



Prescription

The goal of ECEN 421 is to provide a geometric intuition to signal processing. This geometric point of view is a powerful tool for the understanding of signal processing techniques including Fourier transforms, sampling theorems, time-frequency analysis and wavelets. The course provides the mathematical depth and rigor that is necessary for the study of more advanced topics in signal processing, as well as providing the details of applications including image compression, audio coding, and mobile sensing.

Course learning objectives

Students who pass this course will be able to:

1. Use the right tools to tackle advanced signal and data processing problems
2. Have an intuitive understanding of signal processing through a geometrical approach
3. Know the applications of signal processing that are of interest today
4. Understand topics that are at the forefront of signal processing research

Course content

The following is an outline of the topics covered in the lectures.

- Vector spaces
- Infinite Dimensions
- Hilbert Spaces
- Operators
- Bases
- Dual bases
- Frames
- Stochastic processes
- Correlation functions and systems
- The Weiner Filter
- The Matched Filter
- AR and ARMA models
- Spectrum estimation using AR processes, Yule-walker equations
- Subspace frequency estimation
- Cramer Rao Bound, including asymptotic bound
- Linear Estimation
- Maximum Likelihood estimation
- Bayesian estimation

Withdrawal from Course

Withdrawal dates and process:

<https://www.victoria.ac.nz/students/study/course-additions-withdrawals>

Lecturers

Paul Teal (Coordinator)

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420 Alan MacDiarmid Building, Kelburn

Teaching Format

During the trimester there will be three lectures per week.

Dates (trimester, teaching & break dates)

- Teaching: 08 July 2019 - 13 October 2019
- Break: 19 August 2019 - 01 September 2019
- Study period: 14 October 2019 - 17 October 2019
- Exam period: 18 October 2019 - 09 November 2019

Class Times and Room Numbers

08 July 2019 - 18 August 2019

- **Tuesday** 12:00 - 12:50 – 108, Von Zedlitz, Kelburn
- **Wednesday** 12:00 - 12:50 – 108, Von Zedlitz, Kelburn
- **Friday** 10:00 - 10:50 – 401, Murphy, Kelburn

02 September 2019 - 13 October 2019

- **Tuesday** 12:00 - 12:50 – 108, Von Zedlitz, Kelburn
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Set Texts and Recommended Readings

Required

- Vetterli, J. Kovacevic and V. Goyal, "*Foundations of Signal Processing*", Cambridge U. Press, 2013. Downloadable at <http://www.fourierandwavelets.org>. (This free version does not contain homework problems - homework problems will be handed out on paper separately.)

Mandatory Course Requirements

In addition to achieving an overall pass mark of at least 50%, students must:

- submit a reasonable attempt of 80% of assignments.

If you believe that exceptional circumstances may prevent you from meeting the mandatory course requirements, contact the Course Coordinator for advice as soon as possible.

Assessment

This course will be assessed through written assignments, a test, and a final examination.

Assessment Item	Due Date or Test Date	CLO(s)	Percentage
Written assignments (ten assignments worth 3% each), due throughout the trimester.	TBC	CLO: 1,2,3,4	30%
In-class test (1 hour duration)	TBC	CLO: 1,2,3,4	10%
Final examination (3 hours)	TBC	CLO: 1,2,3,4	60%

Extensions

Individual extensions will only be granted in exceptional personal circumstances, and should be negotiated with the course coordinator before the deadline whenever possible. Documentation (eg, medical certificate) may be required.

Workload

In order to maintain satisfactory progress in ECEN 421, you should plan to spend an average of 10 per week on this paper. A plausible and approximate breakdown for these hours would be:

- Lectures and tutorials: 3 hours/week
- Readings: 3 hours/week
- Assignments: 4 hours/week

Teaching Plan

Links to General Course Information

- Academic Integrity and Plagiarism: <https://www.victoria.ac.nz/students/study/exams/integrity-plagiarism>
- Academic Progress: <https://www.victoria.ac.nz/students/study/progress/academic-progress> (including restrictions and non-engagement)
- Dates and deadlines: <https://www.victoria.ac.nz/students/study/dates>
- Grades: <https://www.victoria.ac.nz/students/study/progress/grades>
- Special passes: Refer to the Assessment Handbook, at <https://www.victoria.ac.nz/documents/policy/staff-policy/assessment-handbook.pdf>
- Statutes and policies, e.g. Student Conduct Statute: <https://www.victoria.ac.nz/about/governance/strategy>
- Student support: <https://www.victoria.ac.nz/students/support>
- Students with disabilities: https://www.victoria.ac.nz/st_services/disability/
- Student Charter: <https://www.victoria.ac.nz/learning-teaching/learning-partnerships/student-charter>
- Terms and Conditions: <https://www.victoria.ac.nz/study/apply-enrol/terms-conditions/student-contract>

- Turnitin: <http://www.cad.vuw.ac.nz/wiki/index.php/Turnitin>
- University structure: <https://www.victoria.ac.nz/about/governance/structure>
- VUWSA: <http://www.vuwsa.org.nz>

Offering CRN: [18523](#)

Points: 15

Prerequisites: ECEN 321,

Restrictions: PHYS 421, TECH 421

Duration: 08 July 2019 - 10 November 2019

Starts: Trimester 2

Campus: Kelburn