ELEC3042

Embedded Systems

Session 1, In person-scheduled-weekday, North Ryde 2024

School of Engineering

Contents

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General Information

Unit convenor and teaching staff
Unit Convenor
Alan Kan
alan.kan@mq.edu.au
Contact via Private message on iLearn
Level 1, 50 Waterloo Road
Wed 4-5 pm

Unit Convenor
Rex Di Bona
rex.dibona@mq.edu.au
Contact via Private message on iLearn
Level 1, 50 Waterloo Road
Wed 11-12 am

Credit points
10

Prerequisites
(130cp at 1000 level or above including ELEC2042 or ELEC242 or ELEC241 or MTRN2060 or ELEC260)

Corequisites

Co-badged status

Unit description
Project-based unit. Students complete a major project that emphasize aspects of digital computing systems, including state machines, digital data processing, arithmetic processing, timing, internal and external peripherals. Students will design a program for a microcontroller that will perform processing of real world data to achieve a defined aim. This programming exercise will be used to explore the complexities that make up digital hardware designs.

Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at https://www.mq.edu.au/study/calendar-of-dates

Learning Outcomes

On successful completion of this unit, you will be able to:

ULO1: Describe the various components that comprise a modern embedded system, including those that are essential and those that are optional.

ULO2: Distinguish between the different external and internal interfaces and select which is most appropriate for a given circumstance.

ULO3: Interface a CPU with both internal and external functional units.

ULO4: Program an embedded system in either the assembly or C languages.

ULO5: Construct state machines on an embedded system

General Assessment Information

Grading and passing requirement for unit

There are weekly pre-lab quizzes, two larger quizzes, and two projects that need to be completed for assessment. In order to pass this unit, a student must submit all assements and obtain a total mark of 50 or more for the unit (i.e. obtain a passing grade P/ CR/ D/ HD), and achieve at least 50% in Quiz 2 and the Major Project Defence.

For further details about grading, please refer below in the policies and procedures section.

Hurdle Requirements

Quiz 2 assesses the basic skills needed to make a successful attempt at the Major project. Failing to score a grade of 50% or more in the quiz indicates that the student has fallen too far behind to likely to be successful at completing the Major project. At this point, the student is advised to withdraw from the unit. However, if the student remains determined to complete the unit and as a result, passes the Major Project Defense hurdle on the first attempt (described below), the student will be deemed as having passed this hurdle requirement despite not obtaining a mark of 50%.

The Major Project Defence is an oral examination of the student's ability to explain their final design and implementation of the major project, and justify how their work meets the requirements of the specified task. However, if a student fails to pass the minimum required mark at the first attempt but has passed all other assessments in the unit, you will be offered a second attempt at the Major Project Defence during the supplementary examination period. You will be notified of the exact day and time after the publication of final results for the unit. Prior to the second attempt, you may be required to complete additional work on the Major Project to demonstrate that you have achieved the learning outcomes. The second attempt will be graded as a pass/fail and the maximum grade for the second attempt is the hurdle threshold grade.

Late submissions and Resubmissions

Resubmission of work is not allowed.

Unless a Special Consideration request has been submitted and approved, a 5% penalty (of the total possible mark of the task) will be applied for each day a written report or presentation assessment is not submitted, up until the 7th day (including weekends). After the 7th day, a grade of '0' will be awarded even if the assessment is submitted. The submission time for all uploaded assessments is 11:55 pm. A 1-hour grace period will be provided to students who

experience a technical concern. **You should contact your convenor through iLearn for any anticipated issues that might prevent you from a timely submission of work.**

Re-submission for any submitted and/or graded work will not be allowed.

For any late submission of time-sensitive tasks, such as scheduled tests/exams, performance assessments/presentations, and/or scheduled practical assessments/labs, please apply for Special Consideration. Detailed list of assessments where late submissions WILL be accepted but standard late penalties will apply: *Minor Project Report*

Detailed list of assessments where late submissions WILL NOT be accepted unless Special Consideration is granted: *Quiz 1, Minor Project, Quiz 2, Major Project Design Review, Major Project Code and Demonstration, Major Project Defence.*

Special Consideration

The Special Consideration Policy aims to support students who have been impacted by short-term circumstances or events that are serious, unavoidable and significantly disruptive, and which may affect their performance in assessment. If you experience circumstances or events that affect your ability to complete the assessments in this unit on time, please inform the convenor and submit a Special Consideration request through ask.mq.edu.au.

Assessment Tasks

Name	Weighting	Hurdle	Due
Quiz 1	5%	No	Week 4
Minor project	20%	No	Week 7
Quiz 2	15%	Yes	Week 8
Major Project Design Review	5%	No	Week 9
Product Demonstration	10%	No	Week 13
Major Project Defence	25%	Yes	Week 13
Pre-work Quiz	20%	No	Weekly

Quiz 1

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 2 hours
Due: **Week 4**
Weighting: **5%**

Quiz 1 covers the work covered in the first few weeks of the unit. It ensures the foundation

information is grasped and any shortfalls are caught before the projects commence.

On successful completion you will be able to:

- Describe the various components that comprise a modern embedded system, including those that are essential and those that are optional.
- Distinguish between the different external and internal interfaces and select which is most appropriate for a given circumstance.

Minor project

Assessment Type [1]: Project
Indicative Time on Task [2]: 15 hours
Due: **Week 7**
Weighting: **20%**

The minor project allows the student to present a project that they have been working on. It is used to provide experience for the major project, and is an important milestone to achieving the learning outcomes.

Both the documentation and the code will be graded separately

On successful completion you will be able to:

- Interface a CPU with both internal and external functional units.
- Program an embedded system in either the assembly or C languages.
- Construct state machines on an embedded system

Quiz 2

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 2 hours
Due: **Week 8**
Weighting: **15%**
This is a hurdle assessment task (see assessment policy for more information on hurdle assessment tasks)

This Quiz will be a reprise of the information learnt in the unit so far. It will allow students to demonstrate they are at a stage to demonstrate their competence of the skills necessary for the final project.

On successful completion you will be able to:

- Describe the various components that comprise a modern embedded system, including those that are essential and those that are optional.
- Distinguish between the different external and internal interfaces and select which is most appropriate for a given circumstance.
- Interface a CPU with both internal and external functional units.
- Program an embedded system in either the assembly or C languages.

Major Project Design Review

Assessment Type [1]: Design Task
Indicative Time on Task [2]: 10 hours
Due: **Week 9**
Weighting: **5%**

The design review requires the student to present their design for the major project. This design must be complete and will be verified during the final Major Project Defence,

On successful completion you will be able to:

- Distinguish between the different external and internal interfaces and select which is most appropriate for a given circumstance.
- Interface a CPU with both internal and external functional units.
- Construct state machines on an embedded system

Product Demonstration

Assessment Type [1]: Demonstration
Indicative Time on Task [2]: 13 hours
Due: **Week 13**
Weighting: **10%**

This is a public demonstration of the major project. Each student's code will be run on the provided system and a grade will be awarded based on functionality observed.

On successful completion you will be able to:

- Interface a CPU with both internal and external functional units.

- Program an embedded system in either the assembly or C languages.

- Construct state machines on an embedded system

Major Project Defence

Assessment Type [1]: Viva/oral examination
Indicative Time on Task [2]: 35 hours
Due: **Week 13**
Weighting: **25%**
This is a hurdle assessment task (see assessment policy for more information on hurdle assessment tasks)

In this defence the student must describe the final design and justify why it will solve the requirements of the major project. The design at this stage must be functionally complete and a prototype should be working.

On successful completion you will be able to:

- Distinguish between the different external and internal interfaces and select which is most appropriate for a given circumstance.

- Interface a CPU with both internal and external functional units.

- Program an embedded system in either the assembly or C languages.

- Construct state machines on an embedded system

Pre-work Quiz

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 5 hours
Due: **Weekly**
Weighting: **20%**

Periodic quiz to cover understanding before critical practical exercises

On successful completion you will be able to:

- Interface a CPU with both internal and external functional units.

- Program an embedded system in either the assembly or C languages.

[1] If you need help with your assignment, please contact:

- the academic teaching staff in your unit for guidance in understanding or completing this type of assessment

- the Writing Centre for academic skills support.

[2] Indicative time-on-task is an estimate of the time required for completion of the assessment task and is subject to individual variation

Delivery and Resources

This unit consists of one lecture and one practical sessions per week, starting in Week 1 on campus. Attendance of all lectures and practical sessions is important for successful completion of this unit. Students should plan for in-person attendance each week. Important information regarding unit content and assessments are given during lectures and practical sessions. Students are expected to watch the video recordings on iLearn if they miss a lecture. At times, video recordings of important information conveyed during practical sessions will also be uploaded. Students are expected to watch these when they are made available.

Time-sensitive information and reminders will also be conveyed using iLearn Announcements. Students are expected to read all announcements regularly.

All students are expected to have their own Arduino Uno and select electronic components. A kit of parts is available for purchase from the University at less than cost price, or the student can bring their own kit as long as it has an Arduino Uno and sufficient components. A list of required components will be supplied on iLearn. Students will also need a laptop computer with MPLab X IDE and Arduino software installed. It is preferable that the computer be running Windows 10. Students with Mac laptops are highly encouraged to install Boot Camp and run Windows 10 natively. You will also need access to Zoom for the oral examination.

A list of recommended textbooks can be found on Leganto or in iLearn. Students will also need to refer to component datasheets which will be provided on iLearn.

If students require additional help with understanding of unit material or clarification of assessment requirements when studying at home, the student should post their question to the General Discussion Forum on iLearn. Unit convenors will typically answer these questions within one-two business days. All students are expected to read these posts and are encouraged to contribute to the discussion by answering each others questions. Please do not email questions to unit convenors or use the Private Message on iLearn feature. You will likely be re-directed to post your question to the General Discussion Forum which will delay the time you will receive an answer. Students may also seek face-to-face consultation during the consultation time shown on iLearn. Please notify the unit convenors through a Private Message on iLearn if you would like a face-to-face consultation.

Students experiencing personal hardship should contact the unit convenors through a Private Message on iLearn to discuss how we can support your progress through your studies of this unit.

For the latest information on the University's response to COVID-19, please refer to the Coronavirus infection page on the Macquarie website: https://www.mq.edu.au/about/coronavirus-

faqs. Remember to check this page regularly in case the information and requirements change during semester. If there are any changes to this unit in relation to COVID, these will be communicated via iLearn.

Unit Schedule

This unit covers embedded systems programming in C, state machines, timers and interrupts, ADC, and interfacing with external peripheral using standard protocols such as UART, SPI and I2C.

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (https://policies.mq.edu.au). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- Academic Appeals Policy
- Academic Integrity Policy
- Academic Progression Policy
- Assessment Policy
- Fitness to Practice Procedure
- Assessment Procedure
- Complaints Resolution Procedure for Students and Members of the Public
- Special Consideration Policy

Students seeking more policy resources can visit Student Policies (https://students.mq.edu.au/support/study/policies). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

To find other policies relating to Teaching and Learning, visit Policy Central (https://policies.mq.edu.au) and use the search tool.

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/admin/other-resources/student-conduct

Results

Results published on platform other than eStudent, (eg. iLearn, Coursera etc.) or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in eStudent. For more information visit ask.mq.edu.au or if you are a Global MBA student contact globalmba.support@mq.edu.au

Academic Integrity

At Macquarie, we believe academic integrity – honesty, respect, trust, responsibility, fairness and courage – is at the core of learning, teaching and research. We recognise that meeting the

expectations required to complete your assessments can be challenging. So, we offer you a range of resources and services to help you reach your potential, including free online writing and maths support, academic skills development and wellbeing consultations.

Student Support

Macquarie University provides a range of support services for students. For details, visit http://students.mq.edu.au/support/

The Writing Centre

The Writing Centre provides resources to develop your English language proficiency, academic writing, and communication skills.

- Workshops
- Chat with a WriteWISE peer writing leader
- Access StudyWISE
- Upload an assignment to Studiosity
- Complete the Academic Integrity Module

The Library provides online and face to face support to help you find and use relevant information resources.

- Subject and Research Guides
- Ask a Librarian

Student Services and Support

Macquarie University offers a range of Student Support Services including:

- IT Support
- Accessibility and disability support with study
- Mental health support
- Safety support to respond to bullying, harassment, sexual harassment and sexual assault
- Social support including information about finances, tenancy and legal issues
- Student Advocacy provides independent advice on MQ policies, procedures, and processes

Student Enquiries

Got a question? Ask us via AskMQ, or contact Service Connect.

IT Help

For help with University computer systems and technology, visit http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/.

When using the University's IT, you must adhere to the Acceptable Use of IT Resources Policy. The policy applies to all who connect to the MQ network including students.

Changes from Previous Offering

Pre-lab quizzes have been introduced so that students can test their understanding of the material prior to attempting pratical exercises. Some major project assessment task weightings have been reduced.

Engineers Australia Competency Mapping

EA Competency Standard		Unit Learning Outcomes
Knowledge and Skill Base	1.1 Comprehensive, theory-based understanding of the underpinning fundamentals applicable to the engineering discipline.	1
	1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing.	1
	1.3 In-depth understanding of specialist bodies of knowledge	1
	1.4 Discernment of knowledge development and research directions	
	1.5 Knowledge of engineering design practice	2
	1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice.	
Engineering Application Ability	2.1 Application of established engineering methods to complex problem solving	1,3,4,5
	2.2 Fluent application of engineering techniques, tools and resources.	4,5
	2.3 Application of systematic engineering synthesis and design processes.	4,5
	2.4 Application of systematic approaches to the conduct and management of engineering projects.	
Professional and Personal Attributes	3.1 Ethical conduct and professional accountability.	
	3.2 Effective oral and written communication in professional and lay domains.	
	3.3 Creative, innovative and pro-active demeanour.	
	3.4 Professional use and management of information.	
	3.5 Orderly management of self, and professional conduct.	
	3.6 Effective team membership and team leadership	

Unit information based on version 2024.03 of the Handbook