Course staff

- Lecturer: Dr. Wei Zhang
- Office: EE325
- E-mail: wzhang@ee.unsw.edu.au
- Tel: 9385 4033
- Consultation Time: 2pm-3pm Thursday
- Other Consultation Time: Available upon an appointment made and confirmed by email.

Course details

- 6 Units of Credit (UoC) value for the course
- 4 hours of expected workload per week
- Course website: www.ee.unsw.edu.au/~wzhang/TELE4653.html

Course aims

- TELE4653 is a core course in telecommunication systems, introducing the fundamental concepts in both digital modulation and coding. It comprises fundamentals of communications concepts (signal space, random variables, random process), digital modulation and demodulation techniques, performance analysis, synchronization techniques, coding theory (block codes and convolutional codes), and multi-carrier modulation and coding.

- The course aims to assist students to be familiar with fundamentals of telecommunications, develop understanding of digital modulation and coding theory, and deduce and analyse the behaviour of a telecommunication system.

Relation to other courses

- TELE4653 is a 4th year technical elective in the wireless communications discipline. It is aimed at students wishing to specialise in telecommunications in their degree, and possibly, their future careers.

- **Pre-requisites**: TELE3113: Analogue and Digital Communications, or equivalent, is required. It is also desirable that students have completed ELEC3104: Digital Signal Processing, as several of the ideas taught in that course lay the foundation in some areas of this subject. In addition, a substantial level of mathematics and statistics is required to adequately master the subject matter.

- **Assumed Knowledge**: A basic knowledge and understanding of communication systems and the communication problem, as would be gained from TELE3113, is assumed. Basic knowledge of Fourier theory, digital filters and signal processing is also assumed. Above average competency in the fields of algebra, analysis, and statistics, gained from the second year core mathematics course, commensurate with a student wishing to specialise in telecommunications, will also be required. The assignments and tutorials will require students to be familiar with MATLAB, or some other equivalent numerical computing platform. The laboratories are to be performed on TIMS, the signal processing platform extensively used in TELE3113 and ELEC3104.
- **Following Courses**: As a final year technical elective, it is planned that the standard reached by students at the end of this course would be commensurate with that expected of a graduating telecommunication engineer. There are no follow on courses as such, but students will find that the underlying principles of communication systems taught in this course will provide deeper insight into specialist communications courses in wireless communications, mobile and satellite communications, and optical fibre communications.

**Student learning outcomes**

Upon completing of the course, students should

- be familiar with all the key elements of a digital communication system and at a theoretical level can identify and quantify the factors that determine the performance of a digital communication system.
- be familiar with major modulation techniques, their practical considerations, and be capable of quantifying the performance of a generic modulation scheme.
- Understand the importance and rationale of channel coding in communication, and implement and analyse block coding and convolutional coding schemes.

Students are strongly recommended to read UNSW Graduate Attributes (Engineering) [http://learningandteaching.unsw.edu.au/content/userDocs/grad_attributes.pdf](http://learningandteaching.unsw.edu.au/content/userDocs/grad_attributes.pdf)

**Teaching strategies**

The course consists of lecture, tutorial and laboratory work.

During the lecture, theories and other relevant information will be expounded by the lecturer. Core materials of the course will be elaborated with a variety of practical examples of digital modulation and coding. As the course emphasizes interactive learning, students are encouraged to ask questions and express feedback during the lectures.

The tutorial provides students in-depth quantitative understanding of digital modulation/demodulation and coding techniques. Students will practise their problem-solving skills in the form of discussion and class exercises.

The laboratory work offers students hands-on experience in generating and detecting wireless data signals in various modulation formats, and thus helps students understand the core materials of the course.

**Assessment**

- Laboratory work 24% (6 labs, 4 marks each)
- Assignments 16% (2 assignments, 8 marks each)
- Final Examination 60%
Assessment Details

Laboratory Work (24 marks):

- There are 6 experiments to complete in total. All experiments will be performed on the TIMS systems in EE302, in part using the MATLAB interface.

- Students must attend the laboratory every fortnight at their allotted time. If students find they must miss a lab session for any reason (illness, family or work commitments), they are required to contact the lecturer and make alternative arrangements PRIOR TO the lab session in question. Students who have not done so will receive a mark of zero for the missed lab session – there will be no exceptions. Some lab periods may need to be rescheduled due to public holidays, and the announcement of alternative arrangements will be made during the lectures.

- Students must be marked off by a lab demonstrator at the end of each lab session and have their mark recorded by the demonstrator. It is the responsibility of the student to make sure this is done. If no mark is recorded at the end of the lab for whatever reason, a mark of zero will be given – once again, there will be no exceptions.

- Students are required to maintain a laboratory journal, and the marks obtained directly correspond to the quality of this journal. The journal should record all equipment settings and connections, as well as any measurements and observations made. It is important for all engineers to accurately document all experimental work, and emphasis is placed on the lab journal in this course to ensure that students develop this important attribute of a professional engineer.

Assignments (16 marks):

- There are two assignments to complete in total. The details of the two assignments will be made available on the course website, in week 5 and 10, respectively. The assignments are to be submitted to the lecturer’s email (wzhang@ee.unsw.edu.au) in PDF file with an email subject “TELE4653 Assignment (student ID & name)”. Students must submit the assignments on or before the due date. Later submission will suffer a penalty of 2 marks per day late.

Final Exam (60 marks):

The final examination is a standard closed-book 3-hour written examination, held after week 13, comprising not more than eight compulsory questions. The final examination will test students’ understanding of the course material and analytical skills. Assessment is a graded mark according the correct fraction of the answers to the exam questions.
### Lecture Schedule

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<tr>
<th>Week</th>
<th>Date</th>
<th>Topic</th>
<th>Reference [1]</th>
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<tbody>
<tr>
<td>Week 1</td>
<td>28 February</td>
<td>Fundamentals</td>
<td>Chapter 2</td>
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<tr>
<td>Week 2</td>
<td>7 March</td>
<td>Modulation</td>
<td>Chapter 3</td>
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<tr>
<td>Week 3</td>
<td>14 March</td>
<td>Modulation</td>
<td>Chapter 3</td>
</tr>
<tr>
<td>Week 4</td>
<td>21 March</td>
<td>Modulation</td>
<td>Chapter 3</td>
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<td>Week 5</td>
<td>28 March</td>
<td>Synchronization</td>
<td>Chapter 5</td>
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<tr>
<td>Week 6</td>
<td>4 April</td>
<td>Detection</td>
<td>Chapter 4</td>
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<td>Week 7</td>
<td>11 April</td>
<td>Detection</td>
<td>Chapter 4</td>
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<tr>
<td>Week 8</td>
<td>18 April</td>
<td>Detection</td>
<td>Chapter 4</td>
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**Mid-Semester Break**

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<th>Week 9</th>
<th>Date</th>
<th>Topic</th>
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<tr>
<td>Week 10</td>
<td>9 May</td>
<td>Convolutional Codes</td>
<td>Chapter 8</td>
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<tr>
<td>Week 11</td>
<td>16 May</td>
<td>Convolutional Codes</td>
<td>Chapter 8</td>
</tr>
<tr>
<td>Week 12</td>
<td>23 May</td>
<td>From Theory to Practice: DMC for broadband wireless communications</td>
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Notes:
1. Lecture notes/handouts will be distributed, or else available at course website.
2. All students must attend the lectures every week.

### Resources for students

- **Prescribed textbooks**

- **Reference books**

**Course evaluation and development**

- Any feedback on the course to improve the quality of learning and teaching is appreciated. Please feel free to talk to your lecture staff about it.
- Students’ feedback is gathered periodically on-class and such feedback will be considered carefully with a view to acting on it constructively wherever possible.
- Note that feedback is gathered using various means, including the Course and Teaching Evaluation and Improvement (CATEI) Process.

**Academic honesty and plagiarism**

### What is Plagiarism?
Plagiarism is the presentation of the thoughts or work of another as one’s own.* Examples include:

- direct duplication of the thoughts or work of another, including by copying material, ideas or concepts from a book, article, report or other written document (whether published or unpublished), composition, artwork, design, drawing, circuitry, computer program or software, web site, Internet, other electronic resource, or another person’s assignment without appropriate acknowledgement;
- paraphrasing another person’s work with very minor changes keeping the meaning, form and/or progression of ideas of the original;
- piecing together sections of the work of others into a new whole;
- presenting an assessment item as independent work when it has been produced in whole or part in collusion with other people, for example, another student or a tutor; and
- claiming credit for a proportion a work contributed to a group assessment item that is greater than that actually contributed.†

For the purposes of this policy, submitting an assessment item that has already been submitted for academic credit elsewhere may be considered plagiarism.

Knowingly permitting your work to be copied by another student may also be considered to be plagiarism.

Note that an assessment item produced in oral, not written, form, or involving live presentation, may similarly contain plagiarised material.

The inclusion of the thoughts or work of another with attribution appropriate to the academic discipline does not amount to plagiarism.

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* Footnotes:
† Footnotes:
The Learning Centre website is main repository for resources for staff and students on plagiarism and academic honesty. These resources can be located via:

www.lc.unsw.edu.au/plagiarism

The Learning Centre also provides substantial educational written materials, workshops, and tutorials to aid students, for example, in:

- correct referencing practices;
- paraphrasing, summarising, essay writing, and time management;
- appropriate use of, and attribution for, a range of materials including text, images, formulae and concepts.

Individual assistance is available on request from The Learning Centre.

Students are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting, and the proper referencing of sources in preparing all assessment items.

* Based on that proposed to the University of Newcastle by the St James Ethics Centre. Used with kind permission from the University of Newcastle
† Adapted with kind permission from the University of Melbourne.