
UNSW
THE UNIVERSITY OF NEW SOUTH WALES

FACULTY OF ENGINEERING

SCHOOL OF ELECTRICAL ENGINEERING &
TELECOMMUNICATIONS

TELE3113

# Analogue & Digital Communications

SESSION 2, 2009

Revised on July 15, 2009

## Course staff

- Lecturer: Dr. Wei Zhang
- Office: 325 EE Building
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- Tel: 9385 4033
- Consultation Time: Thursday, 2pm-3pm
- Other Consultation Time: Available upon an appointment made and confirmed by email.

## Course details

- 6 Units of Credit (UoC) value for the course
- 5 hours of expected workload per week

## Course aims

- TELE3113 is the first course in telecommunication systems, introducing the fundamental concepts in both analogue and digital communications. It comprises fundamentals of telecommunications, analogue modulation (AM, DSB, SSB, VSB, QAM, FM and PM) and demodulation techniques, digital baseband modulation (PAM, PWM, PPM, PCM, DM and line coding) and passband modulation (*M*-ary signal, ASK, PSK, FSK, QPSK, QAM) techniques, multiplexing techniques, and error and noise analysis.
- The course aims to assist students to be familiar with fundamentals of telecommunications, develop understanding of analogue and digital communications, and deduce and analyse the behaviour of a telecommunication system.

## Relation to other courses

- TELE3113 is a pre-requisite for all professional electives offered in the Telecommunication option. It assumes basic competency in the second year electronics and systems courses, and requires a mathematical ability of at least up to second year.
- TELE3113 is the minimum pre-requisite for TELE4651 Wireless Communication Technologies, TELE4652 Mobile and Satellite Communication Systems, and TELE4653 Digital Modulation and Coding.

## Assumed knowledge

- It is assumed that the student has a background in calculus, electronics, signals and systems, and probability theory.
- It is assumed that the student has basic knowledge of programming language such as MATLAB or C.

## Student learning outcomes

Upon completing of the course, students should

- be familiar with both time and frequency domain representations of signals;
- be familiar with analogue modulation and demodulation techniques;

- be familiar with digital modulation and demodulation techniques;
- be able to perform noise and error analysis of an analogue or digital telecommunication system.

Students are strongly recommended to read UNSW Graduate Attributes (Engineering) http://www.ltu.unsw.edu.au/content/userDocs/GradAttrEng.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 analogue and digital communications. 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 analogue and digital modulation/demodulation 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 25% (5 labs, 5 marks each)
- Midterm Examination 30%
- Final Examination 45%

How do you pass the course:

Student will pass the course if he/she must achieve

1. No less than 50 marks in total, AND
2. No less than 15 marks in lab work, AND
3. No less than 10 marks in Midterm Exam, AND
4. No less than 15 marks in Final Exam.

**Assessment Details**

- **Laboratory Work (25 marks)**: Five assessable labs (i.e., Lab 1, 2, 3, 4, 5) start in week 4 and end in week 13. The labs help students understand the principles of analogue and digital communications. It requires students to complete labs in slotted time and be marked by a supervisor before the end of each lab session. Each lab work has 5 marks, 2 marks for your lab-preparation and 3 marks for your completion of the labs. Lab supervisor will ask you a few questions individually about the principles of the lab in order to evaluate your pre-lab preparation.

- **Midterm Examination (30 marks)**: The midterm exam is a closed-book 2-hour written examination, held in class on Tuesday of week 8, i.e., **15 September 2009**. It comprises three to five compulsory questions. The midterm exam aims to test students' understanding of the course materials and their problem-solving

abilities. Assessment is a graded mark according the correct fraction of the answers to the exam questions.

- **Final Examination (45 marks)**: The final examination is a standard closed-book 3-hour written examination, held after week 13, comprising not more than six 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.

## Course schedule

1. **Lecture**

| **Lecture Schedule** TELE3113 S2, 2009 | **Tue 9-11 am** (CLB4) **Wed 2 pm** (CLB4) | Topics | Reference [1] |
|---|---|---|---|
| **Week 1** | 21 July<br>22 July | Review of probability theory and random process | |
| **Week 2** | 28 July<br>29 July | Fourier Transform, Introduction to Communication Systems | |
| **Week 3** | 4 Aug<br>5 Aug | Amplitude Modulation (1) | |
| **Week 4** | 11 Aug<br>12 Aug | Amplitude Modulation (2) | |
| **Week 5** | 18 Aug<br>19 Aug | Angle Modulation (1) | |
| **Week 6** | 25 Aug<br>26 Aug | Angle Modulation (2) | |
| **Week 7** | 1 Sep<br>2 Sep | Pulse Modulation | |
| | 5 – 13 September | Mid-Semester Break | |
| **Week 8** | **15 Sep**<br><br>16 Sep | *Tuesday*: **Midterm Examination**<br><br>*Wednesday*: Theme examples of AM/FM | |
| **Week 9** | 22 Sep<br>23 Sep | Baseband Data Transmission | |
| **Week 10** | 29 Sep<br>30 Sep | Band-pass Data Transmission | |
| **Week 11** | 6 Oct<br>7 Oct | Modulation/Detection Theory | |
| **Week 12** | 13 Oct<br>14 Oct | Digital Signal Detection | |

Note:

1. Lectures start in week 1 and finish in week 12.
2. Lecture notes/handouts will be distributed, or else available on course website.
3. All students must attend the lectures on both Tuesday 09-11am and Wednesday 2pm every week.
4. Midterm examination will be held at CLB4 in the Tuesday lecture of week 8, i.e., 9-11 am, 15 September 2009.

## 2. Laboratory work

| **Lab Schedule** TELE3113 S2, 2009 | **Location:** ElecEng302 **Time:** | Topics | Reference |
|---|---|---|---|
| Week 2,3 | | Lab 0: Introduction to TIMS & MATLAB | Lab manual |
| Week 4,5 | | Lab 1: Amplitude Modulation | Lab manual |
| Week 6,7 | | Lab 2: DSB and SSB | Lab manual |
| Week 8,9 | | Lab 3: Frequency Modulation | Lab manual |
| Week 10,11 | | Lab 4: Sampling and TDM | Lab manual |
| Week 12,13 | | Lab 5: Digital Signals: Line codes | Lab manual |

Note:

1. The lab manual is available from the school office as a bound volume, for a nominal fee. Also available on the course website.
2. Some lab slots may be closed due to low enrolments. Lab allocations will be finalised in Week 1.
3. Please come to the lab time you are enrolled in. Should you need to alter your lab time, please contact your supervisor.
4. Lab 0 is an introduction to the TIMS equipment, and to the MATLAB functions that will be used throughout the laboratory course. While Lab 0 is not assessed, it is strongly advised that students do attend, as familiarity with TIMS and MATLAB is essential to being able to complete the labs in allotted time.
5. The assessable labs start in week 4 and end in week 13, and must be attended ***every second week***.

## 3. Tutorial

| **Tutorial Schedule**<br><br>TELE3113<br>S2, 2009 | **Location:**<br>MorvB G5<br><br>**Time:** | Contents |
|---|---|---|
| Week 2,3 | | Tutorial 1 |
| Week 4,5 | | Tutorial 2 |
| Week 6,7 | | Tutorial 3 |
| Week 8,9 | | Tutorial 4 |
| Week 10,11 | | Tutorial 5 |
| Week 12,13 | | Tutorial 6 |

Note:

1. Tutorials begin in week 2.
2. A tutorial must be attended ***every second week***. Please come to your enrolled tutorial, as room sizes are restricted.
3. The tutorial sheets will be distributed by the tutor, or else are available on the course website.

## Resources for students

- Prescribed textbooks
    1. Simon Haykin and Michael Moher, *Introduction to Analog & Digital Communications*, 2nd Ed, John Wiley & Sons, 2006.
- Reference books

2. Simon Haykin, *Communication Systems*, 4th Ed, John Wiley & Sons, 2000.

3. Nevio Benvenuto, Roberto Corvaja, Tomaso Erseghe, and Nicola Laurenti, *Communication Systems: Fundamentals and Design methods*, John Wiley & Sons, 2006.

## 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.

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.