Course Staff

Lecturer:

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Laboratory Coordinator: Prof. G. D. Peng

Lab Demonstrator: To be confirmed

Consultation times: The preferred consultation time for this course is after lectures and during the tutorial. Please feel free for any additional consultation at the start or end of lectures, tutorials or laboratory sessions.

Course details

Credits:

The course is a 6 UoC course; expected workload is 10-12 hours per week throughout the 13 week session.

Contact hours

The course consists of 3 hours of lectures, a 1-hour tutorial every fortnight and a 3-hour laboratory session each fortnight.

Course context and aims

TELE3113 is a main and pre-requisite course in telecommunications that introduces the fundamental concepts and techniques of both analogue and digital communications. This course aims to enable students to be familiar with fundamental concepts and issues, to develop good understanding of basic analogue and digital communication techniques, to perform simple analysis and assessment of system performance.

From a system engineering perspective, we will find that the developments and advances of telecommunication technologies are closely related to those of electrical engineering and computer engineering. For students who undertake studies in fields other than

telecommunications, this course will provide an in-depth overview of the fundamentals as well as modern techniques and systems in the telecommunication field.

A wide range of topics will be covered in this course, including

Telecommunication Fundamentals:

free space propagation characteristics, phasors, fourier transform, spectrum analysis, random signals.

Analogue Techniques:

continuous wave modulation (AM, DSB, SSB, VSB, QAM, FM, and PM),

complex envelope, receivers, error and noise analysis.

Digital techniques:

sampling, quantisation,

digital baseband (PAM, PWM, PPM, PCM, DM, and line coding),

passband: techniques (Binary and M-ary signaling ASK, PSK, FSK, QPSK, QAM),

multiplexing techniques (FDM, TDM, and quadrature multiplexing), intersymbol interference and eye diagrams. System performance analysis and evaluation.

Relation to other courses

Pre-requisite for the course: ELEC2134 and MATH2099.

This course builds the ground for the courses like TELE4651, TELE4652, TELE4653.

TELE3113 is a pre-requisite for all professional electives offered for BE in Telecommunications.

Assumed knowledge: It is essential that the students have shown competency in mathematics, electronics, signals and systems in Year 1 and Year 2. They are strongly advised to review previous ELEC2134 and MATH2099 courses materials.

Learning outcomes

Upon completing of the course, students should

1. have a good understanding of both time and frequency domain representations of signals;

2. have a good understanding of analogue modulation and demodulation techniques;

3. have a good understanding of digital modulation and demodulation techniques; and

4. understand and be able to implement noise and error analysis of an analogue or digital telecommunication system.

This course will contribute to the building up of a number of core UNSW *graduate attributes*.

Teaching strategies

The teaching of the course is delivered through a well-balanced combination of lectures, tutorials, and laboratory work.

Lectures
The lectures provide the students with the explanation of the core materials in the course. The lectures will be delivered 3 hour per week with corresponding lecture notes.

Tutorials
The tutorials enable students to apply various methods to quantitatively analyze the fundamentals of communication systems. Students are expected to attend the tutorials and attempt to solve given tutorial questions before attending the tutorial.

Laboratory work
The laboratories provide the student with hands-on experience to design, analyze and test the communication systems. The laboratory experiments are concerned with modelling various signals on the one hand, and with carrying out different operations upon signals (e.g. filtering, sampling, demodulating) on the other. This approach is intended to provide insights into the properties of, and relationships between, many signals which are fundamental to communications engineering.

Students are expected to prepare for each of the laboratory experiments, prior to coming into the lab. Every student is required to keep an individual record of all the experiments, preferably in the form of a bound book.
Note that the laboratory component contributes to 20% of the final marks. **Lab 2** to **Lab 6** are weighted equally. **There will be no lab exemptions granted**.

The course delivery methods and course content address a number of core UNSW graduate attributes; these include:

   a. The capacity for analytical and critical thinking and for creative problem-solving, which is addressed by the tutorial exercises and laboratory work.

   b. The ability to engage in independent and reflective learning, which is addressed by tutorial exercises together with self-directed study.

   c. The skills of effective communication, which are addressed by the viva-style verbal assessment in the laboratory.

Please refer to http://teaching.unsw.edu.au/sites/default/files/upload-files/GradAttrEng.pdf for more information about graduate attributes.

Course Schedule

Week	Lecture	Ref*	Tut	Lab
1	History of telecommunication and fundamentals of signals and systems **(GDP)**	1, 2		
2	AM, DSB-SC, DSB-WC **(GDP)**	3	1	**Lab 1:** Introduction to TIMS and MATLAB, Amplitude Modulation
3	AM, SSB, VSB **(GDP)**	3	1	**Lab 1:** Introduction to TIMS and MATLAB, Amplitude Modulation
4	Angle modulation Narrowband, wideband FM **(GDP)**	4	2	**Lab 2:** Double and Single Sideband Modulation
5	Angle modulation FM transmission, PLL **(GDP)**	4	2	**Lab 2:** Double and Single Sideband Modulation
6	Sampling and Quantization Multiplexing **(GDP)** **Midterm Exam**	5	3	**Lab 3:** Frequency Modulation
7	Pulse Modulation PCM, DPCM and Delta modulation **(DN)**	5	3	**Lab 3:** Frequency Modulation
8	Band-pass modulation technique M-ary **(DN)**	7	4	**Lab 4:** Sampling and Time Division Multiplexing
9	Fundamentals of probability and statistics. **(DN)**	8	4	**Lab 4:** Sampling and Time Division Multiplexing
10	Noise, Baseband transmission, **(DN)**	8, 6	5	**Lab 5:** Digital Signals: Eye Patterns and Line Codes
11	Detection theory, Optimal detection theory and Matched filter **(DN)**	10	5	**Lab 5:** Digital Signals: Eye Patterns and Line Codes
12	Review **(DN)**	-	6	**Lab 6:** Communication Systems and Performance
13	-	-	6	**Lab 6:** Communication Systems and Performance

*Chapters in textbook: Simon Haykin and Michael Moher, *An Introduction to Analog & Digital Communications*, 2nd Ed., Wiley, 2007

Note on Tutorial:

1. Tutorials begin in Week 2.

2. A tutorial must be attended *every second week*. Please come to your enrolled tutorial session, since the available spaces are limited.

3. The tutorials will be distributed by the lecturer or the tutor.

Note on Laboratory:

1. The lab notes will be distributed by the lecturer or the lab demonstrator.

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 session you are enrolled in. Should you need to change your lab time, please contact your lecturer or lab demonstrator.

4. **Lab 1** is an introduction to the TIMS equipment, and to the MATLAB functions that will be used throughout the laboratory course. While **Lab 1** will not be assessed, it is compulsory for students to attend, since the familiarity with TIMS and MATLAB is essential for you to complete all the labs in allotted time.

5. The assessable labs start in week 3 and end in week 11, and must be attended every second week.

Assessment

Laboratory work: At the end of each lab experiment, the student will be assessed by a lab demonstrator on the successful completion of the experiment and understanding of the experiment and results obtained. Students will be assessed individually.

Midterm examination: There will be a midterm exam conducted in week 7 or 8. The exact time will be announced later in the course newsletter which should be regularly checked by students.

Final examination: The exam in this course is a standard closed-book 3 hours written examination. University approved calculators are allowed. The examination tests analytical and critical thinking and general understanding of the course material in a controlled fashion. Questions may be drawn from any aspect of the course, unless specifically indicated otherwise by the lecture staff.

Summary of assessment

Laboratory work:	20%
Midterm exam:	20%
Final examination:	60%

Resources

Prescribed textbook

1. Simon Haykin and Michael Moher, *An Introduction to Analog & Digital Communications*, 2nd Ed., Wiley, 2007
   Hardcopy: ISBN 978-0-470-46087-0; *E-book*: ISBN 978-0-470-46087-0

Reference textbook

2. Bruce Carlson, Paul B. Crilly and Janet C. Rutledge, *Communication Systems: An Introduction to Signals and Noise in Electrical Communications*, 4th Edition, McGraw-Hill, 2002. Hardcopy: ISBN: 0-07-112175-7
3. Simon Haykin, *Communication Systems*, 4th Edition, John Wiley & Sons, 2001.
4. Nevio Benvenuto, Roberto Corvaja, Tomaso Erseghe, and Nicola Laurenti, *Communication Systems: Fundamentals and Design Methods*, John Wiley & Sons, 2006. Hardcopy: ISBN: 978-0-470-01822-4
5. Loen W. Couch, *Modern Communication Systems: Principles & Applications*, Prentice Hall, (P621.382/84), 1995
6. B. P. Lathi, *Modern Digital & Analog Communication Systems*, 2nd Edition, Oxford University Press, (P621.380413/15J) 2009

Other Matters

Administrative Matters:

You are required to know the School's and University's policies about students' responsibilities, academic & other misconduct, special consideration, conduct of examinations, and the submission & assessment of assignments. You can find these at http://www.eet.unsw.edu.au/.

Any student who, by reason of disability, needs modification of his/her teaching or learning environment is encouraged to contact us or the University's Equity Officer (Disability) on 9385 4734.

Continual Course Improvement:

This course is under constant revision in order to improve the learning outcomes of its students.

Any feedback on the course to improve the teaching and learning is appreciated. Please feel free to talk to your teaching staff whenever it is possible and all feedback will be acted on constructively wherever possible.

Please forward any feedback (positive or negative) on the course to the course convener or via the Course and Teaching Evaluation and Improvement Process.