ENEX20001 *Embedded System Design*
Term 1 - 2020

Profile information current as at 26/04/2024 02:47 pm

All details in this unit profile for ENEX20001 have been officially approved by CQUniversity and represent a learning partnership between the University and you (our student). The information will not be changed unless absolutely necessary and any change will be clearly indicated by an approved correction included in the profile.

General Information

Overview
This unit will introduce you to microcontroller basics and their real world applications. You will learn about different microcontroller families and their similarities and differences from an application point of view. You will also learn about microcontroller architecture, memory maps, addressing modes, interrupts, timers, counters, and hardware interfacing of a chosen microcontroller. You will learn how to program a microcontroller in a high level language using an integrated development environment. Advanced topics of reading analog inputs, implementation of USART (Universal Synchronous Asynchronous Receiver Transmitter) connections with external world, PWM (Pulse Width Modulation), will also be covered in this unit. After learning the fundamentals of hardware interfacing you will practice them in a laboratory using a microcontroller development system based on this specific microcontroller and finally design and prototype an authentic application of embedded system in your project using the same development system. Online education students are required to attend the residential school.

Details
Career Level: *Postgraduate*
Unit Level: *Level 8*
Credit Points: *12*
Student Contribution Band: *8*
Fraction of Full-Time Student Load: *0.25*

Pre-requisites or Co-requisites
ENEE14006 Embedded Microcontrollers is an Anti-Requisite for this unit
Important note: Students enrolled in a subsequent unit who failed their pre-requisite unit, should drop the subsequent unit before the census date or within 10 working days of Fail grade notification. Students who do not drop the unit in this timeframe cannot later drop the unit without academic and financial liability. See details in the Assessment Policy and Procedure (Higher Education Coursework).

Offerings For Term 1 - 2020

- Melbourne
- Perth
- Rockhampton

Attendance Requirements
All on-campus students are expected to attend scheduled classes – in some units, these classes are identified as a mandatory (pass/fail) component and attendance is compulsory. International students, on a student visa, must maintain a full time study load and meet both attendance and academic progress requirements in each study period (satisfactory attendance for International students is defined as maintaining at least an 80% attendance record).

Residential Schools
This unit has a Compulsory Residential School for distance mode students and the details are:
Click here to see your Residential School Timetable.

Website
This unit has a website, within the Moodle system, which is available two weeks before the start of term. It is important that you visit your Moodle site throughout the term. Please visit Moodle for more information.

Class and Assessment Overview

Recommended Student Time Commitment

Each 12-credit Postgraduate unit at CQUniversity requires an overall time commitment of an average of 25 hours of study per week, making a total of 300 hours for the unit.

Class Timetable

Regional Campuses
Bundaberg, Cairns, Emerald, Gladstone, Mackay, Rockhampton, Townsville

Metropolitan Campuses
Adelaide, Brisbane, Melbourne, Perth, Sydney

Assessment Overview

1. **Online Quiz(zes)**
Weighting: Pass/Fail
2. **Written Assessment**
Weighting: 20%
3. **Practical Assessment**
Weighting: 20%
4. **Practical Assessment**
Weighting: 20%
5. **Portfolio**
Weighting: 40%

Assessment Grading

This is a graded unit: your overall grade will be calculated from the marks or grades for each assessment task, based on the relative weightings shown in the table above. You must obtain an overall mark for the unit of at least 50%, or an overall grade of 'pass' in order to pass the unit. If any 'pass/fail' tasks are shown in the table above they must also be completed successfully ('pass' grade). You must also meet any minimum mark requirements specified for a particular assessment task, as detailed in the 'assessment task' section (note that in some instances, the minimum mark for a task may be greater than 50%). Consult the University's Grades and Results Policy for more details of interim results and final grades.

CQUniversity Policies

All University policies are available on the CQUniversity Policy site.
You may wish to view these policies:

- Grades and Results Policy
- Assessment Policy and Procedure (Higher Education Coursework)
- Review of Grade Procedure
- Student Academic Integrity Policy and Procedure
- Monitoring Academic Progress (MAP) Policy and Procedure – Domestic Students
- Monitoring Academic Progress (MAP) Policy and Procedure – International Students
- Student Refund and Credit Balance Policy and Procedure
- Student Feedback – Compliments and Complaints Policy and Procedure
- Information and Communications Technology Acceptable Use Policy and Procedure

This list is not an exhaustive list of all University policies. The full list of University policies are available on the CQUniversity Policy site.

Previous Student Feedback

Feedback, Recommendations and Responses

Every unit is reviewed for enhancement each year. At the most recent review, the following staff and student feedback items were identified and recommendations were made.

Feedback from 'Have your say' Survey

Feedback
The unit is well designed and ran well.

Recommendation
The structure of the unit will remain the same.

Feedback from 'Have your say' Survey

Feedback
The support provided by the Unit Coordinator during the workshops helped a lot for students gain knowledge.

Recommendation
The intensive workshops will be continued.

Feedback from Discussion with teaching team

Feedback
The weekly workshop provided a good opportunity for the students to discuss their issues with the lecturer and tech staff.

Recommendation
The Zoom meeting during the workshop time and campus visits will be continued.

Feedback from 'Have your say' Survey

Feedback
More on-campus staff support is highly appreciated.

Recommendation
Weekly tutorial sessions will be run.

Unit Learning Outcomes

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

1. Apply fundamental structured programming knowledge to perform software tasks
2. Program a microcontroller to interface with external devices such as analog and digital sensors, actuators and computers
3. Analyse and design microcontroller based real-time applications using a given industry standard development system and software tools
4. Prototype an embedded microcontroller system for a real world application
5. Communicate professionally using relevant technical terminology, symbols, and diagrams and effectively document design and prototyped solutions
6. Work autonomously and as a team member to analyse problems and present solutions.

Learning outcomes will be linked to Engineers Australia Stage 1 Competency Standard for Professional Engineers.

Alignment of Learning Outcomes, Assessment and Graduate Attributes

— N/A Level · Introductory Level · Intermediate Level · Graduate Level · Professional Level · Advanced Level

Alignment of Assessment Tasks to Learning Outcomes

Assessment Tasks	Learning Outcomes					
	1	2	3	4	5	6
1 - Online Quiz(zes) - 0%	•					
2 - Written Assessment - 20%	•					
3 - Practical Assessment - 20%		•				
4 - Practical Assessment - 20%			•	•	•	•
5 - Portfolio - 40%	•	•	•	•	•	•

Alignment of Graduate Attributes to Learning Outcomes

Graduate Attributes	Learning Outcomes					
	1	2	3	4	5	6
1 - Knowledge	○	○	○	○	○	○
2 - Communication	○		○	○	○	○
3 - Cognitive, technical and creative skills		○	○	○		○
4 - Research		○	○	○	○	○
5 - Self-management				○		○
6 - Ethical and Professional Responsibility	○	○	○	○	○	○
7 - Leadership						○
8 - Aboriginal and Torres Strait Islander Cultures						

Alignment of Assessment Tasks to Graduate Attributes

Assessment Tasks	Graduate Attributes							
	1	2	3	4	5	6	7	8
1 - Online Quiz(zes) - 0%	○							
2 - Written Assessment - 20%	○	○	○		○	○		
3 - Practical Assessment - 20%	○	○	○	○	○	○		
4 - Practical Assessment - 20%	○	○	○	○	○	○		
5 - Portfolio - 40%	○	○	○	○	○	○	○	

Textbooks and Resources

Textbooks

There are no required textbooks.

Additional Textbook Information
No prescribed text, but encouraged to follow online C language tutorials at their own phase at the beginning.

IT Resources

You will need access to the following IT resources:

- CQUniversity Student Email
- Internet
- Unit Website (Moodle)
- Access to a document scanner and a software that can create pdf documents.
- A computer with 9 pin serial port or USB to serial converter, speaker & microphone, Microsoft Windows OS(7 or later) with admin rights to install software, and good internet connectivity
- Code::Blocks IDE for C programming (freeware from www.codeblocks.org)
- MPLAB IDE: MPALB X (provided by CQU on lab computers) or later and MCC18 C compiler(free download from Microchip website)

Referencing Style

All submissions for this unit must use the referencing style: Harvard (author-date)
For further information, see the Assessment Tasks.

Teaching Contacts

Lasi Piyathilaka Unit Coordinator
l.piyathilaka@cqu.edu.au

Schedule

Week 1 - 09 Mar 2020

Module/Topic	Chapter	Events and Submissions/Topic
• Introduction to Embedded Systems and Microcontrollers • Introduction to programming languages • Introduction to C language Programming environment	N/A	

Week 2 - 16 Mar 2020

Module/Topic	Chapter	Events and Submissions/Topic
• Programming in C language - Fundamentals	N/A	**Pre-test** Due: Week 2 Friday (20 Mar 2020) 11:45 pm AEST

Week 3 - 23 Mar 2020

Module/Topic	Chapter	Events and Submissions/Topic
• PIC Microcontroller and MPLAB X - Introduction • Programming in C language - Essentials I	N/A	

Week 4 - 30 Mar 2020

Module/Topic	Chapter	Events and Submissions/Topic
• PIC 18F4321 Memory, input and output • Programming in C language - Essentials II	N/A	

Week 5 - 06 Apr 2020

Module/Topic	Chapter	Events and Submissions/Topic
• PIC18F4321 Architecture and addressing modes • Programming in C language - Intermediate level	N/A	**C LANGUAGE PROGRAMMING** Due: Week 5 Friday (10 Apr 2020) 11:45 pm AEST

Vacation Week - 13 Apr 2020

Module/Topic	Chapter	Events and Submissions/Topic

Week 6 - 20 Apr 2020

Module/Topic	Chapter	Events and Submissions/Topic
• PIC 18F4321 hardware interfacing I - LCD Display units, Timers and Counters	N/A	

Week 7 - 27 Apr 2020

Module/Topic	Chapter	Events and Submissions/Topic
• PIC 18F4321 hardware interfacing II - Sensors (analog and Digital)	N/A	

Week 8 - 04 May 2020

Module/Topic	Chapter	Events and Submissions/Topic
• PIC 18F4321 hardware interfacing III - Motors and actuators	N/A	**HARDWARE PROGRAMMING USING CQU PIC DEVELOPMENT KIT** Due: Week 8 Friday (8 May 2020) 11:45 pm AEST

Week 9 - 11 May 2020

Module/Topic	Chapter	Events and Submissions/Topic
• PIC 18F4321 hardware interfacing IV - keypads, ultrasound sensors, advanced sensors	N/A	

Week 10 - 18 May 2020

Module/Topic	Chapter	Events and Submissions/Topic
• PIC18F4321 communication - RS232, I2C, SPI	N/A	**LABORATORY PRACTICALS** Due: Week 10 Friday (22 May 2020) 11:45 pm AEST

Week 11 - 25 May 2020

Module/Topic	Chapter	Events and Submissions/Topic
• Introduction to Assembly language programming	N/A	

Week 12 - 01 Jun 2020

Module/Topic	Chapter	Events and Submissions/Topic
• Embedded microcontroller future opportunities	N/A	**PORTFOLIO** Due: Week 12 Friday (5 June 2020) 11:45 pm AEST

Review/Exam Week - 08 Jun 2020

Module/Topic	Chapter	Events and Submissions/Topic

Exam Week - 15 Jun 2020

Module/Topic	Chapter	Events and Submissions/Topic

Assessment Tasks

1 Pre-test

Assessment Type
Online Quiz(zes)

Task Description
This assessment is designed to check the basic knowledge of the students about the embedded system design. Although there is no minimum pass mark to continue studying this unit, for the students who score lower marks in this assessment, additional support will be arranged to bring their fundamental knowledge up to speed with the expectations of this unit. The content of this assessment will be based on the fundamental knowledge of embedded system design which students must have acquired during their undergraduate studies. The test date will be announced in advance and will be within Week 02 of the term.

Number of Quizzes

Frequency of Quizzes

Assessment Due Date
Week 2 Friday (20 Mar 2020) 11:45 pm AEST
The test date will be announced in advanced and will be within Week 02 of the term.

Return Date to Students
Week 2 Friday (20 Mar 2020)
Students will know the test outcomes soon after completion.

Weighting
Pass/Fail

Assessment Criteria
This will be an online quiz with every question formulated as a multiple choice question. Each question will carry equal marks.

Referencing Style

- Harvard (author-date)

Submission
Online

Learning Outcomes Assessed

- Apply fundamental structured programming knowledge to perform software tasks

Graduate Attributes

- Knowledge

2 C LANGUAGE PROGRAMMING

Assessment Type
Written Assessment

Task Description
This assignment is based on C language programming. The essential C language skills needed for embedded microcontroller programming will be tested here and students should develop their own solutions to the given problems. Try to analyse the system first and develop a concept solution, develop a graphical representation of it first before start coding. All evidence of your own work including a soft copy of your workbook should be provided as evidence.
This is an individual assessment item and no teamwork or contribution from others allowed.

Assessment Due Date
Week 5 Friday (10 Apr 2020) 11:45 pm AEST

Return Date to Students
Week 7 Monday (27 Apr 2020)
Marked assignment with feedback. However, there will be no model answers provided. We strive to return assessments within 2 weeks after due date.

Weighting
20%

Assessment Criteria
Detailed assessment criteria is in the assignment itself.
This assignment is based on C language programming skills. To obtain full marks students must provide all in detail problem solving and solution development evidences. Each student must have their unique programs developed by themselves. Answer to every problem should include a flowchart / NS-diagram or other similar graphical representation of the solution. Students should submit the complete working C language code for each question. A clean working program as the answer to a question without evidence of development of it(ex: without a soft copy of workbook pages relevant to it) will receive a maximum of 50% of the allocated marks for that question.

Referencing Style

- Harvard (author-date)

Submission
Online

Submission Instructions
Online submission as a single WORD file and complete program listing for each question to be included in the answer. The program listings should be able to compile without modifications when copied and pasted on Code:Blocs compiler's editor.

Learning Outcomes Assessed

- Apply fundamental structured programming knowledge to perform software tasks

Graduate Attributes

- Knowledge
- Communication
- Cognitive, technical and creative skills
- Self-management
- Ethical and Professional Responsibility

3 HARDWARE PROGRAMMING USING CQU PIC DEVELOPMENT KIT

Assessment Type
Practical Assessment

Task Description
This assignent is based on essential C language programming skills needed for embedded microcontroller programming. The embedded hardware programming skills will be tested here and students should develop their own solutions to the given problems. Try to analyse the system first and develop a concept solution, develop a graphical representation of it first before start coding. All evidence of your own work including a soft copy of your workbook should be provided as evidence.
This assignment is based on CQU PIC development board and all programs must be developed with MPLAB X IDE and in C language. More technical details will be provided with the assignment.
This is an individual assessment item and no teamwork or contribution from others allowed.

Assessment Due Date
Week 8 Friday (8 May 2020) 11:45 pm AEST

Return Date to Students
Week 10 Friday (22 May 2020)
Marked assignment with feedback. However, there will be no model answers provided. We strive to return assessments within 2 weeks after due date.

Weighting
20%

Assessment Criteria
Detailed assessment criteria are included in the assignment itself.
To obtain full marks students must provide all in detail problem solving and solution development evidences. Each student must have their unique programms developed by themselves. Answer to every problem should include a flowchart / NS-diagram or other similar graphical representation of the solution. Students should submit the complete working C language code for each question. A clean working program as the answer to a question without evidence of development of it(ex: a soft copy of workbook pages relevant to it or explanation os your code) will receive a maximum of 50% of the allocated marks for that question.

Referencing Style

- Harvard (author-date)

Submission
Online

Submission Instructions
Online submission as a single WORD file and program listing for each question included in this file. The copy and pasted C code from your submission should run on MPBAB X MCC18 C compiler without modifications.

Learning Outcomes Assessed

- Program a microcontroller to interface with external devices such as analog and digital sensors, actuators and computers

Graduate Attributes

- Knowledge
- Communication
- Cognitive, technical and creative skills
- Research
- Self-management
- Ethical and Professional Responsibility

4 LABORATORY PRACTICALS

Assessment Type
Practical Assessment

Task Description
This is a collection of laboratory practical exercises that each student needs to complete during lab/workshop time. A practical report must be submitted by individuals. Laboratory tasks will be made available during the laboratory classes. This assignment is based on PIC 18F4321 and all programs must be developed with MPLAB X IDE and in C language. More technical details will be provided with the assignment.
This is an individual assessment item and no teamwork or contribution from others allowed.

Assessment Due Date
Week 10 Friday (22 May 2020) 11:45 pm AEST

Return Date to Students
Week 12 Monday (1 June 2020)

Weighting
20%

Minimum mark or grade
50% of the allocated marks for this assessment.

Assessment Criteria
To obtain full marks students must provide all in detail problem solving and solution development evidences. Each student must have their unique programms developed by themselves. Answer to every problem should include a flow chart/ NS diagram or other similar graphical representation of the solution. A clean working program as the answer to a question without evidence of development of it (ex: a soft copy of workbook pages relevant to it) will receive a maximum of 50% of the allocated marks for that question.

Referencing Style

- Harvard (author-date)

Submission
Online

Learning Outcomes Assessed

- Analyse and design microcontroller based real-time applications using a given industry standard development system and software tools
- Prototype an embedded microcontroller system for a real world application
- Communicate professionally using relevant technical terminology, symbols, and diagrams and effectively document design and prototyped solutions
- Work autonomously and as a team member to analyse problems and present solutions.

Graduate Attributes

- Knowledge
- Communication
- Cognitive, technical and creative skills
- Research
- Self-management
- Ethical and Professional Responsibility

5 PORTFOLIO

Assessment Type
Portfolio

Task Description
This is the major project in this unit and it is an open ended project. The team can decide the project in consultation with the lecturer and tutors and must finalyse it by week 3. The main hardware used is the CQU PIC Development kit and the accessories provided by CQU in around 3rd week of the unit. Students are free to use any sensors, actuators, and accessories to the project at their own cost. Project outcome (developed prototype) will be tested towards the end of the term.

Portfolio Details
Portfolio is an individual submission based on a team project. It must contain the following items and omission of any of them will result in a Fail Grade:
1. Copy of team project report (jointly developed by the team)
2. Individual technical contribution report (ONLY your technical contribution towards the group project)
3. Individual programming report (ONLY your programming contributions towards the group project)
4. Peer assessment in the prescribed format (format will be available in Moodle)
5. Individual workbook (scanned /electronic copy of your workbook including your had written work)
6. Evidence of timely completion of assigned project work packages

Presentation details
Each group does a final presentation where every member need to active participation in both of them. The team project presentations will receive instant formative feedback at the end of the presentation. It is expected that all team members be available to answer the questions at the end of their presentation.

Assessment Due Date
Week 12 Friday (5 June 2020) 11:45 pm AEST

Return Date to Students

The portfolio will not be returned until the unit grades are released as there is no final examination for this unit.

Weighting
40%

Minimum mark or grade
50% of the allocated marks for this assessment.

Assessment Criteria
The portfolio marks will be allocated to the project depth, successfulness of each individual element, successfulness of integrating all elements into a complete working prototype, and professional documentation related to project.
The portfolio marks will be allocated to the level of the project, the level of successful completion, the level of programming techniques and effective memory usages etc. Individual student contribution must be provided by each group and this will be used to allocate marks for each group member for the project.
Detailed description of portfolio assessment criteria will be available in Moodle.

Referencing Style

- Harvard (author-date)

Submission
Online

Submission Instructions
Submit Portfolio as a single pdf file and a zip file containing all program listings with correct folder structure.

Learning Outcomes Assessed

- Apply fundamental structured programming knowledge to perform software tasks
- Program a microcontroller to interface with external devices such as analog and digital sensors, actuators and computers

- Analyse and design microcontroller based real-time applications using a given industry standard development system and software tools
- Prototype an embedded microcontroller system for a real world application
- Communicate professionally using relevant technical terminology, symbols, and diagrams and effectively document design and prototyped solutions
- Work autonomously and as a team member to analyse problems and present solutions.

Graduate Attributes

- Knowledge
- Communication
- Cognitive, technical and creative skills
- Research
- Self-management
- Ethical and Professional Responsibility
- Leadership

Academic Integrity Statement

As a CQUniversity student you are expected to act honestly in all aspects of your academic work.

Any assessable work undertaken or submitted for review or assessment must be your own work. Assessable work is any type of work you do to meet the assessment requirements in the unit, including draft work submitted for review and feedback and final work to be assessed.

When you use the ideas, words or data of others in your assessment, you must thoroughly and clearly acknowledge the source of this information by using the correct referencing style for your unit. Using others' work without proper acknowledgement may be considered a form of intellectual dishonesty.

Participating honestly, respectfully, responsibly, and fairly in your university study ensures the CQUniversity qualification you earn will be valued as a true indication of your individual academic achievement and will continue to receive the respect and recognition it deserves.

As a student, you are responsible for reading and following CQUniversity's policies, including the **Student Academic Integrity Policy and Procedure**. This policy sets out CQUniversity's expectations of you to act with integrity, examples of academic integrity breaches to avoid, the processes used to address alleged breaches of academic integrity, and potential penalties.

What is a breach of academic integrity?
A breach of academic integrity includes but is not limited to plagiarism, self-plagiarism, collusion, cheating, contract cheating, and academic misconduct. The Student Academic Integrity Policy and Procedure defines what these terms mean and gives examples.

Why is academic integrity important?
A breach of academic integrity may result in one or more penalties, including suspension or even expulsion from the University. It can also have negative implications for student visas and future enrolment at CQUniversity or elsewhere. Students who engage in contract cheating also risk being blackmailed by contract cheating services.

Where can I get assistance?
For academic advice and guidance, the Academic Learning Centre (ALC) can support you in becoming confident in completing assessments with integrity and of high standard.

What can you do to act with integrity?

Be Honest
If your assessment task is done by someone else, it would be dishonest of you to claim it as your own

Seek Help
If you are not sure about how to cite or reference in essays, reports etc, then seek help from your lecturer, the library or the Academic Learning Centre (ALC)

Produce Original Work
Originality comes from your ability to read widely, think critically, and apply your gained knowledge to address a question or problem