



## Prescription

The course covers advanced topics in physical layer wireless communications. It begins with a brief introduction to Information Theory, leading to the concept of channel capacity. Multiple antenna techniques for both single and multiple user communications are discussed, including diversity, space time coding and digital beamforming. Large scale systems and advanced channel models are discussed. Matlab system simulations are used throughout the course for evaluating the communication system performance.

## Course learning objectives

Students who pass this course will be able to:

1. Understand the basic concepts of information theory as applied to wireless communication systems (BE graduate attributes 3(a), 3(b) and 3(c)).
2. Characterise the capacity of additive white Gaussian noise and fading wireless channels (BE graduate attributes 3(a), 3(b) and 3(c)).
3. Understand the signal processing techniques used in multi-antenna communications for single and multiple users. (BE graduate attributes 3(a), 3(b) and 3(c)).
4. Evaluate the performance of wireless communication systems by means of computer simulations (BE graduate attributes 3(b) and 3(d) and 3(f)).

## Course content

- Introduction to Information Theory
- Multiple Antenna Systems (MIMO)
- Multi-User MIMO
- Large MIMO Systems (Massive MIMO)
- Statistical Channel Models
- 3GPP Channel Models

## Withdrawal from Course

Withdrawal dates and process:

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

## Lecturers

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# Pawel Dmochowski (Coordinator)

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## Teaching Format

The course will be taught via a single 2-hour lecture each week, The third lecture slot will be used for occasional tutorials or catch-up session as necessary.

## Student feedback

Student feedback on University courses may be found at:  
[www.cad.vuw.ac.nz/feedback/feedback\\_display.php](http://www.cad.vuw.ac.nz/feedback/feedback_display.php)

## Dates (trimester, teaching & break dates)

- Teaching: 02 March 2020 - 07 June 2020
- Break: 13 April 2020 - 27 April 2020
- Study period: 08 June 2020 - 11 June 2020
- Exam period: 12 June 2020 - 27 June 2020

## Class Times and Room Numbers

### 02 March 2020 - 22 March 2020

- **Monday** 12:00 - 13:50 – 118, Cotton, Kelburn
- **Tuesday** 12:00 - 12:50 – 118, Cotton, Kelburn
- **Thursday** 12:00 - 12:50 – 118, Cotton, Kelburn

### 27 April 2020 - 07 June 2020

- **Monday** 12:00 - 13:50 – 118, Cotton, Kelburn
- **Tuesday** 12:00 - 12:50 – 118, Cotton, Kelburn
- **Thursday** 12:00 - 12:50 – 118, Cotton, Kelburn

## Set Texts and Recommended Readings

### Required

There are no required texts for this offering.

## Mandatory Course Requirements

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

- achieve a mark of at least 40% on the mid-term test, to demonstrate achievement of all the CLOs of the course.

*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 assignments and a test

Assessment Item	Due Date or Test Date	CLO(s)	Percentage
Assignments	Weeks 3, 6	CLO: 1,2,3,4	20%
Test	Week 7	CLO: 1,2,3	40%
Individual Project 1	Week 9	CLO: 3,4	20%
Individual Project 2	Week 13	CLO: 3,4	20%

## Penalties

Work submitted after the due date will incur a penalty of 10% of the full mark per working day. Late work will not be marked after the model solutions have been made available or if more than one week late.

## 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.

## Submission & Return

All work should be submitted via the submission page on the course web site. Unless otherwise noted, all work should be submitted as pdf files. Handwritten work that is scanned as a pdf is fine. Submission of matlab code alone will not be adequate.

## Workload

In order to maintain satisfactory progress in ECEN 410, you should plan to spend an average of 10 hours per week on this course. A plausible and appropriate breakdown for these hours would be:

- Lectures and tutorials: 3 hours
- Assignments: 5 hours
- Reading and extra problems: 2 hours

## Teaching Plan

See: [https://ecs.wgtn.ac.nz/Courses/ECEN410\\_2020T1/LectureSchedule](https://ecs.wgtn.ac.nz/Courses/ECEN410_2020T1/LectureSchedule)

## Communication of Additional Information

All online material for this course can be accessed at [https://ecs.wgtn.ac.nz/Courses/ECEN410\\_2020T1/](https://ecs.wgtn.ac.nz/Courses/ECEN410_2020T1/)

# Links to General Course Information

- Academic Integrity and Plagiarism: <https://www.wgtn.ac.nz/students/study/exams/integrity-plagiarism>
- Academic Progress: <https://www.wgtn.ac.nz/students/study/progress/academic-progress> (including restrictions and non-engagement)
- Dates and deadlines: <https://www.wgtn.ac.nz/students/study/dates>
- Grades: <https://www.wgtn.ac.nz/students/study/progress/grades>
- Special passes: Refer to the Assessment Handbook, at <https://www.wgtn.ac.nz/documents/policy/staff-policy/assessment-handbook.pdf>
- Statutes and policies, e.g. Student Conduct Statute: <https://www.wgtn.ac.nz/about/governance/strategy>
- Student support: <https://www.wgtn.ac.nz/students/support>
- Students with disabilities: [https://www.wgtn.ac.nz/st\\_services/disability/](https://www.wgtn.ac.nz/st_services/disability/)
- Student Charter: <https://www.wgtn.ac.nz/learning-teaching/learning-partnerships/student-charter>
- Terms and Conditions: <https://www.wgtn.ac.nz/study/apply-enroll/terms-conditions/student-contract>
- Turnitin: <http://www.cad.vuw.ac.nz/wiki/index.php/Turnitin>
- University structure: <https://www.wgtn.ac.nz/about/governance/structure>
- VUWSA: <http://www.vuwsa.org.nz>

**Offering CRN:** [18522](#)

**Points:** 15

**Prerequisites:** ECEN 310

**Duration:** 02 March 2020 - 28 June 2020

**Starts:** Trimester 1

**Campus:** Kelburn