Control Systems Engineering - Course Outline

ECEN 315: 2016 Trimester 2

Course Description

The course studies dynamic systems encountered in a variety of instrumentation and mechatronic systems. It will begin with a study of mathematical modelling of such systems which allows the response of these systems to disturbances to be predicted and their stability to be assessed. The effects of feedback on dynamic systems will be studied, leading to the development of a number of different design techniques for producing control systems.

Prerequisites

Prerequisites: ECEN 220. In particular ECEN315 uses the s-domain extensively, so you will be expected to have a grasp of transfer functions, poles and zeros and the association between system modes and the locations of the system's poles in the s-plane.

Objectives

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

1. Understand analogies between different dynamic systems and to model such systems mathematically. In addition modelling of dynamic systems using software packages such as Matlab and Labview will be required. 3(c) .
2. Understand the response of a dynamic system to an input signal and to be able to predict the response of a particular system. This applies the mathematical and engineering sciences, including physics, to real-life problems 3(a).
3. Understand the concept of feedback and how it influences the response of a system 3(a).
4. Understand the operation and implementation of lead, lag and PID compensation and be able to design such compensators using Root Locus and frequency response techniques 3(b).
5. To synthesise and demonstrate the efficacy of solutions to part or all of complex engineering problems, including formulating models from first principles of engineering science and mathematics 3(b), 3(c), 3(f).
6. To perform practical experiments, such that an engineering goal is achieved, where additional information requires identification, evaluation and conclusions drawn prior to the goal being reached 3(d). Understand the issues of uncertainty and the limitations of the applied methods, including practical issues in the implementation of PID controllers (such as integral windup) 3(e).

Course Material and Textbook

Lecture notes, laboratory scripts and assignments will be posted to the course's Blackboard page. While notes will be provided, students are advised to also take down their own notes in class. These should then be combined with further reading from the recommended reading for the course. The textbook for ECEN 315 is "Control Systems Engineering" by Norman S. Nise which is available in the 3 day reserve section of the library. The library contains a number of other excellent control engineering texts which can be consulted for additional explanation or practice problems. Some additional reading material is listed in the course reading list.

Lectures, Tutorials, Laboratories, and Practical work

Class times for ECEN 315 are:

- Lectures: Monday 1:10 in AM105 and Thursday, Friday 1:10 pm in CO119,
- Laboratories: One 3-hour lab/week: 2-6 pm Tuesday or Thursday in CO249 and CO250 (starting in week two and subject to change),

Though there are three lectures scheduled per week, we will typically use only two of the times for lectures. During the first half of the trimester these will be Monday and Friday. The Thursday session will be used on occasions for tutorials or catch up lectures. The use of the sessions will probably change in the second half of the trimester.

The topics to be covered in lectures and the approximate time allocated to each topic are listed below. Be aware that this is subject to change.

1. Introduction to dynamic systems and control (~1 lecture)
2. Modelling of physical systems, including linearisation (~ 2 lectures)
3. System transfer functions (~ 2 lectures)

4. Analysis of system response (~ 4 lectures)
5. Feedback and multiple subsystems (~ 1 lecture)
6. Stability of a system (~ 1 lecture)
7. Steady state errors (~ 1 lecture)
8. Frequency response of a system and Bode plots (~ 2 lectures)
9. Frequency response techniques (~ 2 lectures)
10. Control design using frequency response (~ 2 lectures)
11. Definition and construction of the Root Locus (~ 2 lectures)
12. Compensation using the Root Locus (~ 2 lectures)
13. Practical issues in PID implementation (~1 lecture)

The laboratory work will consist of one project that will last the entirety of the trimester.

Workload

On average, students should plan to spend 10 hours per week on in this course.

School of Engineering and Computer Science

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

The notice board for ECEN 315 is located on the second floor of the Cotton Building.

Staff

The course coordinator for ECEN 315 is Christopher Hollitt. The lecturers for the course are Christopher Hollitt and Fiona Stevens-McFadden. Their contact details are:

- Dr Christopher Hollitt
- MacDiarmid 233
- +64 4 463 6965
- Christopher.Hollitt@ecs.vuw.ac.nz

- Dr Fiona.StevensMcFadden@vuw.ac.nz
- Fiona.StevensMcFadden@vuw.ac.nz

- Tutor details : Daniel Burmester

Announcements and Communication

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

Assessment

Your grade for ECEN 315will be determined based on the following assessment weightings:

Item	Description	Date	Weight
Project Reports	**Both reports to count equally**	**11 weeks** of labs. Reports due wks 6, 12	**20%**
Assignments	**All count equally**	wks 4,6,8,10	**20%**
Tests	**One 50 min test**	wk 7	**10%**
Final Examination	**3 hours closed book**	**Exam Period**	**50%**

The assignments, tests and exams are intended to assess course objectives one through four, while the laboratory reports assess the remainder.

Assignments must be handed in on the assigned dates - typically one week after the assignment was distributed. Work submitted after the due date will incur a penalty of 10% of the full mark per working day. Do not submit late work into the submission box, as there is little chance that it will be collected. Submit any late work directly to the appropriate lecturer. Late 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

An in-term test will take place on the 5th of May during the normal lecture slot. The test will potentially cover all lecture material covered in the first six weeks of the course. 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.

The timetable for final examinations will be available from the University web site and will be posted on a notice board outside the faculty office. University approved calculators will be permitted in the exam. Paper non-English to English dictionaries will be permitted. The examination period for trimester 2 is 21 October - 12 November.

Plagiarism

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 (eg, as a comment in the code) who helped you in writing the method.

Mandatory Requirements

1. Students must achieve a grade of at least 40% over the two project reports.

Passing ECEN 315

To pass ECEN 315, a student must satisfy mandatory requirements and gain at least a **C-** grade overall.

Withdrawal

The last date for withdrawal from ECEN 315 with entitlement to a refund of tuition fees is Friday 22 July 2016. The last date for withdrawal without being regarded as having failed the course is Friday 23 September 2016 -- though later withdrawals may be approved by the Dean in special circumstances.

Rules & Policies

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.

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Course Outline as PDF

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