TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI VICTORIA UNIVERSITY OF WELLINGTON

SCHOOL OF ENGINEERING AND COMPUTER SCIENCE

Introductory Signal Processing - Course Outline

ECEN 320: 2013 Trimester 1

This document sets out the workload and assessment requirements for ECEN 320. 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 continuous and discrete time signal processing, with applications to electronics and communications. Topics include Fourier, Laplace and z-transforms, filter design and spectral analysis.

Prerequisites

Prerequisites: ECEN 220 (or ENGR 201) or MATH 243 or MATH 244 (or MATH 206)

Restrictions: ECSE 420, ELEN 303, PHYS 420, TECH 420

Objectives (and associated graduate attributes)

At the completion of this course, students will be able to perform the following, and in doing so exhibit the graduate attributes (linked in the electronic copy of this document)

1. Apply the principle of orthogonality of vectors and functions to approximation problems, and be able to derive decompositions based on various orthogonal function sets. 3(a) .
2. Calculate and apply Fourier transforms for functions that are periodic or nonperiodic and that are discrete or continuous in time, both analytically and numerically. 3(a) .
3. Calculate power spectral density via the Fourier transform, and via the autocorrelation function. 3(a) .
4. Apply windowing to spectral estimation. 3(a) .
5. Compute the response of a linear time invariant system (continuous or discrete time) to arbitrary input. 3(a) .
6. Design both analogue and digital filters to meet a given frequency specification, and be able to implement digital filters in software. 3(c) .

Objectives 1-5 are assessed primarily by written assignments and the examination, and to a lesser degree by the laboratory assignments. Objective 6 is assessed primarily by programming and laboratory assignments.

Course Material and Textbooks

Course 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. There are many introductory signal processing texts that cover the material.

The textbook, focusing mainly on the discrete-time signal processing, is

Alan V. Oppenheim, Ronald W. Schafer, *Discrete-Time Signal Processing (3rd Edition)*, Prentice Hall 978-0131988422

and is available at the university bookstore.

The following texts are avilable on 3-day loan or closed reserve from the library:

- B.P. Lathi, *Linear Systems and Signals* , TK5102.5 L352L.
- P.A. Lynn, *An Introduction to the Analysis and Processing of Signals,* TK51092.5 L989I 3rd edn.

Additional references are:

- D.C. Champeney, *Fourier Transforms and their Applications,* QA403.5 C451.
- R.M. Bracewell, *The Fourier transform and its Application,* QA403 B796.
- A. Papoulis, *The Fourier Integral and its Applications,* QA403 P218.
- C.D. McGillem & GR Cooper, *Continuous and Discrete Signals and System Analysis* TK5102.5 M145 C 3rd edn.
- J.N. Rayner, *An Introduction to Spectral Analysis,* QA403 R275.
- W.H. Press et al., *Numerical Recipes for Scientific Computing,* QA76.73 P2 N971.

Lectures, Tutorials, Laboratories, and Practical work

A schedule of lecture topics, readings, and assignment due dates is available online

Lectures for ECEN 320 are: Monday, Wednesday and Friday at 2:00 pm in AM104. Note that some of the Wednesday time slots will be used for tutorials rather than lectures.

Labs for ECEN 320 are: Friday 10:00am-1:00 pm in CO249 and CO250 beginning Friday, 15 March.

Course Content

The following is a preliminary outline of the topics covered in the lectures.

- Signals
- Orthogonality
- Fourier Series
- Fourier Transform
- FT Properties
- Energy/Pwer spectral density
- LTI Systems
- Sampling
- Discrete Time Systems
- DTFT
- Signal Processing and LTI Systems
- DTFT Interpolation
- The Discrete Fourier Transform
- The Fast Fourier Transform
- Review of the Laplace Transform
- The z Transform
- Windowing
- Continuous Time Filters
- Discrete Time Systems
- Allpass and Minimum Phase
- Discrete Time Filters
- Discrete Time Structures

Assignments

There are 9 written assignments, each due on Thursday.

Workload

In order to maintain satisfactory progress in ECEN 320, you should plan to spend an average of at least 10 per week on this paper. A plausible and approximate breakdown for these hours would be:

- Lectures and tutorials: 3 hours/week
- Laboratories: 3 hours/week
- Readings: 1 hours/week
- Assignments: 3 hours/week
- Completion of tests and final exam: 30 hours

School of Engineering and Computer Science

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

Staff

The course organiser for ECEN 320 is Paul Teal. The lecturers for the course are Paul Teal and Pawel Dmochowski. Their contact details are:

- Paul Teal
- McDiarmid 228
- +64 4 463 5966
- paul.teal@vuw etc

- Pawel Dmochowski
- AM 227

- 463 5948
- Pawel.Dmochowski@ecs.vuw etc

The tutor for this course is Jawad Mirza.

Announcements and Communication

The main means of communication outside of lectures will be the ECEN 320 web area at http://ecs.victoria.ac.nz/Courses/ECEN320_2013T1/. There you will find, among other things, this document, and the lecture schedule.

Assessment

Your grade for ECEN 320 will be determined based on the following assessment weightings:

Item	Weight
9 written assignments	20%
7 laboratory sessions	20%
Mid-term test	15%
Final Examination (3 hours)	45%

Bachelor of Engineering students should be aware that copies of their assessed work may be retained for inspection by an IPENZ appointed accreditation panel.

Policies and penalties for late submission

The first 6 laboratory assignments will be Matlab based. The printed results of a Matlab ``publish" of a file constructed during each laboratory session is to be handed in no later than one week following the laboratory session. Assignments and labs not collected in lectures can be collected from the SECS school office.

Late submission of lab work incurs a penalty of 10% per working day.

The best 7 marks for the 9 written assignments will be counted to the 20% for the assignments. Because of the rapid turnaround of these small assignments, late submissions will not be accepted.

Tests and Exams

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. The final examination will be three hours long. No computers, electronic calculators or similar device will be allowed in the final examination. Paper non-English to English dictionaries will be permitted. The examination period for trimester 1 is 14 June - 3 July.

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 computers. 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. Attendance at 85% of lectures
2. Submission of a reasonable attempt of 80% of assignments
3. Submission of a reasonable attempt of 80% of laboratories
4. A mark of no less than 50% in the final exam

Passing ECEN 320

To pass ECEN 320, a student must satisfy mandatory requirements and gain at least a **C** grade overall.

Withdrawal

The last date for withdrawal from ECEN 320 with entitlement to a refund of tuition fees is Friday 15 March 2013. The last date for withdrawal without being regarded as having failed the course is Friday 17 May 2013 -- 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.

Course Outline as PDF