2024 / 25

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South East Technological University

Module Descriptor

Embedded Systems (Computing and Mathematics)

Embedded Systems (A03807)

Short Title: Embedded Systems
Department: Computing and Mathematics
Credits: 5 **Level:** Introductory

Description of Module / Aims

In this module students will learn how to develop embedded real-time software applications for modern micro-controllers intended for the control of industrial processes and mechatronic systems.

Programmes

		stage/semester/status
COMP-0195	BSc (Hons) in Applied Computing (WD_KACCM_B)	2 / 3 / E
COMP-0195	BSc (Hons) in Applied Computing (WD_KCOMP_B)	2 / 3 / E
COMP-0195	BSc (Hons) in Computer Science (WD_KCMSC_B)	2 / 3 / E

Indicative Content

- C Programming basics: Language features; Functions; Data Types; Structures; Pointers; Bit Manipulation
- Interfacing Principles: I/O types; Memory-mapped I/O; Control and Status Registers
- Digital I/O: Direction and Data Registers; Switch debouncing; Output control
- Timers and Counters
- Analogue Inputs: Sampling theorem; Analogue-to-Digital Converter
- Analogue Outputs: Pulse Width Modulation (PWM)
- Microcontroller architecture

Learning Outcomes

On successful completion of this module, a student will be able to:

1. Define the interfacing requirements for controlling an industrial process.
2. Apply a control system software design to a common micro-controller.
3. Code a microcontroller software system using C.
4. Test and debug embedded control software on common microcontrollers.

Learning and Teaching Methods

- Combination of lectures and lab-based practicals.
- The lectures will cover the theory and underlying technologies in embedded application development.
- The lab-based practicals, building on the theoretical knowledge from the lectures, provide the practical skills to develop and test microcontroller software using a modern microcontroller.
- Students will be encouraged to enhance their lab work and assessment submissions using self-directed research and learning into broader embedded systems topics.

Learning Modes

Learning Type	F/T Hours	P/T Hours
Lecture	12	
Practical	36	
Independent Learning	87	

Assessment Methods

	Weighting	Outcomes Assessed
Final Written Examination	50%	1,2
Continuous Assessment	50%	
Assignment	25%	2,3,4
Assignment	25%	2,3,4

Assessment Criteria

<40%: Inability to develop simple software designs from user requirements.

40%–49%: Able to specify interfacing and software requirements for simple discrete control systems.

50%–59%: All the above and in addition be able to implement microcontroller-based solutions.

60%–69%: In addition, be able to develop optimised designs for a common micro-controller.

70%–100%: All previous to an excellent level. Be able to demonstrate an awareness of software quality and performance considerations when developing embedded software applications.

Supplementary Material(s)

- Qian, K., D. Den Haring and L. Cao. *Embedded Software Development with C*. New York: Springer, 2009.

Requested Resources

- Computer Lab: BYOD Lab