School of Electrical Engineering & Telecommunications

UNSW Engineering

ELEC2117

Electrical Systems Design

Term 3, 2021

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Deepak Mishra	d.mishra@unsw.edu.au	Via Email & MS Teams	Room 417	+61293853860

Demonstrators

Name	Email	Availability	Location	Phone
Yen Nee Ho	z5015486@ad.unsw.edu.au			
Aaron Lucas	z5164120@ad.unsw.edu.au			
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School Contact Information

Consultations: Lecturer consultation times will be advised during the first lecture. You are welcome to email the tutor or laboratory demonstrator, who can answer your questions on this course and can also provide you with consultation times. ALL email enquiries should be made from your student email address with ELEC/TELExxxx in the subject line; otherwise they will not be answered.

Keeping Informed: Announcements may be made during classes, via email (to your student email address) and/or via online learning and teaching platforms – in this course, we will use Moodle https://moodle.telt.unsw.edu.au/login/index.php. Please note that you will be deemed to have received this information, so you should take careful note of all announcements.

Student Support Enquiries

For enrolment and progression enquiries please contact Student Services

Web

Electrical Engineering Homepage

Engineering Student Support Services

Engineering Industrial Training

UNSW Study Abroad and Exchange (for inbound students)

UNSW Future Students

Phone

(+61 2) 9385 8500 – Nucleus Student Hub

(+61 2) 9385 7661 – Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

Email

Engineering Student Support Services – current student enquiries

- e.g. enrolment, progression, clash requests, course issues or program-related queries

Engineering Industrial Training – Industrial training questions

UNSW Study Abroad – study abroad student enquiries (for inbound students)

UNSW Exchange – student exchange enquiries (for inbound students)

UNSW Future Students – potential student enquiries

- e.g. admissions, fees, programs, credit transfer

Course Details

Units of Credit 6

Summary of the Course

This second year design course complements the design thread in the School, drawing from knowledge gained in first year courses on electronic circuits, programming, and digital circuits. It is also assumed that students would have been exposed to introductory engineering design concepts, such as those gained from the first year ENGG1000 course.

ELEC2117 is a design oriented course, in which students will carry out a practical electrical engineering design in the second half of session, solving an electrical engineering problem involving computer interfacing of electrical/electronic circuits. The design will be supported by relevant theory and practical proficiency gained in the first half of session. It is proposed that the design will also feature the use of a microcontroller with appropriate hardware and software support. Assessment of the course will be designed around the practical components of the course as well as as the relevant supporting theory.

Course Aims

This aims of this course are to:

- further students knowledge of, and exposure to, electrical engineering design - in particular, to enable students to take an appropriate electrical engineering problem, design a electronics- and microcontroler-based solution, and communicate their work.
- introduce students to microcontrollers, in particular their hardware structure and operation.
- provide an appreciation and application of programming languages including C and assembly.
- facilitate the improvement of students' hardware design skills - in particular obtaining an appreciation of technical characteristics of hardware design including interfacing analogue electronic circuits.

Course Learning Outcomes

After successfully completing this course, you should be able to:

Learning Outcome	EA Stage 1 Competencies
1. Have an understanding of the internal architecture and capabilities of 8-bit PIC microcontrollers.	PE1.1, PE1.2, PE1.3, PE2.2, PE2.3
2. Be able to write assembly language programs for microcontrollers (with RISC architecture).	PE1.3, PE1.4, PE1.5, PE2.2, PE2.3
3. Be able to interface peripheral devices (e.g. keypads, LCDs, LEDs, photo sensors, other ICs, etc.) to a microcontroller.	PE1.1, PE1.3, PE1.4, PE1.5, PE2.2, PE2.3, PE3.4

Learning Outcome	EA Stage 1 Competencies
4. Be able to design, build and test a microcontroller based system to satisfy given design specifications.	PE1.4, PE1.5, PE2.2, PE2.3, PE3.1, PE3.2, PE3.3, PE3.4, PE3.5

Teaching Strategies

The course will consist of a lecture/tutorial component which serves to provide students with the necesasry theoretical background in electronic circuits and microcontroller fundamentals. The laboratory component will be based on the implementation of a design project and split up into two halves. The first seven weeks, including the flexibility week, are to be used to expose the students to the relevant hardware and software to support the project design implementation, and the second for students to carry out the design. Students will be assessed on the design implementation, including its presentation, as well as through ongoing lab ativities, mid-session and final examinations.

Additional Course Information

Relationship to Other Courses

This second-year design course complements the design thread in the School, drawing from knowledge gained in first-year courses on electronic circuits, programming, and digital circuits. It is also assumed that students would have been exposed to introductory engineering design concepts, such as those gained from the first year ENGG1000 course. This is a core course for students following a BE ME in Electrical Engineering program.

Pre-requisites and Assumed Knowledge

The pre-requisite for this course is ELEC2141: Digital Circuit Design and ENGG1000: Engineering design. It is essential that students are familiar with basic electronics. It is further assumed that the students are familiar with basic programming concepts and have completed the first-year computer programming course.

Assessment

This course is run in a flipped-classroom model where standard lectures and labs are integrated into virtual or online hands-on activity-based learning in a laboratory environment. The laboratories and support lectures will form the primary method of instruction for this course. During the lab sessions, students will be guided and supported by lab demonstrators. Students are expected to attend ALL laboratories as lectures and labs are integrated to form a smart classroom teaching model. Students must prepare well for the laboratory classes and will have a mid-term lab examination in Week 5. The students will also work on a design project (individual) from Week 8 to Week 10, which will be assessed in Week 10 (assessment time will be confirmed later).

Laboratory Exemption: There is no laboratory exemption for this course. Regardless of whether equivalent labs have been completed in previous courses, all students enrolled in this course for term 3, 2021 must take all the labs. If for medical reasons, (note that a valid medical certificate must be provided) you are unable to attend an online lab session, you will need to apply for a catch-up lab during another lab time, as agreed by the tutor.

Pre-requisite to pass the course: A satisfactory performance (50% or greater) in each of the following, is a necessary requirement to pass this course:

- **Design Project**
- **Final Exam**

Mid-Semester Examinations (20%): The mid-semester examination consists of a theory test and a practical coding related assessment.

On-going Lab Check Points (5%): For each lab activity from weeks 1-7 you will be required to get yourself marked by a lab demonstrator. These ongoing lab activities will form the basis for your design project and will contribute towards 5% of your total course assessment.

Design Project (40%): Details of the design project will be released in Week 6 and will have to be completed by Week 10. Project work will include 4 hours of lab contact (scheduled lecture/lab times) per week and will involve the design, implementation and testing of an embedded system using a PIC16F886 microcontroller. The project will be assessed in Week 10 or 11 and you must submit a project report at the time of assessment. The assessment will be based on the demonstration of a working system and an oral examination. Submit a typed report (pdf format) which should be clear, comprehensive, and include the following:

- A brief description of the design project.
- Detailed design criteria
- Relevant block diagrams of the design

- All interfacing circuit diagrams
- Details of software design
- Include assembly code you have written (or a link to your code if it is too long)
- All appropriate test results.
- A discussion/comparative analysis showing a clear understanding of the project.

Note

- This project involves a substantial time commitment to successfully complete all parts. It is suggested that you commence work on this project straight away
- As a guide, each report should be at least 4 pages long (excluding code).

Final Exam (35%): There will be a 2-hour final examination.

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Laboratory Activities	5%	29/10/2021 12:00 AM	1, 2, 3, 4
2. Mid-Term Lab Assessment	20%	13/10/2021 04:00 PM	1, 2, 3, 4
3. Design Project	40%	21/11/2021 11:59 PM	1, 2, 3, 4
4. Final Exam	35%	Not Applicable	1, 2, 3, 4

Assessment 1: Laboratory Activities

Start date: 13/09/2021 12:00 AM
Due date: 29/10/2021 12:00 AM

For each lab activity from weeks 1-5, and 7 you will be required to get yourself marked by a lab demonstrator. These ongoing lab activities will form the basis for your design project and these On-going Lab Check Points will contribute towards 5% of your total course assessment

Assessment 2: Mid-Term Lab Assessment

Due date: 13/10/2021 04:00 PM

There will be one Mid-Term Lab Assessment, testing your understanding of the principles, capability and experience on assembly programming skills. If for medical reasons, (note that a valid medical certificate must be provided to the university) you are unable to attend the Lab Assessment, you will be given another Assessment. The mid-semester examination consists of a theory test and practical coding based assessment which will cover all material covered from Week 1 to Week 4.

Assessment 3: Design Project

Due date: 21/11/2021 11:59 PM

Details of the design project will be released in Week 7 and will have to be completed by Week 10. Project work will include 5 hours of lab contact (scheduled consultation and lab times) per week and will involve the design, implementation and testing of an embedded system using a PIC16F886 microcontroller. The project will be assessed in Week 10 and you must submit a project report at the time of assessment. The assessment will be based on the demonstration of a working system and an oral examination. Submit a typed report (pdf format) which should be clear and comprehensive. This project involves a substantial time commitment to successfully complete all parts. It is suggested that you commence work on this project straight away (starting from week 7).

Assessment 4: Final Exam

There will be one final examination, testing your understanding of the principles and your programming skills. If for medical reasons, (note that a valid medical certificate must be provided to the university) you are unable to attend the final exam, you will be given another exam (either oral or written, at the discretion of the course convenor).

- The final exam will be 2 hours long
- The final exam consists of 3 questions (with many parts) and all of them must be answered
- The final exam will cover all material covered from Week 1 to Week 10.

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

Course Schedule

This course is conducted in a flipped-classroom approach, where most of the online course hours are spent in the laboratory sessions involving hands-on lab-based activities conducted via remote or virtual control of the hardware devices which can be observed in real-time using the webcam and the demos being there to act as intermediator wherever required. Except for the first two weeks, there won't be any formal lectures. The course consists of 4 hours of laboratory sessions each week with a 15-min lunch break along with a one-hour weekly online consultation session.

	Day	Time	Location
Lecture + Lab	Monday	2 pm to 6 pm	Online
Consultation	Wednesday	2 pm to 3 pm	Online

View class timetable

Timetable

Date	Type	Content
Week 1: 13 September - 17 September	Lecture	Introductory lecture
	Online Activity	Introductory lab activity 0
Week 2: 20 September - 24 September	Online Activity	Flipped mode lab activity 1 – General purpose input output and delay loops
Week 3: 27 September - 1 October	Online Activity	Flipped mode lab activity 2 – Look-up tables and seven segment displays
Week 4: 4 October - 8 October	Lecture	Consultation Lecture to revise the first three weeks content, resolve any issues with online labs smooth running, discuss the upcoming week's content and previous year exams questions based on the first three lectures. No online lab in week 4 as the Monday, October 4, is a holiday
Week 5: 11 October - 15 October	Assessment	**Mid-Term Exam** on *Wednesday (October 13, 2021, at 2 pm)*
	Online Activity	**Flipped mode lab activity 3** on Monday to learn More on I/O interfacing, keypads, interrupts
Week 6: 18 October - 22 October	Reading	**Flexibility Week**: No new content, no online lab and no assessments, but Release of the design project in the Catchup lab session on Monday

		and a Consultation Lecture on Wednesday (October 20) for the MidTerm revision, Feedback, and Discussing the MidTerm Exam solution along with Design project doubts
Week 7: 25 October - 29 October	Online Activity	Flipped mode activity 4 – LCD interfacing, PWM
Week 8: 1 November - 5 November	Experiment	Design project
Week 9: 8 November - 12 November	Experiment	Design project
Week 10: 15 November - 19 November	Experiment	Design project
	Assessment	Project Evaluations

Resources

Prescribed Resources

The primary source of reference will be the ELEC 2117 lecture notes provided and relevant datasheets and manuals of the microcontrollers and other peripherals used.

Online resources

Moodle: As a part of the teaching component, Moodle will be used to disseminate teaching materials, host forums and occasionally quizzes. Assessment marks will also be made available via Moodle: https://moodle.telt.unsw.edu.au/login/index.php.

Mailing list: Announcements concerning course information will be given in the lectures and/or on Moodle and/or via email (which will be sent to your student email address).

Recommended Resources

Following textbooks/resources are definitely worth considering.

- Designing Embedded Systems with PIC Microcontrollers – Tim Wilmshurst, Elsevier, 2010
- PIC Microcontrollers –Free online book – mikroElektronika; http://www.mikroe.com/products/view/11/book-pic-microcontrollers/
- PIC 16F886 Data Sheet (2007), Microchip Technology; www.microchip.com

Course Evaluation and Development

Continual Course Improvement: This course is under constant revision in order to improve the learning outcomes for all students. The course convenor will be asking for your regular feedback to update the teaching style to better suit the students. Please forward any feedback (positive or negative) on the course to the course convener or via the online student survey myExperience. You can also provide feedback to ELSOC who will raise your concerns at student focus group meetings. As a result of previous feedback obtained for this course and in our efforts to provide a rich and meaningful learning experience, we have continued to evaluate and modify our delivery and assessment methods. In particular, lecture notes have been revised and new digital resources are added to support the blended learning aspects.

Laboratory Workshop Information

Context: Programmable microcontrollers are used in embedded system applications, such as toys, implantable medical devices, remote controls, washing machines, automobiles etc. ELEC2117 is an introductory course that takes students through steps necessary to develop real-world applications using a microcontroller (PIC16F886). Students will explore the microcontroller architecture and gain experience in developing software and hardware.

Syllabus: ELEC2117 is a design-oriented course, in which students will carry out practical electrical

engineering design projects in the second half of the term, solving an electrical engineering problem involving the computer interfacing of electrical/electronic circuits. The design will be supported by relevant theory and practical proficiency gained in the first half of the term. It is proposed that the design will also feature the use of a microcontroller with appropriate hardware and software support. Assessment of the course will be designed around the practical components of the course, as well as the relevant supporting theory.

Academic Honesty and Plagiarism

Academic Honesty and Plagiarism

Plagiarism is the unacknowledged use of other people's work, including the copying of assignment works and laboratory results from other students. Plagiarism is considered a form of academic misconduct, and the University has very strict rules that include some severe penalties. For UNSW policies, penalties and information to help you avoid plagiarism, see https://student.unsw.edu.au/plagiarism. To find out if you understand plagiarism correctly, try this short quiz: https://student.unsw.edu.au/plagiarism-quiz.

General Conduct and Behaviour

Consideration and respect for the needs of your fellow students and teaching staff is an expectation. Conduct which unduly disrupts or interferes with a class is not acceptable and students may be asked to leave the class.

Academic Information

COVID19 - Important Health Related Notice

Your health and the health of those in your class is critically important. You must stay at home if you are sick or have been advised to self-isolate by NSW health or government authorities. Current alerts and a list of hotspots can be found here. **You will not be penalised for missing a face-to-face activity due to illness or a requirement to self-isolate**. We will work with you to ensure continuity of learning during your isolation and have plans in place for you to catch up on any content or learning activities you may miss. Where this might not be possible, an application for fee remission may be discussed.

If you are required to self-isolate and/or need emotional or financial support, please contact the Nucleus: Student Hub. If you are unable to complete an assessment, or attend a class with an attendance or participation requirement, please let your teacher know and apply for special consideration through the Special Consideration portal. To advise the University of a positive COVID-19 test result or if you suspect you have COVID-19 and are being tested, please fill in this form.

UNSW requires all staff and students to follow NSW Health advice. Any failure to act in accordance with that advice may amount to a breach of the Student Code of Conduct. Please refer to the Safe Return to Campus guide for students for more information on safe practices.

Dates to note

Important Dates available at: https://student.unsw.edu.au/dates

Student Responsibilities and Conduct

Students are expected to be familiar with and adhere to all UNSW policies (see https://student.unsw.edu.au/policy), and particular attention is drawn to the following:

Workload

It is expected that you will spend at least **15 hours per week** studying a 6 UoC course, from Week 1 until the final assessment, including both formal classes and *independent, self-directed study*. In periods where you need to complete assignments or prepare for examinations, the workload may be greater. Over-commitment has been a common source of failure for many students. You should take the required workload into account when planning how to balance study with employment and other activities.

Attendance

Regular and punctual attendance at all classes is expected. UNSW regulations state that if students attend less than 80% of scheduled classes they may be refused final assessment.

Work Health and Safety

UNSW policy requires each person to work safely and responsibly, in order to avoid personal injury and to protect the safety of others.

Special Consideration and Supplementary Examinations

You must submit all assignments and attend all examinations scheduled for your course. You can apply for special consideration when illness or other circumstances beyond your control interfere with an assessment performance. If you need to submit an application for special consideration for an exam or assessment, you must submit the application **prior to the start** of the exam or before the assessment is submitted, except where illness or misadventure prevent you from doing so. Be aware of the "fit to sit/submit" rule which means that if you sit an exam or submit an assignment, you are declaring yourself well enough to do so and cannot later apply for Special Consideration. For more information and how to apply, see https://student.unsw.edu.au/special-consideration.

Administrative Matters

On issues and procedures regarding such matters as special needs, equity and diversity, occupational health and safety, enrolment, rights, and general expectations of students, please refer to the School and UNSW policies:

https://student.unsw.edu.au/guide

https://www.engineering.unsw.edu.au/electrical-engineering/resources

Image Credit

Synergies in Sound 2016

CRICOS

CRICOS Provider Code: 00098G

Acknowledgement of Country

We acknowledge the Bedegal people who are the traditional custodians of the lands on which UNSW Kensington campus is located.

Appendix: Engineers Australia (EA) Professional Engineer Competency Standard

Program Intended Learning Outcomes	
Knowledge and skill base	
PE1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline	✓
PE1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline	✓
PE1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline	✓
PE1.4 Discernment of knowledge development and research directions within the engineering discipline	✓
PE1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline	✓
PE1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline	
Engineering application ability	
PE2.1 Application of established engineering methods to complex engineering problem solving	
PE2.2 Fluent application of engineering techniques, tools and resources	✓
PE2.3 Application of systematic engineering synthesis and design processes	✓
PE2.4 Application of systematic approaches to the conduct and management of engineering projects	
Professional and personal attributes	
PE3.1 Ethical conduct and professional accountability	✓
PE3.2 Effective oral and written communication in professional and lay domains	✓
PE3.3 Creative, innovative and pro-active demeanour	✓
PE3.4 Professional use and management of information	✓
PE3.5 Orderly management of self, and professional conduct	✓
PE3.6 Effective team membership and team leadership	