Module Descriptor

Title	Embedded Systems		
Session	2025/26	**Status**	Published
Code	COMP08107	**SCQF Level**	8
Credit Points	20	**ECTS (European Credit Transfer Scheme)**	10
School	**Computing, Engineering and Physical Sciences**		
Module Co-ordinator	B Koirala		

Summary of Module

Around 90% of electronic devices use embedded microprocessors. Mobile phones, printers, robots, drones, routers, cars, microwave ovens and washing machines are some examples of devices which are controlled by embedded microprocessors. The prevalence of these devices globally imply that it is crucial to understand the fundamentals of embedded systems design and programming. In addition, the software development for such embedded processor systems is different from the typical PC software development. This is due to the restrictions of the available processor performance, RAM, I/O, etc. This module aims to develop knowledge and practical expertise in embedded systems and learn about their basic architectural components, applications, and corresponding design constraints, as well as develop efficient and reliable software for the target application. Based on a specific microcontroller and a set of real-world applications and examples, students will learn the functionality of microcontrollers and their integration within an embedded system. This will include (but is not limited to) topics such as memory maps, GPIOs, interrupts, ADC/DAC, timers, serial/parallel communication, and power management.

Students will also get an opportunity to explore a variety of different sensors and platforms, and enhance their understanding of programming in a low-level language such as C.

This module will work to develop a number of the key 'I am UWS' Graduate Attributes to make those who complete this module:

- Universal: Critical Thinker; Ethically-minded and Research-minded
- Work Ready: Problem-Solver; Effective Communicator; and Ambitious
- Successful: Autonomous, Resilient; and Driven

Module Delivery Method	On-Campus[1] ☒	Hybrid[2] ☐	Online[3] ☒	Work -Based Learning[4] ☐
Campuses for Module Delivery	☐ Ayr ☐ Dumfries	☒ Lanarkshire ☐ London ☐ Paisley	☒ Online / Distance Learning ☐ Other (specify) Online Delivery / Distance Learning applies to delivery in the BSc (Hons) Data, AI and Software Engineering programme only	

Terms for Module Delivery	Term 1	☐	Term 2	☐	Term 3	☒
Long-thin Delivery over more than one Term	Term 1 – Term 2	☐	Term 2 – Term 3	☐	Term 3 – Term 1	☐

Learning Outcomes	
L1	Demonstrate a critical knowledge of embedded processor system hardware and of designing appropriate system for the target application.
L2	Write, test and debug interactive programs to handle registers, memory access, take inputs from sensors and control interfaces.
L3	Use PC based emulator tools to develop software for various embedded systems.
L4	N/A
L5	N/A

Employability Skills and Personal Development Planning (PDP) Skills	
SCQF Headings	**During completion of this module, there will be an opportunity to achieve core skills in:**
Knowledge and Understanding (K and U)	**SCQF 8** Knowledge and understanding of the scope and defining features of embedded systems, and an integrated knowledge of its main areas and boundaries. A critical understanding of the principles, principal theories, concepts and terminology associated with embedded systems.

[1] Where contact hours are synchronous/ live and take place fully on campus. Campus-based learning is focused on providing an interactive learning experience supported by a range of digitally-enabled asynchronous learning opportunities including learning materials, resources, and opportunities provided via the virtual learning environment. On-campus contact hours will be clearly articulated to students.

[2] The module includes a combination of synchronous/ live on-campus and online learning events. These will be supported by a range of digitally-enabled asynchronous learning opportunities including learning materials, resources, and opportunities provided via the virtual learning environment. On-campus and online contact hours will be clearly articulated to students.

[3] Where all learning is solely delivered by web-based or internet-based technologies and the participants can engage in all learning activities through these means. All required contact hours will be clearly articulated to students.

[4] Learning activities where the main location for the learning experience is in the workplace. All required contact hours, whether online or on campus, will be clearly articulated to students

Practice: Applied Knowledge and Understanding	**SCQF 8** Use the principle skills, techniques and practices related to embedded systems. Practise routine methods of enquiry to practise in a range of contexts that include a degree of unpredictability.
Generic Cognitive skills	**SCQF 8** Undertake critical analysis, evaluation and/or synthesis of ideas, concepts, information and issues in systems programming. Identify and analyse routine professional problems and issues. Draw on a range of sources in making judgements.
Communication, ICT and Numeracy Skills	**SCQF 8** Use a wide range of skills in support of established practices; Present or convey, formally and informally, information about topics to informed audiences; Interpret, use and evaluate data.
Autonomy, Accountability and Working with Others	**SCQF 8** Ability to design and carry out a solution for the practical problems with peers.

Prerequisites	**Module Code**	**Module Title**
	Other	
Co-requisites	**Module Code**	**Module Title**

Learning and Teaching	
In line with current learning and teaching principles, a 20-credit module includes 200 learning hours, normally including a minimum of 36 contact hours and maximum of 48 contact hours. 48	
Learning Activities During completion of this module, the learning activities undertaken to achieve the module learning outcomes are stated below:	**Student Learning Hours** (Note: Learning hours include both contact hours and hours spent on other learning activities)
Lecture / Core Content Delivery	12
Tutorial / Synchronous Support Activity	12
Laboratory / Practical Demonstration / Workshop	24
Independent Study	152
Please select	
Please select	
TOTAL	200

Indicative Resources
The following materials form essential underpinning for the module content and ultimately for the learning outcomes:

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- Barr, M. and Massa A. “Programming Embedded Systems: With C and GNU Development Tools”, 2nd Edition, O'Reilly Media, 2006.
- Blum, J. (2013) Exploring Ardunio. Wiley. ISBN-10: 1118549368, ISBN-13: 978-1118549360
- Boxall, J. (2013) Arduino Workshop: A Hands-On Introduction with 65 Projects. (1st Edition) No Starch Press.ISBN-10: 1593274483, ISBN-13: 978-1593274481
- Mazidi, M et al (2019) Arduino Programming From Beginning to Advanced. MicroDigitalEd. ISBN-10:1970054204, ISBN-13: 978-1970054200
- Popovici, K., Jerraya, A., Rousseau, F., Wolf, M. “Embedded Software Design and Programming of Multiprocessor System-on-Chip: Simulink and System C Case Studies”, Springer, 2010
- Sestoft, P. (2017) Programming Language Concepts (2nd Edition). Springer ISBN-10: 331960788X, ISBN-13: 978-331960788
- Arduino Project Book (Basic)
- Exploring Arduino by Jeremy Blum
- Arduino Workshop: A Hands-On Introduction with 65 Projects by John Boxall
- The Official Raspberry Pi Guide
- Raspberry Pi Projects Book (Russel Barnes et al)

Links to be used during the module:

- Arduino Course on Programming Electronics Academy (https://programmingelectronics.com)
- Raspberry Pi and the Internet of Things (https://www.udemy.com/from-0-to-1-raspberry-pi/)
- Lot of courses and explanations (https://www.sparkfun.com/)
- Arduino simulator (https://library.io/)
- Server for IoT projects (https://thingspeak.com/)

(N.B. Although reading lists should include current publications, students are advised (particularly for material marked with an asterisk*) to wait until the start of session for confirmation of the most up-to-date material)

Attendance and Engagement Requirements

In line with the Student Attendance and Engagement Procedure, Students are academically engaged if they are regularly attending and participating in timetabled on-campus and online teaching sessions, asynchronous online learning activities, course-related learning resources, and complete assessments and submit these on time.

For the purposes of this module, academic engagement equates to the following:

The School of Computing, Engineering and Physical Sciences considers attendance and engagement to mean a commitment to attending, and engaging in, timetabled sessions. You will scan your attendance via the scanners each time you are on-campus and you will login to the VLE several times per week. Where you are unable to attend a timetabled learning session due to illness or other circumstance, you should notify the Programme Leader that you cannot attend. Across the School an 80% attendance threshold is set. If you fall below this, you will be referred to the Student Success Team to see how we can best support your studies.

Equality and Diversity
The University's Equality, Diversity and Human Rights Procedure can be accessed at the following link: UWS Equality, Diversity and Human Rights Code. Aligned with the University's commitment to equality and diversity, this module supports equality of opportunity for students from all backgrounds and learning needs. Using the VLE, material will be presented electronically in formats that allow flexible access and manipulation of content. This module complies with University regulations and guidance on inclusive learning and teaching practice. This module has lab-based teaching and as such you are advised to speak to the Module Co-ordinator to ensure that specialist assistive equipment, support provision and adjustment to assessment practice can be put in place, in accordance with the University's policies and regulations.
(N.B. Every effort will be made by the University to accommodate any equality and diversity issues brought to the attention of the School)

Supplemental Information

Divisional Programme Board	**Computing**
Overall Assessment Results	☐ **Pass / Fail** ☒ **Graded**
Module Eligible for Compensation	☐ **Yes** ☒ **No** **If this module is eligible for compensation, there may be cases where compensation is not permitted due to programme accreditation requirements. Please check the associated programme specification for details.**
School Assessment Board	Business & Applied Computing
Moderator	Henry Hunter
External Examiner	A Jindal
Accreditation Details	N/A
Module Appears in CPD catalogue	☐ **Yes** ☒ **No**
Changes / Version Number	1.1

Assessment (also refer to Assessment Outcomes Grids below)
Assessment 1
Class test (written): The test will be held after the completion of the taught course. (40%)
Assessment 2
Lab-based coursework: The coursework is undertaken in the second half of the module. (60%)
Assessment 3
(N.B. (i) Assessment Outcomes Grids for the module (one for each component) can be found below which clearly demonstrate how the learning outcomes of the module will be assessed. (ii) An indicative schedule listing approximate times within the academic calendar when assessment is likely to feature will be provided within the Student Module Handbook.)

Component 1

Assessment Type	LO1	LO2	LO3	LO4	LO5	Weighting of Assessment Element (%)	Timetabled Contact Hours
Class test (written)	☒	☒	☒	☐	☐	40	2

Component 2							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**
Portfolio of practical work	☒	☒	☒	☐	☐	60	2

Component 3							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**
	☐	☐	☐	☐	☐		
Combined total for all components						100%	hours

Change Control

What	When	Who
Attendance and DEI Regulations	20/01/2025	L Cunningham