

# Advanced Mechatronic Engineering 1: Hardware and Control - Course Outline

## ECEN 425: 2015 Trimester 1

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This document sets out the workload and assessment requirements for ECEN 425. It also provides contact information for staff involved in the course. If the contents of this document are altered during the course, you will be advised of the change by an announcement in lectures and/or on the course web site. A printed copy of this document is held in the School Office.

Mechatronics, unlike traditional engineering techniques, is a multi-disciplinary approach to solving engineering problems. In its simplest form it is the intelligent control of an electromechanical systems, and as such, practitioners must be skilled in electronics, mechanics, and software, and also understand the underlying physics, mathematics and even marketing.

This course provides an introduction to the techniques of mechatronics. It begins by covering the engineering concepts of compromise in the choice of sensors. It then covers basic signal conditioning and noise concepts, derivation of the transfer function, and the output from a mechatronic system - specifically some form of actuator. The course continues with some specific ranging sensor circuits and applications, including practical implementation. Practical control systems for industrial plant and mechatronic systems are detailed. Mechatronic design considerations are discussed based on implementation through the SolidWorks CAD package.

The practical nature of this course is emphasised through the design assignments (100% of the course mark), where the student will implement Microcontroller circuit, range finding system and advanced CAD simulations.

## Objectives

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By the end of the course, students should be able to:

1. Skilled in the high-level construction and use of a modern microcontroller to solve a variety of challenging real-world problems (Graduate attribute [3\(a\)](#)).
2. Be able to understand, design and construct complex circuits (in particular a microcontroller development board and analogue ranging circuits). (Graduate attributes [3\(e\)](#) and [3\(f\)](#)).
3. Understand the issues involving motor driver circuits and be able to design a driver circuit for dc motors. (Graduate attribute [3\(b\)](#)).
4. Understand, and implement, Mechanical Engineering design principles within Mechatronics systems (Graduate attribute [3\(a\)](#)).
5. Understand and using appropriate tools, implement Mechatronics design principles, including the multi-objective and iterative nature of design. (Graduate attribute [1\(a\)](#), [3\(f\)](#)).

## Textbook

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The textbook for ECEN 425 is: The textbook for ECEN 425 is: Shigley's Mechanical Engineering Design (Hardcover) McGraw-Hill Science/Engineering/Math; Any edition from the 9 edition (January 15, 2010) is fine.

## Lectures, Tutorials, Laboratories, and Practical work

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A [schedule](#) of lecture topics, readings, and assignment due dates is available online

Lectures for ECEN 425 are:

- Lectures: Monday, Tuesday, Thursday 10-10:50am in Murphy 631,

## Assignments and Projects

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There is no formal examination for this course. There will be Six assignments plus one test. The weightings are provisionally as follows:

- 10%: Initial mechatronic design
- 10%: Microcontroller familiarisation and debugging
- 20%: Range finder construction and integration
- 20%: Complex robotic design
- 15%: Lego assignment
- 15%: SolidWorks, e.g. Gear design
- 10% Test

These will be confirmed when the assignments are given out.

## Workload

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In ECEN 425 the expectation is that you will do roughly 10 hours of work per week over 15 weeks. This workload is not evenly spread – some weeks with heavy practical assessment will require considerably more than 10 hours, at other times, particularly at the end of the course, substantially fewer hours will be required.

## School of Engineering and Computer Science

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The School office is located on level three of the Cotton Building ([Cotton 358](#)).

## Staff

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The course coordinator for ECEN 425 is [Dale Carnegie](#) . The lecturers for the course are [Will Browne](#) and [Dale Carnegie](#). Their contact details are:

- A/Prof Will Browne
- [MacDiarmid 418](#)
- +64 4 463 5233 extension 8489
- [will.browne@ecs.vuw.ac.nz](mailto:will.browne@ecs.vuw.ac.nz)
  
- Prof Dale Carnegie
- [MacDiarmid 224](#)
- +64 4 4637485
- [dale.carnegie@vuw.ac.nz](mailto:dale.carnegie@vuw.ac.nz)
  
- Tutor: Jim Murphy
  
- Class Representative: Hamish Colenso

## Announcements and Communication

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This course uses Blackboard. Course materials and other information will be posted on Blackboard. Students should check Blackboard regularly. Email will also be used for communication, so please ensure that your email address is correct in the VUW system.

## Assessment

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Your grade for ECEN 425 will be determined based on the following assessment weightings:

<u>Item</u>	<u>Description</u>	<u>Date</u>	<u>Weight</u>
<b>Initial mechatronic design</b>	<b>Water tank</b>	13/16/26 March	<b>10%</b>
<b>Microcontroller</b>	<b>Familiarisation and debugging</b>	20 March	<b>10%</b>
<b>Rangefinder</b>	<b>Construction and integration</b>	20 April	<b>20%</b>
<b>Complex robotic design</b>	<b>Robotic pilot whale</b>	1 June	<b>20%</b>
<b>Lego assignment</b>	<b>Let the battle begin...</b>	26-29 June	<b>15%</b>
<b>SolidWorks</b>	<b>Gear design</b>	22 May	<b>15%</b>
<b>Test</b>	<b>Mechanical design</b>	14 May	<b>10%</b>

The assignments, and tests are intended to assess course objectives one through five, with objective three including directed reading.

Assignments must be handed in on the assigned dates. Work submitted after the due date will incur a penalty of 10% of the full mark per working day. Work will not be marked after the model solutions have been made available or if more than one week late. Extensions will be given only in exceptional circumstances, and if agreed before the due date. In the event of an aegrotat application, regular submission and performance in assignments and laboratories will contribute substantially to the outcome.

Bachelor of Engineering students should be aware that copies of their assessed work may be retained for inspection by accreditation panel.

## Tests and Exams

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One in-term test will take place on the 1st of April during the normal lecture slot - this is subject to confirmation - in order to balance work across other courses. If you cannot attend a test for an extraordinary reason please communicate this in writing as soon as possible in order to allow alternative arrangements.

## Practical Work

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See assessment

## Plagiarism

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### Working Together and Plagiarism

We encourage you to discuss the principles of the course and assignments with other students, to help and seek help with programming details, problems involving the lab machines. However, any work you hand in must be your own work.

The [School policy on Plagiarism](#) (claiming other people's work as your own) is available from the course home page. Please read it. We will penalise anyone we find plagiarising, whether from students currently doing the course, or from other sources. Students who knowingly allow other students to copy their work may also be penalised. If you have had help from someone else (other than a tutor), it is always safe to state the help that you got. For example, if you had help from someone else in writing a component of your code, it is not plagiarism as long as you state (e.g., as a comment in the code) who helped you in writing the method.

## Mandatory Requirements

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None beyond passing the course

## Passing ECEN 425

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To pass ECEN 425, a student must satisfy mandatory requirements and gain at least a **C-** grade overall.

## Withdrawal

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The last date for withdrawal from ECEN 425 with entitlement to a refund of tuition fees is Friday 13 March 2015. The last date for withdrawal without being regarded as having failed the course is Friday 15 May 2015 -- though later withdrawals may be approved by the Dean in special circumstances.

## Rules & Policies

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Find key dates, explanations of grades and other useful information at <http://www.victoria.ac.nz/home/study>.

Find out about academic progress and restricted enrolment at <http://www.victoria.ac.nz/home/study/academic-progress>.

The University's statutes and policies are available at <http://www.victoria.ac.nz/home/about/policy>, except qualification statutes, which are available via the Calendar webpage at <http://www.victoria.ac.nz/home/study/calendar> (See Section C).

Further information about the University's academic processes can be found on the website of the Assistant Vice-Chancellor (Academic) at <http://www.victoria.ac.nz/home/about/avcacademic>

All students are expected to be familiar with the following regulations and policies, which are available from the school web site:

[Grievances](#)

[Student and Staff Conduct](#)

[Meeting the Needs of Students with Disabilities](#)

[Student Support](#)

[Academic Integrity and Plagiarism](#)

[Dates and Deadlines including Withdrawal dates](#)

[School Laboratory Hours and Rules](#)

[Printing Allocations](#)

[Expectations of Students in ECS courses](#)

The School of Engineering and Computer Science strives to anticipate all problems associated with its courses, laboratories and equipment. We hope you will find that your courses meet your expectations of a quality learning experience.

If you think we have overlooked something or would like to make a suggestion feel free to talk to your course organiser or lecturer.

