Module specification

When printed this becomes an uncontrolled document. Please access the Module Directory for the most up to date version by clicking on the following link: Module directory

Module Code	ENG53E
Module Title	Embedded Systems
Level	5
Credit value	20
Faculty	FAST
HECoS Code	10-05-46
Cost Code	GAME

Programmes in which module to be offered

Programme title	Is the module core or option for this programme
BEng (Hons) Electrical and Electronic Engineering	Core
MEng (Hons) Electrical and Electronic Engineering	Core

Pre-requisites

None

Breakdown of module hours

Learning and teaching hours	30 hrs
Supervised learning e.g., practical classes, workshops	0 hrs
Total active learning and teaching hours	30 hrs
Guided independent study	170 hrs
Module duration (total hours)	200 hrs

For office use only	
Initial approval date	Feb 17
With effect from date	September 2022
Date and details of revision	Aug 22: module learning outcomes and syllabus update in engineering revalidation
Version number	2

Module aims

- To 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.
- To provide a knowledge of the programming languages and the software used for programming microcontrollers.
- To develop the 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	Define microprocessor key capabilities both as central processing element in a computer system and as embedded element in an electronic system.
2	Apply a systematic approach to design embedded systems to address the application needs, and develop the basic knowledge and skills to build, debug, test, evaluate an embedded system.
3	Write, test and evaluate computer language programs for engineering applications involving sensors and actuators.

In addition to the module learning outcomes, students will also cover the following accreditation of higher education programme (AHEP) fourth edition learning outcomes: C2.

Assessment

Indicative Assessment Tasks:
This module will be assessed by means of producing a portfolio of evidence gathered throughout the duration of the course demonstrating a theoretical and practical knowledge of embedded systems and their application in engineering situations. The portfolio will cover all learning outcomes. The portfolio should have a word count of 4000 or equivalent.

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, computer aided simulations and practical lab work. Learning materials will include in-class and on-line lecture notes, exercises and tutorials. Access to practical Laboratory facilities and software packages will be available to students. Extensive use will be made of VLE (Moodle) to supplement learning materials.

The module will be taught through a combination of lectures and workshops. An active and inclusive approach is used to engage learners in the topics and will involve individual, group work and flipped learning experiences aligned to the university's Active Learning Framework (ALF). The approach offers students a flexible and adaptive learning experience that can accommodate a range of options that includes both on campus learning and remote learning where appropriate.

The Moodle VLE and other on-line materials and resources will be available to support learning. ALF offers a balance between the classroom elements and digitally enabled activity incorporating flexible and accessible resources and flexible and accessible feedback to support learning.

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 e.g., to drive 'power' equipment. Memory-mapped I/O and I/O mapping. Communication: polling and interrupts. Bus systems e.g., VME, STE, I^2C.

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

Digital system design process: Combinational simplification: tabular method. Sequential system design and analysis for components and circuits. D/A and A/D conversions

Introduction to FPGA/CPLD: Introduction to FPGA, structural description, behavioural description, design organisation and parameterisation. VHDL or Verilog basic concepts

Indicative Bibliography:

Essential Reads

A. S. Berger, *Embedded Systems Design: An Introduction to Processes, Tools & Techniques*. Oxfordshire, UK: Routledge, 2001.

Other indicative reading

M. A. Mazidi et.al, *8051 Microcontroller and Embedded Systems, Intl. Edition*. London UK: Pearson, 2014.

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.

Core Attributes
Engaged
Creative
Ethical

Key Attitudes
Commitment
Confidence
Adaptability

Practical Skillsets
Digital Fluency
Organisation
Leadership and Team working
Critical Thinking
Communication