Analogue Circuits and Systems - Course Outline

ECEN 203/PHYS 235: 2012 Trimester 2

The aim of this course is to introduce students, in a practically-oriented way, to a number of topics in analogue electronics, including circuit theorems, transducers, power supplies, semiconductor devices, transistor amplifiers, operational amplifiers and circuits. It builds on the basic circuit theory developed in PHYS 115 and is an integral part of the major in Electronic and Computer Systems for both BE and BSc. At the end of the course students do a design project which includes designing, laying out and populating a printed circuit board. ECEN 203 is a prerequisite for further courses in analogue electronics.

Objectives

On successfully completing this course, students should have:

1. Both theoretical and practical experience of
   - the methods and uses of circuit analysis techniques 3(a)
   - the use and limitations of standard measuring instruments 3(d) , 3(f)
   - the major types of diodes and their uses and with the structure and operation of bipolar junction and field effect transistors 3(b)
   - the basic concepts of feedback and its application to amplifier circuits 3(b)
   - a range of standard operational amplifier circuits 3(b)
2. Experience of the design and population of printed circuit boards 3(f)
3. The ability to maintain a detailed laboratory log book 2(b)
4. The ability to write an appropriate laboratory report in a suitable format. 2(b)

Prerequisites

The prerequisites for ECEN 203 are:

- PHYS115 or comparable background
- MATH 151

Restrictions: ELEN201, PHYS235 (or ECEN203)

Course Materials and Texts

There are no set textbooks for ECEN 203, however the following are useful references:

- *Microelectronic Circuits", 3rd edition, Sedra and Smith*
- *The Art of Electronics", Horowitz and Hill*
- *Electronics: A System Approach", 3rd edition, Neil Storey*

A laboratory manual will be provided and students will be required to have a laboratory logbook. The logbook should be a bound notebook e.g., A4, 1J5, containing squared paper. A scientific calculator is also required and access to a computer is recommended.

Lectures, Tutorials, Laboratories, and Practical work

Lectures: Monday, Tuesday 13.10 – 14.00, AM 202

Labs: One 3-hour lab per week: Wednesday 14.00 – 17.00, Thursday 14.00 – 17.00 pm LB 217

Tutorials: Friday 13.10 – 14.00, AM 202

Course Operation

Material is introduced in lectures (2 per week) and further illustrated in tutorials. However, perhaps the most important part of the course is the laboratory where students will obtain hands on experience of building circuits and investigating the properties of electronic components.

Assessments

The assessment for ECEN 203 is internally assessed and involves assignments, two 1-hour tests and laboratory work.

The assessment for ECEN 203 is internally assessed and involves assignments, two mid-term tests and laboratory work, as detailed below:

Assessed Item	Length / Duration	Due Date	% of Final Grade	Objectives Assessed
Assignments	n/a	Set and due approximately weekly	5%	1
Laboratory Reports	4-6 pages each	(1) Monday 10 Sept (2) Monday 1 Oct	15% each	1 and 4
Design Project	4-6 pages	Friday 26 Oct	15%	1, 2 and 4
Laboratory Logbook	n/a	After each lab class	10%	1 and 3
Tests	1 Hour	(1) Tuesday 11 Sept (2) Monday 15 Oct	20% each	1

All work is due in on the due date. Marks will be deducted at a rate of 10% of the full mark for each working day late. Work will not be marked if more than 1 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.

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 approximately *12* hours per week, in order to achieve an average grade for this course.

School of Engineering and Computer Science

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

Staff

The course coordinator for ECEN 203 is Dr Petrik Galvosas. The lecturers for the course are Dr Petrik Galvosas and Dr Sergei Obruchkov. Their contact details are:

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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

Course Content

- **Introduction and revision** (1 lecture) –revision of basics, circuit analysis –Kirchhoff's laws and mesh method, current and voltage dividers, voltage and current sources.
- **Circuit theorems** (2 lectures) –Thevenin and Norton theorems, application of Thevenin's theorem, application of Norton's theorem, source resistance and circuit loading, superposition theorem.
- **Capacitors and inductors** (1 lecture) –capacitors – introduction, step function responses of an RC circuit, inductors – introduction, step function response of an RL circuit.
- **AC Circuits** (1 lecture) –phase relationships between current and voltage for R, C and L, impedance, impedance of R, C and L.
- **RC and RL filters** (1 lecture) RC high and low pass filters, differentiators and integrators.
- **Diodes** (2 lectures) – semiconductors, pn junctions, biasing, diode characteristic, diode models, rectification and diode bridges.
- **Zener Diodes** (1 lecture) zener characteristic, zener model, regulation.
- **Amplifiers** (2 lectures) – introduction to amplifiers, voltage, current and transconductance amplifiers, ideal amplifiers, input and output impedance, feedback.

- **OP amps** (2 lectures) – properties of an ideal op amp, slew rate, op amp circuits – inverting, inverting and non-inverting amplifiers, voltage follower, summing, difference and logarithmic amplifiers, active integrators and differentiators, slew rate.
- **MOSFETs** (2 lectures) – structure and operation, input, transfer and output characteristics, dc circuits, MOSFETs as amplifiers, small signal equivalent circuits.
- **Bipolar Junction Transistors** (3 lectures) – the bipolar junction transistor (BJT), current gain, transconductance, input, transfer and output characteristics, BJT as an amplifier – inverting amplifier, dc biasing, small signal approximations, small signal equivalent circuits, common emitter and emitter follower amplifiers.

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

To be deemed to have completed the course, a student must complete

1. The laboratory course;
2. all items of assessment; and
3. submit at least 50% of course assignments.

Important dates are:

1. First Test: Tuesday 11 Sept, 5.00 pm, HMLT 001 second test: Monday 15 Oct, 5.00 pm, HMLT 001
2. first report: set Monday 20 August due monday 10 September by 5pm second report: set Friday 21 September due Monday 1 October by 5pm
3. Design report: due Friday 26 Oct
4. Logbook: handed in at the end of every lab session
5. Assignments: set Tuesday at 1 or 2 week intervals, due 1 week after being set

Passing ECEN 203

To pass ECEN 203, a student must satisfy mandatory requirements and gain at least a **C** grade overall.

Withdrawal

The last date for withdrawal from ECEN 203 with entitlement to a refund of tuition fees is Friday 27 July 2012. The last date for withdrawal without being regarded as having failed the course is Friday 28 Sept 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

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.