Title:	Physical Computing APPROVED
Long Title:	Physical Computing

Module Code:	COMP6043	**Duration:**	1 Semester

Credits:	5
NFQ Level:	Fundamental
Field of Study:	Computer Science
Valid From:	Semester 1 - 2017/18 (September 2017)
Module Delivered in	**6 programme(s)**
Next Review Date:	June 2021
Module Coordinator:	Sean McSweeney
Module Author:	David Murphy
Module Description:	Physical computing refers to computer systems that can sense and respond to the analog world. This module studies the key elements that comprise such systems (e.g. sensors, actuators, microcontrollers, microprocessors, memory, and communication protocols), in addition to more general computer hardware topics such as storage and peripheral devices. Additionally, students will learn how to program such systems to interact with the physical environment and/or human interfaces.

Learning Outcomes	
On successful completion of this module the learner will be able to:	
LO1	Describe the operation and applications of fundamental electronic components.
LO2	Explain the process by which a digital computer system interacts with an analog physical environment.
LO3	Discuss the principal components that make up a computer system and how they are interconnected to achieve a level of functionality and performance.
LO4	Outline the common communication protocols used in computer systems, both over wired and wireless connections.
LO5	Design and build simple single-board computer and microcontroller-based applications that interact with the physical environment.

Pre-requisite learning
Incompatible Modules *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.*
No incompatible modules listed
Co-requisite Modules
No Co-requisite modules listed
Requirements *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.*
No requirements listed
Co-requisites
No Co Requisites listed

Module Content & Assessment

Indicative Content
Electronic Circuits and Components Basics of electricity, resistors, capacitors, inductors, diodes, transistors.
Analog/Digital Interface Analog/digital signals, ADCs, DACs, sensors (e.g. acoustic, accelerometers, gyroscopes, TPH, light, touchscreen, position, proximity), actuators (e.g. DC motors, servo motors, stepper motors, LCDs).
System Components and Architecture Memory, CPUs, I/O systems, storage devices, firmware (e.g. BIOS).
Communication Methods UART, SPI, I2C, WiFi, Bluetooth, Zigbee.
Physical Computing Applications Development of single-board computer and microcontroller-based applications to sense and control physical devices (e.g. using Raspberry Pis and/or Arduino kits). Applications may also require students to interconnect computer systems (e.g. interface a Raspberry Pi with an Arduino board) to build a larger system.

Assessment Breakdown	%
Course Work	50.00%
End of Module Formal Examination	50.00%

Course Work

Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Multiple Choice Questions	An in-class examination that will require the student to demonstrate understanding of electronic circuits and components, analog/digital interfaces, basic elements of a computer system and how a given microcontroller/SBC (e.g. Arduino and/or Raspberry Pi) may be used to sense and control physical devices.	1,2,3	25.0	Week 7
Practical/Skills Evaluation	Weekly assessed laboratory practicals developing physical computing applications. Laboratory practicals will require students to build input and output circuits to interface with a microcontroller and/or SBC, and program the microcontroller/SBC to achieve a given functionality.	1,2,5	25.0	Every Week

End of Module Formal Examination

Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Formal Exam	End of semester formal examination.	1,2,3,4,5	50.0	End-of-Semester

Reassessment Requirement
Repeat examination *Reassessment of this module will consist of a repeat examination. It is possible that there will also be a requirement to be reassessed in a coursework element.*

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

Module Workload

Workload: Full Time				
Workload Type	*Workload Description*	*Hours*	*Frequency*	*Average Weekly Learner Workload*
Lecture	Lectures delivering the theory underpinning the learning outcomes.	2.0	Every Week	2.00
Lab	Lab supporting the learning outcomes and content delivered in lectures.	2.0	Every Week	2.00
Independent & Directed Learning (Non-contact)	Independent study.	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				
Workload Type	*Workload Description*	*Hours*	*Frequency*	*Average Weekly Learner Workload*
Lecture	Lectures delivering the theory underpinning the learning outcomes.	2.0	Every Week	2.00
Lab	Lab supporting the learning outcomes and content delivered in lectures.	2.0	Every Week	2.00
Independent & Directed Learning (Non-contact)	Independent study.	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

- **Paul Scherz and Simon Monk 2016, *Practical Electronics for Inventors*, 4th Ed., McGraw-Hill Education TAB [ISBN: 9781259587542]**
- **Simon Monk 2017, *Electronics Cookbook: Practical Electronic Recipes with Arduino and Raspberry Pi*, 1st Ed., O'Reilly Media [ISBN: 9781491953402]**
- **David L. Tarnoff 2006, *Computer Organization and Design Fundamentals*, 1st Ed., Lulu.com [ISBN: 9781411636903]**

Supplementary Book Resources

- **John Boxall 2013, *Arduino Workshop: A Hands-On Introduction with 65 Projects*, 1st Ed., No Starch Press [ISBN: 9781593274481]**
- **Simon Monk 2016, *Raspberry Pi Cookbook: Software and Hardware Problems and Solutions*, 2nd Ed., O'Reilly Media [ISBN: 9781491939109]**
- **Simon Monk 2016, *Programming Arduino: Getting Started with Sketches*, 2nd Ed., McGraw-Hill Education TAB [ISBN: 9781259641633]**
- **Simon Monk 2015, *Programming the Raspberry Pi, Second Edition: Getting Started with Python*, 2nd Ed., McGraw-Hill Education TAB [ISBN: 9781259587405]**

This module does not have any article/paper resources

Other Resources

- **Website: *Sparkfun Tutorials***
  https://learn.sparkfun.com/tutorials/
- **Website: *Arduino Home Page***
  https://www.arduino.cc/
- **Website: *Raspberry Pi Home Page***
  https://www.raspberrypi.org/
- **E-book: *All About Circuits***
  http://www.allaboutcircuits.com/textbook /

Module Delivered in

Programme Code	Programme	Semester	Delivery
CR_KSDEV_8	Bachelor of Science (Honours) in Software Development	2	Mandatory
CR_KDNET_8	Bachelor of Science (Honours) in Computer Systems	2	Mandatory
CR_KITMN_8	Bachelor of Science (Honours) in IT Management	2	Mandatory
CR_KITSP_7	Bachelor of Science in Information Technology	2	Mandatory
CR_KCOMP_7	Bachelor of Science in Software Development	2	Mandatory
CR_KCOME_6	Higher Certificate in Science in Software Development	2	Mandatory