School of
Engineering and Computer Science
Te Kura Mātai Pūkaha, Pūrorohiko

Prescription

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, e.g. PID, dynamic response and stability. Students design and construct their own microcontroller development system. Mechatronic design considerations are discussed based on implementation through the SolidWorks CAD package.

Course learning objectives

Students who pass this course will be able to:

1. Select an appropriate embedded controller to solve complex mechatronic engineering projects. Be able to programme the embedded controller to interface to sensors and actuators and make control decisions.
2. Understand the issues involve in high power switching for mechatronic devices. The student will be able to design power switching solutions for battery-powered mechatronic devices.
3. Interface with a client to fully specify a complex mechatronic engineering design. Working in groups, the students will be able to design to the proof-of-concept level, novel and complex mechatronic systems.
4. Understand the integration issues of a mechatronic design, specifically how the electronic, mechanical and software components of a mechatronic design are inter-dependent and strongly interact with each other.
5. Understand, and apply, Mechanical Engineering design principles to the design of a Mechatronics system.
6. Design bespoke components in SolidWorks. The student will be expected to 3D print these components and demonstrate they function as specified.

Course content

This course deals with advanced concepts in mechatronics design. It incorporates a combination of formative and summative feedback to provide the students with considerable experience in taking a complex mechatronic problem from an initial design brief through to a full proof-of-concept realisation. Issues of advanced microcontroller configuration, power switching requirements, mechanical engineering, rapid prototyping are covered. The expectation is for a student to become very familiar with the inter-dependencies of electronic, mechanical and software engineering as it applies to a mechatronic system.

Required Academic Background

Students must be familiar with the programming of an embedded controller, specifically (but not

necessarily limited to) microcontrollers. ECEN 301 or an equivalent is normally required.

Withdrawal from Course

Withdrawal dates and process:
https://www.wgtn.ac.nz/students/study/course-additions-withdrawals

Lecturers

Dale Carnegie (Coordinator)

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224 Alan MacDiarmid Building, Kelburn

Jim Murphy

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202 92 Fairlie Tce, Kelburn

Teaching Format

This course will be offered in-person and online. For students in Wellington, there will be a combination of in-person components and web/internet based resources. It will also be possible to take the course entirely online for those who cannot attend on campus, with all the components provided in-person also made available online.

2020 detailed format is currently being designed, 2019 details were:
During the trimester there will be two or three lectures per week.

Student feedback

Student feedback on University courses may be found at: www.cad.vuw.ac.nz/feedback/feedback_display.php

Dates (trimester, teaching & break dates)

- Teaching: 13 July 2020 - 18 October 2020
- Break: 17 August 2020 - 30 August 2020
- Exam period: 19 October 2020 - 25 October 2020

Class Times and Room Numbers

13 July 2020 - 16 August 2020

- **Monday** 15:10 - 16:00 – 531, Murphy, Kelburn
- **Tuesday** 15:10 - 16:00 – 531, Murphy, Kelburn
- **Thursday** 15:10 - 16:00 – 531, Murphy, Kelburn

31 August 2020 - 18 October 2020

- **Monday** 15:10 - 16:00 – 531, Murphy, Kelburn
- **Tuesday** 15:10 - 16:00 – 531, Murphy, Kelburn
- **Thursday** 15:10 - 16:00 – 531, Murphy, Kelburn

Other Classes

There are no other non-lecture classes as part of ECEN 425. However, some of the assessments will involve laboratory or practical work. No specific lab sessions are scheduled, students can self-organise the times to undertake such practical work.

Set Texts and Recommended Readings

Required

There are no required texts for this offering.

Mandatory Course Requirements

There are no mandatory course requirements for this course.

If you believe that exceptional circumstances may prevent you from meeting the mandatory course requirements, contact the Course Coordinator for advice as soon as possible.

Assessment

This course will be assessed through the following:

- A mastery evaluation of a student's ability to configure a microcontroller development environment
- A formative evaluation of a student's ability to engage with a client, and working in a group, design a complex mechatronic system
- A summative evaluation of a student's ability to engage with a client, and working in a group, design a challenging and complext mechatronic system.
- A mechatronic integration assessment that tests a student's ability to integrate the electronics, mechanics and software to achieve a successful mechatronic design
- A rapid prototyping assessment that evaluates a student's ability to design a gearing system to some provided specification
- Two written assessments designed to evaluate a student's ability to apply the principles of mechanical engineering deisgn.

Assessment Item	Due Date or Test Date	CLO(s)	Percentage
Going Beyond DataSheets. This assignment requires students to research the practicalities of common mechatronic power supplies and lubricants. This information must be presented in a concise manner demonstrating that the student understands how these would be actually implemented in a real mechatronic system.	week 3	CLO: 1	10%
Introduction to larger scale mechatronic design. This is a formative assessment item requiring students to work in groups, interact with a client to fully specify a mechatronic design problem and then resolve this design specification into a proof-of-concept (paper only) solution.	week 5	CLO: 1,2,3,4,5	15%
Large Scale Mechatronic Design. This is a summative assessment, building from assignment 2. In a group you must again fully specify a complex mechatronic design involving client interaction. This is a more challenging design than Assignment 2, and the expectation is that students will build upon their previous formative assessment to successfully complete this challenging design to the (paper) proof-of-concept level.	week 8	CLO: 1,2,3,4,5	30%
Mechancial Principles 1. This is an individual written assignment evaluating the student's ability to design a mechanical system involving power transfer, bearings and gears. Note that if there is an increase to the Covid Alert levels, then this assignment will be made more extensive and become worth 15%. The relative weighting of the test will be reduced in this instance from 20% down to 10%.	week 9	CLO: 6	5%
Test covering design process, mechanical engineering principles, power circuits etc. Note that should the Covid Alert levels increase and the test is then delivered online, the weighting of this test will reduce to 10%. The mechanical assignment will be increased in both size and weighting to offset this reduction.	week 11	CLO: 1,2,3,4,5,6	20%
Rapid Prototyping and Mechanical Design. SolidWorks is used to design a complex gearing system that is then 3D-printed and evaluated against the design specifications.	week 10	CLO: 5,6	20%

Penalties

A 5% penalty per day an assessment item is late will be applied.

Extensions

Individual extensions will only be granted in exceptional personal circumstances, and should be negotiated with the course coordinator before the deadline whenever possible. Documentation (eg, medical certificate) may be required.

Submission & Return

Assessments are to be provided to the course lecturer by the due date (unless otherwise explicitly directed). All efforts will be made to return the graded assessments within two weeks of the submission date.

Marking Criteria

Please see individual assignment briefs (supplied on Blackboard) for Marking Criteria.

Group Work

Some group work is required, however the assessment will be individualised. Whilst the nature of some of the assessments requires multiple people working on the design, each individual student will be required to submit an individual written report and participate in the oral presentation. Informed by a peer assessment, an individual grade will be assigned.

Peer Assessment

The student's peers within a working group will be asked to comment on each member's contribution to the project, their punctuality and the quality and quantity of the work submitted to the group. The course lecturer will use these comments to inform the grade each individual is assigned.

Required Equipment

Any materials required for practical projects will be provided.

Workload

In ECEN 425 the expectation is that you will do approximately 10 hours of work per week over 15 weeks. A substantial number of the assessments are assigned (but not due) during the first week. The submissions dates are spread, and there is an expectation for the students to time-manage their workload evenly. Some work involves group meetings, and these meetings must be factored into the student's weekly time allocation.

Teaching Plan

The teaching plan will be accessible on the ECEN 425 Blackboard page.

Communication of Additional Information

This course uses Blackboard. Course materials and other information will be posted on Blackboard. Students should check Blackboard regularly.

Links to General Course Information

- Academic Integrity and Plagiarism: https://www.wgtn.ac.nz/students/study/exams/integrity-plagiarism
- Academic Progress: https://www.wgtn.ac.nz/students/study/progress/academic-progess (including restrictions and non-engagement)
- Dates and deadlines: https://www.wgtn.ac.nz/students/study/dates
- Grades: https://www.wgtn.ac.nz/students/study/progress/grades
- Special passes: Refer to the Assessment Handbook, at https://www.wgtn.ac.nz/documents/policy/staff-policy/assessment-handbook.pdf
- Statutes and policies, e.g. Student Conduct Statute: https://www.wgtn.ac.nz/about/governance/strategy

- Student support: https://www.wgtn.ac.nz/students/support
- Students with disabilities: https://www.wgtn.ac.nz/st_services/disability/
- Student Charter: https://www.wgtn.ac.nz/learning-teaching/learning-partnerships/student-charter
- Terms and Conditions: https://www.wgtn.ac.nz/study/apply-enrol/terms-conditions/student-contract
- Turnitin: http://www.cad.vuw.ac.nz/wiki/index.php/Turnitin
- University structure: https://www.wgtn.ac.nz/about/governance/structure
- VUWSA: http://www.vuwsa.org.nz

Offering CRN: 18524

Points: 15
Prerequisites: ECEN 301 (or PHYS 340)
Duration: 13 July 2020 - 25 October 2020
Starts: Trimester 2
Campus: Kelburn