Control Systems Engineering - Course Outline

ECEN 315: 2012 Trimester 1

This document sets out the workload and assessment requirements for ECEN 315. 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.

Course Description

The course studies dynamic systems encountered in a variety of instrumentation and mechatronic systems. It will look at the modelling of such systems and the response of these systems to a disturbance. In addition, the control of dynamic systems using feedback and the design of control systems using different design techniques will be studied.

Prerequisites

Prerequisites: ECEN 220 or ENGR201;

Restrictions: ECSE 422, PHYS 422, TECH 422, ELEN 302

Objectives

By the end of the course, students should be able to: [This course contributes to the graduate attributes (GA) as indicated below. A full table of these attributes is available at Graduate Attributes.]

1. Understand analogies between different dynamic systems and to be able to model such systems. This assists in understanding the wider implications of these engineering concepts, including responsibility in social, cultural and environmental issues 1(a) .

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

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

5. To understand some practical issues in implementation and tuning of a PID controller, such as integral windup

6. To model various dynamic systems using software packages such as Matlab and Simulink 3(c) .

7. 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).

8. To perform practical experiments, such that an engineering goal is achieved, where additional information required 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, whilst mitigating the associated risks 3(e).

Course Material and Textbook

Outline notes will be provided, but 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 is also be available in the 3 day reserve section of the library. Any further textbooks to be used for recommended reading will be detailed when appropriate.

Lectures, Tutorials, Laboratories, and Practical work

Class times for ECEN 315 are:

- Lectures: Monday, Wednesday, Friday 9-10am in LBLT118,
- Laboratories: One 3-hour lab/week: 1:10pm - 5pm on Thursdays in CO249/CO250 (starting in week two),
- Tutorials: At certain times, a part of the laboratory time and lecture slots (especially Fridays) will be used as a tutorial.

The following is the material to be covered during the lectures. However, this is subject to change.

1. Introduction to dynamic systems and control (~1 lecture)

2. Modelling of physical systems, including linearisation (~ 4 lectures)

3. System transfer functions (~ 2 lectures)

4. Analysis of system response (~ 2 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)

Workload

On average, students should plan to spend a minimum of 10 hours per point i.e. 150 hours for a 15 point course, or 10-12 hours per week, in order to achieve an average grade in this course. A further time of approximately 30 hours will be required during the study and examination period.

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 Will Browne and Christopher Hollitt. Their contact details are:

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

- Dr Will Browne
- Cotton 341
- +64 4 463 5233 extension 8489
- will.browne@ecs.vuw.ac.nz

Tutor details : Ian Leow, Daniel Tomicek

Announcements and Communication

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

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

Item	Description	Date	Weight
Laboratory Work	**All reports to count**	**11 weeks** 5th April 8th June	**20%**
Assignments	**All 3 to count**	26th March 7th May 21st May	**10%**

Tests	**Two tests of 50 min each**	27th April 1st June	**20%**
Final Examination	**3 hours closed book**	**Exam Period**	**50%**

Assignments and laboratory reports must be handed in on the assigned dates - typically one week after the experiment was performed or the assignment was distributed. 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

Two in-term test will take place on 8th April and 27th May during the normal lecture slot - this is subject to confirmation in order to balance work across other courses. If you cannot attend a test please communicate this in writing, stating your reasons, to organiser as soon as possible in order to make 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 1 is 15 June - 4 July.

Plagiarism

We encourage you to discuss the principles of the course and assignments with other students. However, any work you hand in must be your own.

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.

Passing ECEN 315

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

To satisfy the mandatory course requirements for ECEN 315 a student must

1. Submit a credible attempt for both laboratory reports,
2. Achieve at least a **D** grade in the examination.

Withdrawal

The last date for withdrawal from ECEN 315 with entitlement to a refund of tuition fees is Friday 16 March 2012. The last date for withdrawal without being regarded as having failed the course is Friday 18 May 2012 -- 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

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.