



Title:	Programming Microcontrollers APPROVED
Long Title:	Programming Microcontrollers
Module Code:	SOFT7029
Duration:	1 Semester
Credits:	5
NFQ Level:	Intermediate
Field of Study:	Computer Software
Valid From:	Semester 1 - 2017/18 (September 2017)
Module Delivered in	1 programme(s)
Module Coordinator:	Sean McSweeney
Module Author:	Sean McSweeney
Module Description:	Microcontrollers are essential to the ongoing operation of most of the machinery that facilitates modern living from aerospace systems to coffee machines. This module provides learner with the specialist skills required to design and develop embedded software for microcontroller sensing/actuation applications.
Learning Outcomes	
<i>On successful completion of this module the learner will be able to:</i>	
LO1	Appraise contemporary microcontroller architectures and capabilities.
LO2	Evaluate the impact of sensing/actuation requirements on embedded controller software.
LO3	Assess common contemporary microcontroller communication interfaces.
LO4	Develop embedded software for defined sensing and processing constraints.
LO5	Validate embedded software using debugging and emulation techniques and tools.
Pre-requisite learning	
Module Recommendations	
<i>This is prior learning (or a practical skill) that is strongly recommended before enrolment in this module. You may enrol in this module if you have not acquired the recommended learning but you will have considerable difficulty in passing (i.e. achieving the learning outcomes of) the module. While the prior learning is expressed as named CIT module(s) it also allows for learning (in another module or modules) which is equivalent to the learning specified in the named module(s).</i>	
Incompatible Modules	
<i>These are modules which have learning outcomes that are too similar to the learning outcomes of this module. You may not earn additional credit for the same learning and therefore you may not enrol in this module if you have successfully completed any modules in the incompatible list.</i>	
No incompatible modules listed	
Co-requisite Modules	
No Co-requisite modules listed	
Requirements	
<i>This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed. You may not enrol on this module if you have not acquired the learning specified in this section.</i>	
No requirements listed	

Module Content & Assessment

Indicative Content

Embedded Systems Introduction

Overview of embedded systems, microprocessors, micro-controllers, anatomy of contemporary platforms, I/O and processing capabilities and considerations.

Communication Interfaces

Buses and data rates(I2C, SPI, 1-Wire, PWM, CAN), internal and external interrupts, interrupt base I/O programming, Direct Memory Access.

Sensing and Actuation

Environmental, motion and contact sensing, motor control, linear actuators and relays, impact of sensing latency and frequency on software design.

Control and Data Handling

Implementation of simple control strategies. Design and implementation of open and closed loop control. Connecting a microcontroller to the internet securely.

Debugging and Emulation

Considerations for embedded systems, low level simulation, developing hardware test strategies, on-board debugging (JTAG), emulation.

Assessment Breakdown

	%
Course Work	100.00%

Course Work

Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date
Written Report	Written report evaluating two or more contemporary platforms for a specified application scenario.	1,2	20.0	Week 5
Short Answer Questions	This assessment will evaluate the learners understanding on the theoretical elements of the module.	1,2,3,4,5	30.0	Week 12
Project	Project developing, deploying and debugging embedded software for a contemporary platform from a defined specification.	3,4,5	50.0	Sem End

No End of Module Formal Examination

Reassessment Requirement

Coursework Only

This module is reassessed solely on the basis of re-submitted coursework. There is no repeat written examination.

The institute reserves the right to alter the nature and timings of assessment

Module Workload

Workload: Full Time				
<i>Workload Type</i>	<i>Workload Description</i>	<i>Hours</i>	<i>Frequency</i>	<i>Average Weekly Learner Workload</i>
Lecture	Lecture delivering theory underpinning learning outcomes.	2.0	Every Week	2.00
Lab	Practical computer-based lab supporting learning outcomes.	2.0	Every Week	2.00
Independent & Directed Learning (Non-contact)	Independent & directed learning	3.0	Every Week	3.00
Total Hours				7.00
Total Weekly Learner Workload				7.00
Total Weekly Contact Hours				4.00

Workload: Part Time				
<i>Workload Type</i>	<i>Workload Description</i>	<i>Hours</i>	<i>Frequency</i>	<i>Average Weekly Learner Workload</i>
Lecture	Lecture delivering theory underpinning learning outcomes.	2.0	Every Week	2.00
Lab	Practical computer-based lab supporting learning outcomes.	2.0	Every Week	2.00
Independent & Directed Learning (Non-contact)	Independent & directed learning.	3.0	Every Week	3.00
Total Hours				7.00
Total Weekly Learner Workload				7.00
Total Weekly Contact Hours				4.00

Module Resources

Recommended Book Resources

- Joseph Yiu 2013, *The Definitive Guide to ARM® Cortex-M3 and Cortex-M4 Processors*, 3rd Ed., Newnes [ISBN: 9780124080829]

Supplementary Book Resources

- Jonathan W Valvano 2012, *Embedded Systems: Introduction to Arm Cortex-M Microcontrollers*, 5th Ed., CreateSpace Independent Publishing Platform [ISBN: 9781477508992]
- Yifeng Zhu 2015, *Embedded Systems with ARM Cortex-M Microcontrollers in Assembly Language and C*, 2nd Ed., E-Man Press LLC [ISBN: 9780982692639]
- Elecia White 2011, *Making Embedded Systems: Design Patterns for Great Software*, O'Reilly Media [ISBN: 9781449302146]

This module does not have any article/paper resources

Other Resources

- Website: *Technical News*
<http://microcontroller.com/>

Module Delivered in

Programme Code	Programme	Semester	Delivery
CR_KDNET_8	Bachelor of Science (Honours) in Computer Systems	5	Mandatory