	100165
Cost Code	GAME

Programmes in which module to be offered

Programme title	Is the module core or option for this programme
BEng (Hons) Mechatronics Engineering	Core

Pre-requisites

None

Breakdown of module hours

Learning and teaching hours	60 hrs
Placement tutor support	0 hrs
Supervised learning e.g. practical classes, workshops	0 hrs
Project supervision (level 6 projects and dissertation modules only)	0 hrs
Total active learning and teaching hours	**0** hrs
Placement / work based learning	0 hrs
Guided independent study	140 hrs
Module duration (total hours)	200 hrs

For office use only	
Initial approval date	24/09/2020
With effect from date	24/09/2020
Date and details of revision	
Version number	1

Module aims

1. Demonstrate 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 provide a knowledge of the programming languages and the software used for programming microcontrollers.
3. How to interface 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	Demonstrate knowledge of microprocessor capabilities both as the central processing element in a computer system and as an embedded element in an electronic system.
2	Apply a systematic approach to design industrial electronics systems to address the application needs, and develop the basic knowledge and skills to build, debug, test, evaluate and electronics systems; Design appropriate hardware interfacing.
3	Write, test and evaluate computer language programs for engineering applications.

Assessment

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.

Indicative Assessment Tasks:

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	Weighting (%)
1	1, 2, 3	Portfolio	100%

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%.

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 (Moodle) to supplement learning materials.

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

Indicative Syllabus Outline

Digital conventions: Bit, byte, word; binary, hexadecimal, octal; binary arithmetic, logical operations; Gray code, BCD, ASCII.

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/Omapping. 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.

Employability skills – the Glyndŵr Graduate

Each module and programme is designed to cover core Glyndŵr Graduate Attributes with the aim that each Graduate will leave Glyndŵr having achieved key employability skills as part of their study. The following attributes will be covered within this module either through the content or as part of the assessment. The programme is designed to cover all attributes and each module may cover different areas. Click here to read more about the Glyndwr Graduate attributes

Core Attributes
Creative
Ethical

Key Attitudes
Adaptability

Practical Skillsets
Digital Fluency