Embedded Systems - Course Outline

ECEN 301/PHYS 340: 2012 Trimester 1

This document sets out the workload and assessment requirements for ECEN 301. 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.

Objectives

On completing ECEN 301, a student should:

1. Be skilled in the high-level use of a modern microcontroller to solve a variety of real-world problems. (BE graduate attribute (3b))
2. Understand the advantages and disadvantages of a range of different sensors, signal conditioning and signal processing elements of an embedded control system and be able to select the option best suited for a variety of engineering applications. (BE graduate attribute (3b) (3e))
3. Be able to implement a variety of signal conditioning techniques including bridges, passive and active filters. (BE graduate attribute (3b))
4. Understand the design compromises relating to serial versus parallel data transmission. (BE graduate attribute (3b))
5. Be familiar with the physical principles of analogue to digital conversion and sampling theorems. From knowledge of the advantages and disadvantages of a variety of ADC techniques, the student will be able to select the appropriate device for a range of engineering applications. (BE graduate attribute (3b))
6. Understand the variety of memory devices available complete with an appreciation of their advantages and disadvantages. The student should be able to interface DRAM, SRAM, and ROM memory devices to a microcontroller, and understand the timing and control functions.
7. Understand and be able to apply the concepts of transfer functions and Bode Approximations in order to predict the behaviour of a simple system. (BE graduate attribute (3a) (3c))
8. Have a basic understanding of classical PID control theory and Fuzzy logic. (BE graduate attribute (3b))
9. Be able to understand and summarise literature available online and elsewhere in order to supplement the information provided during the lectures. Several assessment questions will require the student to undertake such independent research. (BE graduate attribute (2b) (3d))
10. Be able to effectively communicate in a written manner the methodology, design compromises, results and evaluation of a variety of microcontroller based solutions to real-world problems. This will culminate in a report detailing these considerations for the design of a PID controller for a DC motor operating under varying loads.(BE graduate attribute (2b) (3f))

Prerequisites

The prerequisites for ECEN 301 are:

- ECEN201

Course Materials and Textbook

Students will be provided with a comprehensive study guide which contains all the lecture OHTs but with blanks that will need to be filled in during the lectures. A complete PDF of these slides is available via Blackboard for students who have either missed a lecture or wish to have the material entered in advance.

Students will also be issued with a set of comprehensive notes. This set of notes covers all the material that will be covered in the lectures other than material that you will be required to independently research. A laboratory manual with the laboratory exercises is also provided as well as a user manual for the microcontroller that you will be using.

No textbook is required, however students may consider purchasing one of these texts as an additional source of information. In order of preference, some suggestions are:

- Bolton, W. *Mechatronics*, 3rd edition_
- Alciatore, D and Hisand, M, *Introduction to Mechatronics and Measurement Systems*, 2nd edition.
- Horowitz & Hill *The Art of Electronics*, 2nd edition, (a little out of date, but contains many practical details – a must for people who are seriously interested in electronics).

Lectures, Tutorials, Laboratories, and Practical work

A schedule of lecture topics is available online.

Lectures and tutorial sessions for ECEN 301 are:

- Tuesday 1:10 - 3:30 pm in AM LT105
- Wednesday 1:10 - 2:00 pm in AM LT105

There are approximately 20 lectures, 2 tests and approximately 7 tutorials, spanning trimester 1 from 5 March 2012 through to 10 June 2012. The tutorial sessions will normally be held during the second hour of the Tuesday lecture, although for the first three weeks, a double lecture will be held during that period.

Laboratory sessions will be scheduled in the first week of term and will commence in the second week. The laboratory sessions will be held in CO 249.

Assignments and Projects

There will be two tests designed to assess analytical skills and the knowledge base of students (objectives 2-8). The laboratory part of the course assessment is designed to lest the student's ability to design and debug microprocessor code and circuits (objective 1), to maintain a reliable laboratory notebook, and to report in written form on their design work (objective 9).

Workload

The expectation is that you will do roughly 10 hours of work per week on average. This will normally comprise

- 2 hours of lectures
- 1 hour tutorial
- 3-4 hours of laboratory work, and
- on average 3-4 hours of assignment work, laboratory write-ups, and background reading.

School of Engineering and Computer Science

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

Staff

The course organiser and lecturer for ECEN 301 is Dale Carnegie. His contact details are:

- *Dale Carnegie*
- AM 224
- +64 4 463 7485
- Dale.Carnegie@ecs.vuw.ac.nz

A senior graduate student (Ben Drayton) will supervise the laboratory work. Ben's laboratory is Laby 311 (email b.drayton@gmail.com). He will be assisted by ME students Alexander Kane and Henry Williams.

Announcements and Communication

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

Registered students will find information on Blackboard at: http://blackboard.vuw.ac.nz

Assessment

The course is entirely internally assessed (there is no formal examination), comprising 33.3% written assignments, 33.4% tests and quizzes and 33.3% laboratory work, detailed as follows:

- 11.2% term test 1
- 16.7% term test 2
- 5.5% closed book quizzes administered during lecture time.
- 33.3% three internal written assignments.
- 33.3% laboratory work including major practical assignment, laboratory write-ups and laboratory practical marks.

Note there is a non-linear relationship between the write-up mark and your overall laboratory grade. For example, a mark

of 8/10 for a write-up does not guarantee you an A grade for the laboratory work since several of these items are designated as mastery assignments. This will be further explained in the lectures.

Late assessment will be penalized at the rate of 5% for every day the assessment is late. The lecturer may refuse to mark work that has been handed in over a week late, and may also refuse if the assessment has been marked and returned to the class. In such instances, a zero grade for that assessment shall result.

Cheating involves the direct copying of another's work. It is expected that the first penalty applied shall be a grade of zero for BOTH students involved, i.e., the student who has copied the work, and the student from whom the work was copied (if the lecturer believes this was done with the student's knowledge). It can be expected that further action will be taken including reporting to the University Disciplinary Committee. It is possible that cheating will result in automatic failure of the course. NOTE: that this does NOT prohibit you discussing problems and labs with your peers. In fact you are encouraged to discuss and share ideas. However, the submitted report /assignment MUST be in your own words and demonstrate your understanding. Assignments will be issued at regular intervals. Approved calculators will be permitted in the tests, but will not be required for the closed book quizzes.

Laboratories

The course includes seven 3-hour experiments and one major practical assignment design exercise.

- **Laboratory Reports** You are required to submit a formal laboratory report for each of the assigned labs. These should be of professional standard, detailing the objective of the laboratory exercise, the methodology employed, a justification for any design decisions, results obtained and an analysis or evaluation of your results. You should answer any questions asked of you in the laboratory manual.

- **Major Assignment** The real test of what you have learnt from this course is your ability to design a useful microprocessor-/microcontroller-based instrument or circuit. The last practical assignment involves the control of a dc motor using a microcontroller and a classical control algorithm. This assignment brings together most of the material you have covered in the preceding laboratory exercises.

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

It is expected that ALL work will be completed and handed in for marking. An incomplete or fail grade will be issued to any student who satisfies ANY of the below requirements.

1. Satisfactorily completes less than 5 of the 7 assigned labs (a demonstrator must verify all lab work). Note that session 6 and session 7 is a double lab session intended to take 2 weeks to complete. Failure to satisfactorily complete this double lab will count as two failures to this mandatory standard.
2. Does not turn up for either of the two assigned internal tests.
3. Hands in less than 3 assignments.
4. Is caught cheating in any form (this includes laboratory work)
5. Scores less than 40% on **both** the internal tests.

Passing ECEN 301

To pass ECEN 301, a student must satisfy mandatory requirements and gain at least a **C** grade overall.

Withdrawal

The last date for withdrawal from ECEN 301 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
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.