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MODULE DESCRIPTOR

Module Title

Real-Time Embedded Systems

Reference	EN5503	Version	5
Created	December 2017	SCQF Level	SCQF 11
Approved	January 2010	SCQF Points	15
Amended	May 2019	ECTS Points	7.5

Aims of Module

To enable the student to develop the skills and knowledge involved in the design and implementation of real-time embedded systems.

Learning Outcomes for Module

On completion of this module, students are expected to be able to:

1	Design interfaces between microprocessors and peripheral devices.
2	Design and implement software for real-time embedded systems which control and monitor external hardware.

Indicative Module Content

Microcontroller based systems: architecture, integrated peripherals, timers, serial peripheral interfaces, exception handling. Real-time systems: Multi-tasking, real-time operating systems. Inter-task communication and synchronisation. Resource scheduling, allocation and protection, structures of queues and tables, device interfaces, task scheduling. Methods and tools for the development of real-time systems. Embedded Systems: Nature of embedded systems, applications, hardware requirements, case studies, impact on software development. Software development process. Debugging support. Fuzzy Logic: for real-time microcontroller based systems. Interface Design: bus systems, address decoding, registers and buffering, development of interface driver software.

Module Delivery

The module is taught using a structured programme of lectures, tutorials, laboratories and student-centred learning. The development of a practical real-time embedded system will form a major element of the practical work.

Indicative Student Workload	Full Time	Part Time
Contact Hours	38	38
Non-Contact Hours	112	112
Placement/Work-Based Learning Experience [Notional] Hours	N/A	N/A
TOTAL	150	150
Actual Placement hours for professional, statutory or regulatory body		

ASSESSMENT PLAN

If a major/minor model is used and box is ticked, % weightings below are indicative only.

Component 1

| Type: | Coursework | Weighting: | 30% | Outcomes Assessed: | 1 |

| Description: | Design and development of a microprocessor interface. |

Component 2

| Type: | Coursework | Weighting: | 70% | Outcomes Assessed: | 2 |

| Description: | Mini project involving the development of software for real-time applications on microcontroller systems. |

MODULE PERFORMANCE DESCRIPTOR

Explanatory Text

A minimum of 40% in each component and an aggregate of 50% or above.

Module Grade	Minimum Requirements to achieve Module Grade:
A	70% - 100%
B	60% - 69%
C	55% - 59%
D	50% - 54%
E	40% - 49%
F	0% - 39%
NS	Non-submission of work by published deadline or non-attendance for examination

Module Requirements

Prerequisites for Module	None.
Corequisites for module	None.
Precluded Modules	None.

INDICATIVE BIBLIOGRAPHY

1	CADY, F. M., 2007. Software and Hardware Engineering. 2nd ed. Oxford University Press.
2	VALVANO, J. W., 2006. Developing Embedded Software in C Using IC11/IC12/Metrowerks. Brooks/Cole Pub. Co..
3	BARRY, R., 2010. FreeRTOS eBook Standard Edition: Using FreeRTOS Real Time Kernel - A Practical Guide. Real Time Engineering Ltd..