

Title:	Microcontroller Applications APPROVED
Long Title:	Microcontroller Applications
Module Code:	ELEC6035
Credits:	5
NFQ Level:	Fundamental
Field of Study:	Electrical Engineering
Valid From:	Semester 1 - 2017/18 (September 2017)
Module Delivered in	3 programme(s)
Module Coordinator:	JOSEPH CONNELL
Module Author:	JOSEPH CONNELL
Module Description:	This module introduces students to the principles of operation of microcontrollers and their practical application using the C programming language. The emphasis is on using the development tools to interface with the physical environment with examples relevant to electrical engineering students.
Learning Outcomes	
<i>On successful completion of this module the learner will be able to:</i>	
LO1	Describe the main properties of a microcontroller required to select a device for a given application.
LO2	Write high level program code to monitor and control digital I/O from the physical environment.
LO3	Write and deploy program code to measure analog signals from external sensors for digital system control.
LO4	Write and test structured code in a microcontroller project to enable debugging and code reuse.
LO5	Interface the microcontroller to other computing devices via a serial interface bus.
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>	
No recommendations listed	
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	
Co-requisites	
No Co Requisites listed	

Module Content & Assessment

Indicative Content

Introduction to microcontrollers

Microcontrollers compared to microprocessors, microcontroller programming, interfacing with sensors (e.g. buttons) and actuators (e.g. motors). Microcontroller selection.

Arduino programming

Structure of Arduino sketches, compilation, loading and running compiled code, problem solving by program design and implementation

Digital monitoring and control

Microcontroller Digital Input/Output Ports and I/O pins. LED wiring and control. Wiring up switches and push buttons. IF THEN ELSE operation. LOOPS. Timers. SWITCH statements.

Analog monitoring and control

Analog to Digital Conversion. Analog input ports. Number systems and variable types. Pulse width modulation (PWM).

Structured design

System design and modularity. System hardware and software block diagrams. Functions to realise block operations. Passing variables to and from functions. Function libraries. Debugging process.

Device driver circuits

Circuits to drive devices requiring higher voltages or currents than can be directly handled by the microcontroller. Low voltage DC motors, Servos, Relays etc.

Communication Interfaces

Introduction to RS232 serial interface to a PC and interfacing to other peripherals.

Assessment Breakdown

%

Course Work

100.00%

Course Work

Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date
Practical/Skills Evaluation	Program assignment for digital monitoring and control	1,2	25.0	Week 5
Practical/Skills Evaluation	Program assignment for mixed digital and analog measurement and control	2,3,4,5	25.0	Week 10
Practical/Skills Evaluation	Final project integrating previous work in a capstone project with documented program structure	1,2,3,4,5	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>
Lab	Device programming	3.0	Every Week	3.00
Independent & Directed Learning (Non-contact)	Assignments	2.0	Every Week	2.00
Independent & Directed Learning (Non-contact)	Code development and test	2.0	Every Week	2.00
Total Hours				7.00
Total Weekly Learner Workload				7.00
Total Weekly Contact Hours				3.00

Workload: Part Time

<i>Workload Type</i>	<i>Workload Description</i>	<i>Hours</i>	<i>Frequency</i>	<i>Average Weekly Learner Workload</i>
Lab	Device Programming	3.0	Every Week	3.00
Independent & Directed Learning (Non-contact)	Assignments	2.0	Every Week	2.00
Independent & Directed Learning (Non-contact)	Code development and Test	2.0	Every Week	2.00
Total Hours				7.00
Total Weekly Learner Workload				7.00
Total Weekly Contact Hours				3.00

Module Resources
<i>Recommended Book Resources</i>
<ul style="list-style-type: none"> • Michael Margolis, Nicholas Robert Weldin, 2011, <i>Arduino Cookbook</i>, 1 Ed., O'Reilly Media [ISBN: 978-0596802479]
<i>Supplementary Book Resources</i>
<ul style="list-style-type: none"> • Michael McRoberts, 2010, <i>Beginning Arduino</i>, 1 Ed., 17, Apress [ISBN: 1430232404]
<i>This module does not have any article/paper resources</i>
<i>Other Resources</i>
<ul style="list-style-type: none"> • Website: <i>Arduino</i> http://www.arduino.cc/ • Website:: <i>The World Famous Index of Arduino & Freeduino Knowledge</i> http://www.freeduino.org/ • Website:: <i>LadyAda</i> http://www.ladyada.net/ • Website:: Jeremy Blum 2011, <i>Tutorials for Arduino</i>, YouTube https://www.youtube.com/watch?v=fCxA9_k_g6s

Module Delivered in			
Programme Code	Programme	Semester	Delivery
CR_EEPSY_8	<u>Bachelor of Engineering (Honours) in Electrical Engineering</u>	4	Mandatory
CR_EELEC_7	<u>Bachelor of Engineering in Electrical Engineering</u>	4	Mandatory
CR_EELEC_6	<u>Higher Certificate in Engineering in Electrical Engineering</u>	4	Mandatory