Pre-Requisite Modules code(s)	*Co-Requisite Modules code(s)*	*ECTS Credits*	*Module Code*	*Module Title*
		5	*CMPU2013*	*Microprocessors*

8.2.2. Microprocessors

Module authors: Frank Duignan, Richard Hayes

Module Description:

This module introduces the students to hardware and software aspects of microprocessor and microcontroller system development.

Module aim

The aim of this module is to provide students with an understanding of the inner operation of computers and the way in which they interact with external devices.

Learning Outcomes:

On completion of this module, the learner will be able to:

(1) Design, write and debug simple assembly-language programs for the 80x86 family of microprocessors.
(2) Design, write and debug simple C-language programs for the 80x86 family of microprocessors and a microcontroller.
(3) Perform arithmetic in the binary and hexadecimal number systems.
(4) Explain the role played by (and limitations of) the stack in a high level programming language.
(5) Explain the operation of simple circuits that interface microprocessors to external devices.
(6) Outline the operation of microprocessor system elements such as RAM, ROM, Timers and communications peripherals.
(7) Discuss the encoding of different types of computer data (e.g. ASCII characters, Unicode, floating point numbers).
(8) Discuss interrupt handling in microprocessor systems.

Learning and Teaching Methods:

Lectures, laboratory work, self-learning.

Module content

- Analogue systems vs. Digital systems
- The binary and hexadecimal number systems, signed and unsigned numbers.
- Microprocessor core elements: Registers, flags, calculation units, buses, RAM, ROM, Parallel I/O ports.
- Microcontroller programming : registers, memory map, I/O port mapping.
- Interfacing with actuators and sensors
- Analogue to digital and digital to analogue conversion
- Introduction to interrupts.

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		5	*CMPU2013*	*Microprocessors*

- Introduction to serial communications
- Writing simple 80x86 assembler programs, addressing modes, decision making, looping.
- Calling subroutines and the behaviour of the stack.
- Relating simple C-programs to Assembler programs : Allocation of variables, assignment of values to variables, looping, decision making.
- System calls.
- The C-calling convention.
- Mixed language programming
- Code optimization

Laboratory programme

There are three sections in the laboratory programme:

- Microcontroller labs (4 weeks)
- x86 labs (4 weeks)
- Mini project (4 weeks). The mini project is typically a microcontroller application which includes input/output and structured programming.

Module Assessment

There are two main sections to the module mark:

Section 1:

- Two online/automated tests, one dealing with the 80x86 family of processors, the other with a microcontroller. Each accounts for 10% of the total module mark.
- Laboratory reports account for 20% of the module mark.
- Mini project work accounts for 20% of the module mark.

Section 2:

- The remaining 50% of the module marks are assigned to an end of module written exam which covers all of the course material. Students are expected to answer 3 questions out of a total of 4.
- Section 1 accounts for 50% of the total module mark.
- Similarly, Section 2 accounts for 50% of the total module mark.

Assessment of specific learning outcomes:

- (1),(2),(5),(8) Assessment based on performance in laboratory
- (3) to (8) Assessed using online tests and end of module test.

Pre-Requisite Modules code(s)	*Co-Requisite Modules code(s)*	*ECTS Credits*	*Module Code*	*Module Title*
		5	*CMPU2013*	*Microprocessors*

Essential Reading: On-line class notes.

Supplemental Reading:

Brey, Barry B., 1994 The Intel microprocessors : 8086/8088, 80186, 80286, 80386, and 80486 architecture, programming and interfacing. Prentice Hall.

Web references, journals and other:

Microcontroller datasheets and programming guides will be available on module website.

Students will also be expected to download, test and modify various sample programs from the module website.

Further Details:

Module to be delivered over one semester consisting of 2 hours class work, 2 hours laboratory work and self directed learning.

Self directed learning: Students will be expected to complete laboratory reports and prepare for other formal assessment components.

Date of Academic Council approval ……