SYST H4605: Embedded Systems

Module Title:	Embedded Systems
Language of Instruction:	English

Credits:	5

NFQ Level:	8

Module Delivered In	1 programme(s)

Teaching & Learning Strategies:	The module will be delivered via a blend of lectures and problem based learning through tutorials and practical classes.

Module Aim:	To provide students with the skills and techniques required to develop and test software and hardware for embedded systems. To provide students knowledge of embedded system design with particular emphasis on aircraft systems.

Learning Outcomes	
On successful completion of this module the learner should be able to:	
LO1	Evaluate the processes of how hardware and software components interact to form an embedded system.
LO2	Create, simulate and debug software for an embedded system.
LO3	Perform virtual system modelling of both the hardware and software components.
LO4	Integrate hardware and software components to form an embedded system and evaluate its performance.

Pre-requisite learning
Module Recommendations *This is prior learning (or a practical skill) that is recommended before enrolment in this module.*
No recommendations listed
Incompatible Modules *These are modules which have learning outcomes that are too similar to the learning outcomes of this module.*
No incompatible modules listed
Co-requisite Modules
No Co-requisite modules listed
Requirements *This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed.*
No requirements listed

SYST H4605: Embedded Systems

Module Content & Assessment

Indicative Content
Introduction to Embedded Systems Description of an embedded system, types of embedded systems. common applications of embedded systems.
Microcontroller Architectures Description of primary components contained within embedded systems, central processing units and their architectures, CPU and microcontroller operation, fetch decode and execute cycle, memories and register types contained within CPUs and microcontrollers.
Review of Assembly Language Programming Digital numbering systems, program counter, ROM space, control, arithmetic and logic instructions, standard instruction set, sequence of events during program execution.
Embedded Systems Programming Program design, flowcharts, variables and constants, I/O operations, operators and expressions (arithmetic, logical and relational operators, conditional expression, etc.), control statements (while loop, do/while loop, for loop, if/else, switch/case, etc.), functions and arrays, I/O port programming, timers, interrupts.
Microcontroller Interfacing and Serial Communications Common interface and communication protocols, interfacing with common I/O devices and sensors. interfacing with analog and digital signals. port I/O, ability to sink and source current, driving AC and DC loads.
System Development, Testing and Debug Design documentation, integrated development environments (IDEs), embedded debug concepts, debug techniques (step mode, breakpoints, variable watching, etc.)
Embedded Systems for Aerospace Applications Introduction to field-programmable gate arrays (FPGAs), real-time operating systems, international standards for airborne software and electronic hardware (DO-178C, DO-254, DO-160, etc.).
Introduction to Artificial Intelligence (AI) for Embedded System Definition and Scope of AI, introduction to machine learning (ML), types of machine learning (supervised, unsupervised, reinforcement). Introduction to neural nets and deep learning. Applications of AI and ML.

Assessment Breakdown	%
Continuous Assessment	30.00%
Project	40.00%
Practical	30.00%

Continuous Assessment

Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Examination	Students will be assessed periodically to gauge their understanding and knowledge of the material.	1,2	30.00	Ongoing

Project

Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Project	Project designed to allow students to apply their knowledge of embedded systems. The project may involve developing hardware, software or a combination of both.	3,4	40.00	n/a

Practical

Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Practical/Skills Evaluation	Students will complete laboratory assignments and tasks designed to reinforce their learning through practical application.	2,3,4	30.00	Every Second Week

No End of Module Formal Examination

SETU Carlow Campus reserves the right to alter the nature and timings of assessment

SYST H4605: Embedded Systems

Module Workload

Workload: Full Time		
Workload Type	*Frequency*	*Average Weekly Learner Workload*
Lecture	12 Weeks per Stage	3.00
Practicals	12 Weeks per Stage	2.00
Independent Learning	Every Week	65.00
	Total Hours	125.00

Module Delivered In

Programme Code	Programme	Semester	Delivery
CW_EEAER_B	Bachelor of Engineering (Honours) in Aerospace Engineering	7	Mandatory