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MODULE DESCRIPTOR

Module Title

Embedded Systems

Reference	EN3544	Version	4
Created	April 2022	SCQF Level	SCQF 9
Approved	May 2019	SCQF Points	15
Amended	May 2022	ECTS Points	7.5

Aims of Module

To provide the student with the ability to evaluate the operation of microprocessor-based computer systems and to design and implement software for interfacing and real-time operation.

Learning Outcomes for Module

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

- 1 Describe and evaluate the design of microcontroller input/output sub-systems.
- 2 Implement and test programs incorporating: C and assembly language, linking, polled and interrupt driven peripheral interfaces.
- 3 Design, build and test a component employing the hardware and software essentials of a small real-time system.
- 4 Demonstrate proficiency in coding, testing and aspects of design to prescribed programming tasks.

Indicative Module Content

Microprocessor system design: nature of embedded real-time systems, hardware requirements, impact on software development, exceptions and interrupts, industrial applications, case studies. Integrated and external peripherals: timers, analogue to digital and digital to analogue conversion, serial peripheral interfaces (e.g. SPI, I2C), serial bus peripherals and memory; working with manufacturers data sheets and application notes. Software development: software development process; cross-compilation and linkage of C and assembly language; debugging support; input/output programming - polled and interrupt driven (e.g. ADC, SPI, Key Wakeup);

Module Delivery

Full-time students: This module is delivered by a combination of lectures and tutorials. It will be supported by practical examples and activities including computer based laboratory exercises. Part-time students: This module is delivered by a combination of lectures and tutorials online. It will be supported by drop-in evening sessions and labs on campus. Assessments will primarily be online although exams will be held on campus with the full-time cohorts.

Indicative Student Workload	Full Time	Part Time
Contact Hours	36	36
Non-Contact Hours	114	114
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:	50%	Outcomes Assessed:	1, 2, 3
Description:	Portfolio of software development exercises involving microprocessor interfacing and control.				

Component 2

Type:	Coursework	Weighting:	50%	Outcomes Assessed:	4
Description:	Mini project development by employing the concepts covered in the microcontroller laboratory exercises.				

MODULE PERFORMANCE DESCRIPTOR

Explanatory Text

The module has 2 components and to gain an overall pass a minimum D grade must be achieved in each component. The component weighting is as follows: C1 is worth 50% and C2 is worth 50%.

		Coursework:						
		A	B	C	D	E	F	NS
Coursework:	A	A	A	B	B	E	E	
	B	A	B	B	C	E	E	
	C	B	B	C	C	E	E	
	D	B	C	C	D	E	E	
	E	E	E	E	E	E	F	
	F	E	E	E	E	F	F	
	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 The Definitive Guide to ARM? CORTEX?-M3 and CORTEX?-M4 Processors Book, 3rd Edition, 2014.
- 2 Nucleo Boards Programming with the STM32CubeIDE by Dogan Ibrahim
- 3 AZIDI, M.A., NAIMI, S. and NAIMI, S., 2016. ARM Assembly Language Programming and Architecture. MicroDigitalEd.