COURSE OUTLINE

ELC404 Advanced Digital and Embedded Systems

School: School of Science, Technology and Engineering

2024 | Semester 2

UniSC Moreton Bay

BLENDED LEARNING

Most of your course is on campus but you may be able to do some components of this course online.

Please go to usc.edu.au for up to date information on the teaching sessions and campuses where this course is usually offered.

1. What is this course about?

1.1. Description

This course introduces you to digital and embedded systems and enhances your investigative, design and problem-solving skills. Both hardware and software components are considered in finding solutions to problems. You will learn about advanced digital logic design, real-time programming concepts using C and POSIX, logic devices, and the architecture of microcontrollers and their applications in embedded systems. You will gain practical experience of interfacing embedded microcontrollers with physical sensors and develop skills in designing embedded systems to meet various design requirements.

1.2. How will this course be delivered?

ACTIVITY	HOURS	BEGINNING WEEK	FREQUENCY
BLENDED LEARNING			
Learning materials – Asynchronous weekly learning material	1hr	Week 1	13 times
Seminar – On campus	1hr	Week 1	3 times
Tutorial/Workshop 1 – On campus	2hrs	Week 1	10 times
Laboratory 1 – On campus	2hrs	Week 2	5 times

1.3. Course Topics

Topics may include:

- Advanced Digital Design with Finite State Machines (FSMs)
- Finite State Machine Implementation
- Instruction Set Architectures
- Advanced Processor Architectures and Pipelining
- Pipelined Control and Hazards
- Embedded Systems
- Real-Time Hardware Components
- Real-Time Operating Systems (RTOS)
- Tasks and Scheduling
- Priority Protocols
- Concurrent Programming and POSIX

2. What level is this course?

400 Level (Graduate)

Demonstrating coherence and breadth or depth of knowledge and skills. Independent application of knowledge and skills in unfamiliar contexts. Meeting professional requirements and AQF descriptors for the degree. May require pre-requisites where discipline specific introductory or developing knowledge or skills is necessary. Normally undertaken in the third or fourth full-time study year of an undergraduate program.

3. What is the unit value of this course?

12 units

4. How does this course contribute to my learning?

COURSE LEARNING OUTCOMES	GRADUATE QUALITIES MAPPING	PROFESSIONAL STANDARD MAPPING *
On successful completion of this course, you should be able to...	Completing these tasks successfully will contribute to you becoming...	Engineers Australia Stage 1 Professional Engineer Competency Standards
1 Demonstrate knowledge of digital logic design, combinational circuits and synchronous sequential logic, as well as principles and operations of different programmable logic devices and the operation of CPU and memory handling methods.	Knowledgeable	1, 1.3.a, 1.3
2 Interpret the operations of microcontrollers and their application in embedded systems, as well as different number systems, Boolean algebra and C, assembly language and event driven programming.	Knowledgeable	1, 1.3.a, 1.3
3 Analyse and verify the operation of digital and embedded systems using debugging tools and debug errors in coding an embedded system.	Creative and critical thinker	2, 2.1.b, 2.1
4 Identify, formulate and design solutions to a problem using microcontrollers and programmable logic devices.	Empowered	2, 2.2.a, 2.3.a, 2.2, 2.3
5 Design and analyse software program to control different microprocessor peripherals.	Empowered	2, 2.2.d, 2.2
6 Design and implement practical programmable solutions using digital and embedded systems to meet design specifications.	Engaged	2, 2.3.a, 2.3

* Competencies by Professional Body

CODE	COMPETENCY
ENGINEERS AUSTRALIA STAGE 1 PROFESSIONAL ENGINEER COMPETENCY STANDARDS	
1	Elements of competency: Knowledge and Skill Base
1.3.a	Knowledge and Skill Base - In-depth understanding of specialist bodies of knowledge within the engineering discipline: Proficiently applies advanced technical knowledge and skills in at least one specialist practice domain of the engineering discipline.
1.3	Knowledge and Skill Base: In-depth understanding of specialist bodies of knowledge within the engineering discipline.
2	Elements of competency: Engineering Application Ability

CODE	COMPETENCY
2.1.b	Engineering Application Ability - Application of established engineering methods to complex engineering problem solving: Ensures that all aspects of an engineering activity are soundly based on fundamental principles - by diagnosing, and taking appropriate action with data, calculations, results, proposals, processes, practices, and documented information that may be ill-founded, illogical, erroneous, unreliable or unrealistic.
2.2.a	Engineering Application Ability - Fluent application of engineering techniques, tools and resources: Proficiently identifies, selects and applies the materials, components, devices, systems, processes, resources, plant and equipment relevant to the engineering discipline.
2.3.a	Engineering Application Ability - Application of systematic engineering synthesis and design processes: Proficiently applies technical knowledge and open ended problem solving skills as well as appropriate tools and resources to design components, elements, systems, plant, facilities and/or processes to satisfy user requirements.
2.2.d	Engineering Application Ability - Fluent application of engineering techniques, tools and resources: Applies a wide range of engineering tools for analysis, simulation, visualisation, synthesis and design, including assessing the accuracy and limitations of such tools, and validation of their results.
2.1	Engineering Application Ability: Application of established engineering methods to complex engineering problem solving.
2.2	Engineering Application Ability: Fluent application of engineering techniques, tools and resources.
2.3	Engineering Application Ability: Application of systematic engineering synthesis and design processes.

5. Am I eligible to enrol in this course?

Refer to the UniSC Glossary of terms for definitions of “pre-requisites, co-requisites and anti-requisites”.

5.1. Pre-requisites

Enrolled in GC004, GD004, MC004, GC005, GD005, MC005, GC006, GD006, MC006, SC404 or SC405

5.2. Co-requisites

Not applicable

5.3. Anti-requisites

Not applicable

5.4. Specific assumed prior knowledge and skills (where applicable)

Not applicable

6. How am I going to be assessed?

6.1. Grading Scale

Standard Grading (GRD)

High Distinction (HD), Distinction (DN), Credit (CR), Pass (PS), Fail (FL).

6.2. Details of early feedback on progress

Early feedback will be provided through completion of weekly activities in workshops. Furthermore, feedback on each assessment will be provided which will be used to help with the following assessment.

6.3. Assessment tasks

DELIVERY MODE	TASK NO.	ASSESSMENT PRODUCT	INDIVIDUAL OR GROUP	WEIGHTING %	WHAT IS THE DURATION / LENGTH?	WHEN SHOULD I SUBMIT?	WHERE SHOULD I SUBMIT IT?
All	1	Practical / Laboratory Skills, and Written Piece	Individual	30%	1500 words	Week 5	Online Assignment Submission with plagiarism check
All	2	Artefact - Technical and Scientific, and Written Piece	Individual	30%	1500 words	Week 9	Online Assignment Submission with plagiarism check
All	3	Examination - Centrally Scheduled	Individual	40%	2 hours	Exam Period	Online Assignment Submission with plagiarism check

All - Assessment Task 1: Project

GOAL:	Apply knowledge and skills acquired in the course
PRODUCT:	Practical / Laboratory Skills, and Written Piece
FORMAT:	Experimental work and / or projects to verify students ability to apply knowledge and skills acquired in the course

CRITERIA:

No.		Learning Outcome assessed
1	Analysis and verification of the operation of digital and embedded systems using debugging tools and debug errors in coding an embedded system.	3
2	Identification, formulation and design of solutions to a problem using microcontrollers and programmable logic devices.	4
3	Design and implementation of practical programmable solutions using digital and embedded systems to meet design specifications.	6
4	Design and analysis of software program to control different microprocessor peripherals.	5
5	Demonstration of knowledge of digital logic design, combinational circuits and synchronous sequential logic, as well as principles and operations of different programmable logic devices and the operation of CPU and memory handling methods.	1
6	Interpretation of the operations of microcontrollers and their application in embedded systems, as well as different number systems, Boolean algebra and C, assembly language and event driven programming.	2

GENERIC SKILLS:	Communication, Problem solving, Organisation, Applying technologies, Information literacy

All - Assessment Task 2: System review

GOAL:	Review of a topical digital and embedded system challenge relevant to advanced industrial processes
PRODUCT:	Artefact - Technical and Scientific, and Written Piece
FORMAT:	n/a
CRITERIA:	

No.		Learning Outcome assessed
1	Analysis and verification of the operation of digital and embedded systems using debugging tools and debug errors in coding an embedded system.	3
2	Identification, formulation and design of solutions to a problem using microcontrollers and programmable logic devices.	4
3	Demonstration of knowledge of digital logic design, combinational circuits and synchronous sequential logic, as well as principles and operations of different programmable logic devices and the operation of CPU and memory handling methods.	1

GENERIC SKILLS:	Communication, Problem solving, Organisation, Applying technologies

All - Assessment Task 3: Final exam

GOAL:	Questions and problems related to the course contents
PRODUCT:	Examination - Centrally Scheduled
FORMAT:	Questions and problems related to the course contents
CRITERIA:	

No.		Learning Outcome assessed
1	Analysis and verification of the operation of digital and embedded systems using debugging tools and debug errors in coding an embedded system.	3
2	Identification, formulation and design of solutions to a problem using microcontrollers and programmable logic devices.	4
3	Design and implementation of practical programmable solutions using digital and embedded systems to meet design specifications.	6
4	Design and analysis of software program to control different microprocessor peripherals.	5
5	Demonstration of knowledge of digital logic design, combinational circuits and synchronous sequential logic, as well as principles and operations of different programmable logic devices and the operation of CPU and memory handling methods.	1
6	Interpretation of the operations of microcontrollers and their application in embedded systems, as well as different number systems, Boolean algebra and C, assembly language and event driven programming.	1

GENERIC SKILLS:	Communication, Problem solving, Organisation, Applying technologies, Information literacy

7. Directed study hours

A 12-unit course will have total of 150 learning hours which will include directed study hours (including online if required), self-directed learning and completion of assessable tasks. Student workload is calculated at 12.5 learning hours per one unit.

8. What resources do I need to undertake this course?

Please note: Course information, including specific information of recommended readings, learning activities, resources, weekly readings, etc. are available on the course Canvas site– Please log in as soon as possible.

8.1. Prescribed text(s) or course reader

There are no required/recommended resources for this course.

8.2. Specific requirements

Not applicable

9. How are risks managed in this course?

Health and safety risks for this course have been assessed as low. It is your responsibility to review course material, search online, discuss with lecturers and peers and understand the health and safety risks associated with your specific course of study and to familiarise yourself with the University's general health and safety principles by reviewing the online induction training for students, and following the instructions of the University staff.

10. What administrative information is relevant to this course?

10.1. Assessment: Academic Integrity

Academic integrity is the ethical standard of university participation. It ensures that students graduate as a result of proving they are competent in their discipline. This is integral in maintaining the value of academic qualifications. Each industry has expectations and standards of the skills and knowledge within that discipline and these are reflected in assessment.

Academic integrity means that you do not engage in any activity that is considered to be academic fraud; including plagiarism, collusion or outsourcing any part of any assessment item to any other person. You are expected to be honest and ethical by completing all work yourself and indicating in your work which ideas and information were developed by you and which were taken from others. You cannot provide your assessment work to others. You are also expected to provide evidence of wide and critical reading, usually by using appropriate academic references.

In order to minimise incidents of academic fraud, this course may require that some of its assessment tasks, when submitted to Canvas, are electronically checked through Turnitin. This software allows for text comparisons to be made between your submitted assessment item and all other work to which Turnitin has access.

10.2. Assessment: Additional Requirements

Eligibility for Supplementary Assessment

Your eligibility for supplementary assessment in a course is dependent of the following conditions applying:

- The final mark is in the percentage range 47% to 49.4%

- The course is graded using the Standard Grading scale

- You have not failed an assessment task in the course due to academic misconduct

10.3. Assessment: Submission penalties

Late submission of assessment tasks will be penalised at the following maximum rate (the rates are cumulative):

- 5% (of the assessment task's identified value) per day for the first two days from the date identified as the due date for the assessment task
- 10% (of the assessment task's identified value) for the third day
- 20% (of the assessment task's identified value) for the fourth day and subsequent days up to and including seven days from the date identified as the due date for the assessment task
- A result of zero is awarded for an assessment task submitted seven days from the date identified as the due date for the assessment task.

Weekdays and weekends are included in the calculation of days late.

To request an extension, you must contact your Course Coordinator and supply the required documentation to negotiate an outcome.

Refer to the Assessment: Courses and Coursework Programs – Procedures

10.4. SafeUniSC

UniSC is committed to a culture of respect and providing a safe and supportive environment for all members of our community. For immediate assistance on campus contact SafeUniSC by phone: 07 5430 1168 or using the SafeZone app. For general enquires contact the SafeUniSC team by phone 07 5456 3864 or email safe@usc.edu.au.

The SafeUniSC Specialist Service is a Student Wellbeing service that provides free and confidential support to students who may have experienced or observed behaviour that could cause fear, offence or trauma. To contact the service call 07 5430 1226 or email studentwellbeing@usc.edu.au.

10.5. Study help

For help with course-specific advice, for example what information to include in your assessment, you should first contact your tutor, then your course coordinator, if needed.

If you require additional assistance, the Learning Advisers are trained professionals who are ready to help you develop a wide range of academic skills. Visit the Learning Advisers web page for more information, or contact Student Central for further assistance: +61 7 5430 2890 or studentcentral@usc.edu.au.

10.6. Wellbeing Services

Student Wellbeing provide free and confidential counselling on a wide range of personal, academic, social and psychological matters, to foster positive mental health and wellbeing for your academic success.

To book a confidential appointment go to Student Hub, email studentwellbeing@usc.edu.au or call 07 5430 1226.

10.7. AccessAbility Services

Ability Advisers ensure equal access to all aspects of university life. If your studies are affected by a disability, learning disorder mental health issue, injury or illness, or you are a primary carer for someone with a disability or who is considered frail and aged, AccessAbility Services can provide access to appropriate reasonable adjustments and practical advice about the support and facilities available to you throughout the University.

To book a confidential appointment go to Student Hub, email AccessAbility@usc.edu.au or call 07 5430 2890.

10.8. Links to relevant University policy and procedures

For more information on Academic Learning & Teaching categories including:

- Assessment: Courses and Coursework Programs
- Review of Assessment and Final Grades
- Supplementary Assessment
- Central Examinations
- Deferred Examinations
- Student Conduct
- Students with a Disability

For more information, visit https://www.usc.edu.au/explore/policies-and-procedures#academic-learning-and-teaching

10.9. Student Charter

UniSC is committed to excellence in teaching, research and engagement in an environment that is inclusive, inspiring, safe and respectful. The Student Charter sets out what students can expect from the University, and what in turn is expected of students, to achieve these outcomes.

10.10. General Enquiries

In person:

- **UniSC Sunshine Coast** - Student Central, Ground Floor, Building C, 90 Sippy Downs Drive, Sippy Downs
- **UniSC Moreton Bay** - Service Centre, Ground Floor, Foundation Building, Gympie Road, Petrie
- **UniSC SouthBank** - Student Central, Building A4 (SW1), 52 Merivale Street, South Brisbane
- **UniSC Gympie** - Student Central, 71 Cartwright Road, Gympie
- **UniSC Fraser Coast** - Student Central, Student Central, Building A, 161 Old Maryborough Rd, Hervey Bay
- **UniSC Caboolture** - Student Central, Level 1 Building J, Cnr Manley and Tallon Street, Caboolture

Tel: +61 7 5430 2890

Email: studentcentral@usc.edu.au