School of Engineering

ELEC2720: Introduction to Embedded Computing

Callaghan
Semester 1 - 2024

COURSE OUTLINE

OVERVIEW

Course Description

Students in ELEC2720 will learn about microcontrollers, their low level architecture, and the techniques of programming a microcontroller using the C programming language. Students will develop a practical product by programming a microcontroller with C and will learn to use modern peripheral devices used in embedded systems, including interrupt controllers, direct memory access, communication devices such as SPI and I2C. The assessments for this course are broken into a number of progressive practical assignments contributing towards a final demonstrable product. There will also be a final exam component to examine the basic concepts presented during the course. Students are encouraged to familiarise themselves with the materials available online. The lectorials and supervised laboratory sessions are interactive sessions for the students to discuss their questions with the instructors. The hardware required to complete the practical components of this course is readily available at low cost enabling inclined students to complete many of the activities off campus. All materials for this course will be available online prior to face to face sessions.

Academic Progress Requirements

Nil

Requisites

If you have successfully completed ELEC2700 you cannot enrol in this course.

Assumed Knowledge

ELEC1710 Digital and Computer Electronics 1, and ENGG1003 Introduction to Procedural Programming

Contact Hours

Callaghan
Laboratory
Face to Face On Campus
2 hour(s) per week(s) for 13 week(s) starting Week 1

Lectorial
Face to Face On Campus
2 hour(s) per week(s) for 13 week(s) starting Week 1

Lectorial
Face to Face On Campus
1 hour(s) per week(s) for 13 week(s) starting Week 1

Unit Weighting

10

Workload

Students are required to spend on average 120-140 hours of effort (contact and non-contact) including assessments per 10 unit course.

CONTACTS

Course Coordinator

Callaghan
A/Pr Lawrence Ong
Lawrence.Ong@newcastle.edu.au
0249215385
Consultation: By appointment

Teaching Staff

Other teaching staff will be advised on the course Canvas site.

School Office

School of Engineering
EAG02
EA Building
Callaghan
+61 2 4921 5798
9.00am-1.00pm and 2.00pm-5.00pm (Monday to Friday)

SYLLABUS

Course Content

1. Introduction to C programming
2. C programming for embedded systems
3. ARM architecture
4. Special function/configuration registers
5. Hardware interrupts and vector interrupt controller
6. Direct memory access
7. A/D converters
8. General purpose input-output ports and timers
9. Serial communication, I2C, SPI, Synchronous parallel interfaces
10. Introduction to Real Time Operating Systems

Course Learning Outcomes

On successful completion of this course, students will be able to:

1. Write C programs on PC and microcontrollers
2. Program microcontrollers for developing practical products
3. Configure peripheral devices using special function registers
4. Apply direct memory access for fast data transfer
5. Network a number of microcontrollers via an appropriate serial communication protocol like I2C, SPI, etc
6. Program A/D converters and general purpose input output ports on microcontrollers

Course Materials

Lecture Materials:

- Lecture materials will be posted on Canvas.

Other Resources:

- Other supporting material, including materials required to complete the assignments, will be posted on Canvas.

Recommended Text:

- Title: C How to Program
  Edition: 9th edition
  Author: Paul Deitel, Harvey Deitel
  Year: 2021
  Publisher: Pearson
  URL: https://www.pearson.com/store/p/c-how-to-program-global-edition/P100000101264/9781292110974
  ISBN-13: 9780137454372

- Title: Mastering STM32
  Author: Carmine Noviello
  Year: 2018
  Publisher: LeanPub
  URL: https://leanpub.com/mastering-stm32

ASSESSMENTS

This course has 6 assessments. Each assessment is described in more detail in the sections below.

	Assessment Name	Due Date	Involvement	Weighting	Learning Outcomes
1	Laboratory Assignment 1	11:55pm, Sunday 24/3/2024	Combination	10%	1, 3, 6
2	Laboratory Assignment 2	11:55pm, Sunday 7/4/2024	Combination	10%	1, 3, 5
3	Laboratory Assignment 3	11:55pm, Sunday 5/5/2024	Combination	15%	1, 3, 4
4	Laboratory Assignment 4	11:55pm, Sunday 19/5/2024	Combination	15%	1, 3, 4, 5, 6
5	Laboratory Assignment 5	11:55pm, Sunday 2/6/2024	Combination	20%	1, 2, 3, 4, 5, 6
6	Examination	During university examination period.	Individual	30%	1, 2, 3, 4, 5, 6

Late Submissions

The mark for an assessment item submitted after the designated time on the due date, without an approved extension of time, will be reduced by 10% of the possible maximum mark for that assessment item for each day or part day that the assessment item is late. Note: this applies equally to week and weekend days.

Assessment 1 - Laboratory Assignment 1

Assessment Type	Written Assignment
Purpose	To develop skills in C programming by completing a number of exercises.
Description	C Programming.
Weighting	10%
Due Date	11:55pm, Sunday 24/3/2024
Submission Method	Online Multiple-choice questions to be answered on Canvas.
Assessment Criteria	Correct answers to questions.
Return Method	Online
Feedback Provided	Online
Opportunity to Reattempt	Students WILL NOT be given the opportunity to reattempt this assessment.

Assessment 2 - Laboratory Assignment 2

Assessment Type	Written Assignment
Purpose	To use general purpose input/output functions and configure special function registers.
Description	General Purpose Input/Output.
Weighting	10%
Due Date	11:55pm, Sunday 7/4/2024
Submission Method	Online 1. Multiple-choice questions to be answered on Canvas. 2. Program source to be submitted on Canvas. Assessment will take place during normal laboratory sessions and includes a demonstration of the working program.
Assessment Criteria	1. Correct answers to questions. 2. Understanding of working code. Implementation of hardware functions. Quality of code.
Return Method	Online
Feedback Provided	Online
Opportunity to Reattempt	Students WILL NOT be given the opportunity to reattempt this assessment.

Assessment 3 - Laboratory Assignment 3

Assessment Type	Written Assignment
Purpose	To utilise interrupts and direct memory access for performing input/output functions.
Description	Interrupts and Direct Memory Access.
Weighting	15%
Due Date	11:55pm, Sunday 5/5/2024
Submission Method	Online 1. Multiple-choice questions to be answered on Canvas. 2. Program source to be submitted on Canvas. Assessment will take place during normal laboratory sessions and includes a demonstration of the working program.
Assessment Criteria	1. Correct answers to questions. 2. Understanding of working code. Implementation of hardware functions. Quality of code.
Return Method	Online
Feedback Provided	Online
Opportunity to Reattempt	Students WILL NOT be given the opportunity to reattempt this assessment.

Assessment 4 - Laboratory Assignment 4

Assessment Type	Written Assignment
Purpose	To interface with an analogue input.
Description	Analogue to Digital Conversion.
Weighting	15%
Due Date	11:55pm, Sunday 19/5/2024
Submission Method	Online 1. Multiple-choice questions to be answered on Canvas. 2. Program source to be submitted on Canvas. Assessment will take place during normal laboratory sessions and includes a demonstration of the working program.
Assessment Criteria	1. Correct answers to questions. 2. Understanding of working code. Implementation of hardware functions. Quality of code.
Return Method	Online
Feedback Provided	Online
Opportunity to Reattempt	Students WILL NOT be given the opportunity to reattempt this assessment.

Assessment 5 - Laboratory Assignment 5

Assessment Type	Written Assignment
Purpose	To develop an application that uses timers and serial communications.
Description	Serial Peripheral Interface, timer, and functions learned up to this point.
Weighting	20%
Due Date	11:55pm, Sunday 2/6/2024
Submission Method	Online Program source to be submitted on Canvas. Assessment will take place during normal laboratory sessions and includes a demonstration of the working program.
Assessment Criteria	Understanding of working code. Implementation of hardware functions. Quality of code.
Return Method	Online
Feedback Provided	Online
Opportunity to Reattempt	Students WILL NOT be given the opportunity to reattempt this assessment.

Assessment 6 - Examination

Assessment Type	Formal Examination
Purpose	To assess knowledge gained during the course.
Description	The formal exam will test all topics covered during the course. Questions will be drawn from lectures and assignments.
Weighting	30%
Length	2 hours
Due Date	During university examination period.
Submission Method	Formal Exam
Assessment Criteria	Details will be made available on the course Canvas site prior to the exam.
Return Method	Not Returned
Feedback Provided	No Feedback
Opportunity to Reattempt	Students WILL NOT be given the opportunity to reattempt this assessment.

ADDITIONAL INFORMATION

Grading Scheme

This course is graded as follows:

Range of Marks	Grade	Description
85-100	High Distinction (HD)	Outstanding standard indicating comprehensive knowledge and understanding of the relevant materials; demonstration of an outstanding level of academic achievement; mastery of skills*; and achievement of all assessment objectives.
75-84	Distinction (D)	Excellent standard indicating a very high level of knowledge and understanding of the relevant materials; demonstration of a very high level of academic ability; sound development of skills*; and achievement of all assessment objectives.
65-74	Credit (C)	Good standard indicating a high level of knowledge and understanding of the relevant materials; demonstration of a high level of academic achievement; reasonable development of skills*; and achievement of all learning outcomes.
50-64	Pass (P)	Satisfactory standard indicating an adequate knowledge and understanding of the relevant materials; demonstration of an adequate level of academic achievement; satisfactory development of skills*; and achievement of all learning outcomes.
0-49	Fail (FF)	Failure to satisfactorily achieve learning outcomes. If all compulsory course components are not completed the mark will be zero. A fail grade may also be awarded following disciplinary action.

*Skills are those identified for the purposes of assessment task(s).

Communication Methods

Communication methods used in this course include:

- Canvas Course Site: Students will receive communications via the posting of content or announcements on the Canvas course site.
- Email: Students will receive communications via their student email account.
- Face to Face: Communication will be provided via face to face meetings or supervision.

Course Evaluation

Each year feedback is sought from students and other stakeholders about the courses offered in the University for the purposes of identifying areas of excellence and potential improvement.

Oral Interviews (Vivas)

As part of the evaluation process of any assessment item in this course an oral examination (viva) may be conducted. The purpose of the oral examination is to verify the authorship of the material submitted in response to the assessment task. The oral examination will be conducted in accordance with the principles set out in the Oral Examination (viva) Procedure. In cases where the oral examination reveals the assessment item may not be the student's own work the case will be dealt with under the Student Conduct Rule.

Academic Misconduct

All students are required to meet the academic integrity standards of the University. These standards reinforce the importance of integrity and honesty in an academic environment. Academic Integrity policies apply to all students of the University in all modes of study and in all locations. For the Student Academic Integrity Policy, refer to https://policies.newcastle.edu.au/document/view-current.php?id=35.

Adverse Circumstances

The University acknowledges the right of students to seek consideration for the impact of allowable adverse circumstances that may affect their performance in assessment item(s). Applications for special consideration due to adverse circumstances will be made using the online Adverse Circumstances system where:

1. the assessment item is a major assessment item; or
2. the assessment item is a minor assessment item and the Course Co-ordinator has specified in the Course Outline that students may apply the online Adverse Circumstances system;
3. you are requesting a change of placement; or
4. the course has a compulsory attendance requirement.

Before applying you must refer to the Adverse Circumstance Affecting Assessment Items Procedure available at:
https://policies.newcastle.edu.au/document/view-current.php?id=236

Important Policy Information

The Help button in the Canvas Navigation menu contains helpful information for using the Learning Management System. Students should familiarise themselves with the policies and procedures at https://www.newcastle.edu.au/current-students/respect-at-uni/policies-and-procedures that support a safe and respectful environment at the University.

This course outline was approved by the Head of School on 30.01.2024. No alteration of this course outline is permitted without Head of School approval. If a change is approved, students will be notified and an amended course outline will be provided in the same manner as the original.

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Graduate Profile Statements – ELEC2720 – S1 2024

This course builds students' capacity in the following University of Newcastle Bachelor of Engineering Graduate Profile Statements (based on 2011 Engineers Australia revised Stage 1 Competency Standards for Professional Engineers):

UON Att.	University of Newcastle Bachelor of Engineering Graduate Profile Statements/ Engineers Australia Stage 1 competency statements	Taught	Practised	Assessed	Skill Level (1-4)
	Professional Attributes				
11	3.1. Ethical conduct and professional accountability				
12	3.2. Effective oral and written communication in professional and lay domains.				
13	3.3. Creative, innovative and pro-active demeanour.		☑	☑	2
14	3.4. Professional use and management of information.	☑	☑	☑	2
15	3.5. Orderly management of self, and professional conduct.				
16	3.6. Effective team membership and team leadership.				
	Engineering Ability				
7	2.1. Application of established engineering methods to complex engineering problem solving.	☑	☑	☑	2
8	2.2. Fluent application of engineering techniques, tools and resources.				
9	2.3. Application of systematic engineering synthesis and design processes.	☑	☑	☑	2
10	2.4. Application of systematic approaches to the conduct and management of engineering projects.		☑	☑	2
	Knowledge Base				
1	1.1. Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline.				
2	1.2. Conceptual understanding of the, mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline.				
3	1.3. In-depth understanding of specialist bodies of knowledge within the engineering discipline.	☑	☑	☑	3
4	1.4. Discernment of knowledge development and research directions within the engineering discipline.	☑	☑	☑	2
5	1.5. Knowledge of contextual factors impacting the engineering discipline.				
6	1.6. Understanding of the scope, principles, norms, accountabilities and bounds of contemporary engineering practice in the specific discipline.				