School of Electrical Engineering and Telecommunications

Term 3, 2019
Course Outline

ELEC3104
Digital Signal Processing (Guided Online Delivery)

Course Staff

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Format: This online course will support 40 students only, and every 10 students will be allocated one of the above tutors for online discussion and support. The course will run as per the following:

1. Week 1 will involve a compulsory face-to-face group discussion on Monday 7pm-8pm in room EE102(G17).
2. Weeks 2-4 will involve watching recorded lectures with 1 hour per week of online group tutor support and a 10-minute individual oral assessment with the tutor in weeks 2 and 4.
3. **Week 5 will comprise 12 hours of face-to-face tutorial-labs for all 40 students (5pm-8pm Mon to Thu)**.
4. Weeks 6-9 will involve watching recorded lectures with 1 hour per week of online group tutor support and a 10-minute individual oral assessment with the tutor in weeks 7 and 9.
5. **Week 10 will comprise 12 hours of face-to-face tutorial-labs and mini-project (individual) for all 40 students (5pm-8pm Mon to Thu)**.
6. Online group discussion with tutors for 1 hour/week on **Mondays 7pm-8pm from week 2 is compulsory** for this mode of learning.
7. Online individual oral assessment for 10 minutes in weeks 2,4,7 and 9 will be scheduled during **Fridays 6-8pm** and **is compulsory** for this mode of learning.
8. At the conclusion of each weekly online forum, you must reflect on the content and discussion via the production of a weekly reflection sheet that should be submitted each **Wednesday**.
9. There are no tutorial-lab exemptions and rescheduling of face-to-face tutorial-labs will not be possible.

Note: If this format is not suitable for your learning, then please do not enrol in this offering.

Keeping Informed: Announcements may be made via email (to your student email address) and/or via online learning and teaching platforms – in this course, we will use Moodle

https://moodle.telt.unsw.edu.au/login/index.php. Please note that you will be deemed to have received this information, so you should take careful note of all announcements.

Course Summary

	Day	Time	Location	Name
Lectures	Recorded and available online			Prof. E. Ambikairajah
Tutorial-Labs	Mon – Thu (Wks 5 &, 10)	5pm – 8pm	EE108	Above lab demonstrators (face-to-face)
Consultations	Online group discussion with allocated tutors: 1 hour/week (Monday 7pm-8pm)			Above tutors (online)
Oral Assessments	Online 1:1 oral assessment with allocated tutors: 10 minutes/week (Friday 6-8pm)			Above tutors (online)

Context and Aims

Signal Processing is the process of measuring, manipulating and analysing real-world signals. ELEC3104 Digital Signal Processing is an introductory course which takes students through the fundamentals of discrete time signal and systems theory.

Aims

The course aims to equip students with:

- An understanding of the time and frequency domain representations of signals and systems.
- The skills to identify the correct type of filter required for a given problem and to demonstrate the design and implementation of a digital filter.
- An understanding of multi-rate processing and multi-rate systems.

Indicative Course Schedule

Week	Lecture	Mode
1	Signals and Systems (CH1) & DSP Fundamentals (CH2)	Online
2	DSP Fundamentals (CH2) & Discrete-Time Systems (CH3)	
3	Discrete-Time Systems (CH3) & Introduction to z-Transform (CH4)	
4	Introduction to z-Transform (CH4) & Introduction to Digital Filters (CH5)	
5	Tutorial-Labs 1 (Group) + Class Written Exam 1	Face to face (With above lab demonstrators)
6	Discrete-Time Fourier Transform (CH6)) & Analog Filters (CH7)	Online
7	IIR Digital Filter Design (CH8)	
8	FIR Digital Filter Design (CH8)	
9	Multirate DSP (CH9) & DSP Applications	
10	Tutorial Labs 2 (Group) + Mini-Project (Individual)+ Class Written Exam 2	Face to face (With above lab demonstrators)

Assessment

Online oral assessments (4 x 10 min, weeks 2,4,7 and 9)	24%
Class Exams (2 x 60 min written exams, weeks 5 and 10) – closed book exam	30%
Mini-Project (Individual: 20%) + Project report (individual: 10%)	30%
Weekly Reflection Sheets	16%

Course Details

Credits

This is a 6 UoC course and the expected workload is 15 hours per week throughout the 10-week term.

Relationship to Other Courses

This is a 3rd year course in the School of Electrical Engineering and Telecommunications at the University of New South Wales. It is a core course for students following a BE (Electrical) or (Telecommunications) program and other combined degree programs, and an elective for Computer Engineering students.

Pre-requisites and Assumed Knowledge

The pre-requisite for this course is ELEC2134, Circuits and Signals. It is essential that students are familiar with basic circuit theory, signal analysis and transform methods. It is further assumed that students are familiar with the MATLAB environment, and have good computer literacy.

Note: MATLAB Tutorial Videos: **http://eemedia.ee.unsw.edu.au/MatlabTutorial/index.htm**

Subsequent Courses

The course is a pre-requisite for all professional electives in the Signal Processing group, including ELEC4621 Advanced Digital Signal Processing and ELEC4622 Multimedia Signal Processing.

Learning outcomes

At the end of the course students should be able to:

1. Analyse linear time-invariant systems
2. Demonstrate competency in time and frequency domain analysis of signals and systems including transform methods
3. Design and analyse digital filters for a given specification
4. Implement a simple multi-rate system

This course addresses the Engineers Australia (National Accreditation Body) Stage I competency standard as outlined in ***Appendix A***.

Syllabus

Processing and analysis of continuous (analogue) and discrete-time (digital) signals. Sampling continuous signals: the sampling theorem, reconstruction, aliasing and the z-transform. Filter impulse and frequency responses, stability and digital oscillators. The Discrete Fourier Transform (DFT). Fundamentals of the design and realisation of finite impulse response (FIR) and infinite impulse response (IIR) digital filters. Linear and non-linear phase filters. Decimation, interpolation, multi-rate digital signal processing.

Teaching Strategies

Delivery Mode

The entire analytical component of the course will be delivered via online lectures (recorded lectures will be available) and online discussions with assigned tutors.

Learning in this course

1. You are expected to learn from all online lectures every week and participate in the weekly discussion with allocated tutors.
2. You must prepare well for your weekly online discussion with the tutors and the face-to-face tutorial-lab classes.
3. Each week, you must reflect on the content and discussion via the production of a weekly reflection sheet.
4. You must attend all the face-to-face tutorial-labs/mini-project sessions, oral assessments, and class exams.
5. Reading additional texts will further enhance your learning experience.
6. Group learning is also encouraged (each online discussion group will have 10 students).
7. For an online course such as this, it is *vital* that you undertake adequate self-directed study every week during the term.

Face-to-Face Tutorial-Laboratory classes (Weeks 5 and 10)

The integrated tutorial-laboratory sessions are designed to help you develop your analytical skills and see how they are applicable in a practical context. You may divide your time between the analytical and the laboratory components of the tutorial-laboratory as per your convenience, but you should complete both within the allocated time. Tutorial-laboratory attendance (weeks 5 & 10) will be kept, and you must attend all tutorial-labs.

The mini-project (week 10) is designed to provide a hands-on exposure to the applications of the concepts learnt in the course in implementing a DSP system. You are strongly encouraged to discuss your mini-project implementation with your tutors to complement your self-directed learning. The mini-project (individual) will be released in week 8.

Tutorial-Laboratory Exemption

There is no tutorial-laboratory exemption for this online course. Regardless of whether equivalent labs have been completed in previous courses, all students enrolled in this online course must take the tutorial-labs and mini-project. If, for medical reasons, (note that a valid medical certificate must be provided) you are unable to attend a tutorial-lab, please contact your assigned tutor.

Requirements to pass the course

A satisfactory performance (50% or greater) overall in the course, and in **each** of the following, is a necessary requirement to pass this course:

- Mini-Project (Individual)
- At least one class exam (week 5 and 10)

Assessment

The assessment scheme in this course reflects the intention to assess your learning progress through the term. Ongoing assessment occurs through online oral assessments, class exams (Weeks 5 and 10), and the mini-project presentation in the final week.

Online Oral Assessments (24%)

There is a total of 4 online oral assessments worth 6% each. Each oral assessment will nominally take 10 minutes and will be scheduled on the Friday of weeks 2, 4, 7 and 9 during the time 6-8pm. Please find the following schedule:

- Monday: Online discussion of content for that week, 7pm-8pm
- Wednesday: completion of reflection sheet, reflecting on content and online discussion for that week and uploading reflection sheet via Moodle.
- Friday: Online 1:1 oral assessment of content, during 6-8pm.

Class Written Exams (30%) – closed book exam
There are 2 class exams, one on Friday of Week 5 and one on Friday of Week 10. Each exam will be 60 mins long. **You must pass at least one of the class exams to pass the course.**

Tutorial-Labs/Mini-Project (30%)
The tutorial-lab 1 will be released in week 4 and tutorial-lab 2 will be released in week 9. The mini-project (individual) will be released in week 8 and you are expected to complete it by the end of week 10. You can make use of the 12 hours of tutorial-lab time available in week 10 to consult with your tutors regarding the mini-project. This mini-project must be completed individually. The mini-project will be assessed on the last day of Week 10 by the tutors (20%), as well as via the submission of a project report (2500 (5 pages) to 4000 words (8 pages)) by Wednesday **week 11, 28th November, 2019** (10%).

Your project report should consist of name, student ID, date of submission, title of the report, abstract, description of the project, equations if any, diagrams, MATLAB plots, results, conclusion, etc. Fonts should be Times New Roman or Arial, and font size should be 12 point for the body text, larger sizes could be used for the headings. **You must pass the mini-project to pass the course.**

Relationship of Assessment Methods to Learning Outcomes

	Learning Outcomes			
Assessment	**1**	**2**	**3**	**4**
Class Exam 1 (15%)	✓	✓	-	-
Class Exam 2 (15%)	✓	✓	✓	-
Mini-Project (20%+10%)	✓	✓	✓	✓
Online Oral Assessments (24%)	✓	✓	✓	✓
Weekly Reflection Sheets (16%)	✓	✓	✓	✓

Course Resources

Reference books

- A. V. Oppenheim, R. W. Schafer, & P. Buck, Discrete-Time Signal Processing, Prentice-Hall, 2010.
- S. K. Mitra, Digital Signal Processing, McGraw-Hill, 2011.
- J. Proakis & D. Manolakis, Digital Signal Processing, Prentice-Hall, 2007.
- A. Antoniou, Digital Signal Processing – Signals, Systems and Filters, McGraw-Hill, 2016

On-line resources

Moodle

As a part of the teaching component, Moodle will be used to disseminate teaching materials, host forums and occasionally quizzes. Assessment marks will also be made available via Moodle: https://moodle.telt.unsw.edu.au/login/index.php.

Mailing list

Announcements concerning course information will be given in the lectures and/or on Moodle and/or via email (which will be sent to your student email address).

Other Matters

Academic Honesty and Plagiarism

Plagiarism is the unacknowledged use of other people's work, including the copying of assignment works and laboratory results from other students. Plagiarism is considered a form of academic misconduct, and the University has very strict rules that include some severe penalties. For UNSW policies, penalties and information to help you avoid plagiarism, see https://student.unsw.edu.au/plagiarism. To find out if you understand plagiarism correctly, try this short quiz: https://student.unsw.edu.au/plagiarism-quiz.

Student Responsibilities and Conduct

Students are expected to be familiar with and adhere to all UNSW policies (see https://student.unsw.edu.au/guide), and particular attention is drawn to the following:

Workload

It is expected that you will spend at least **twelve hours per week** studying a 6 UoC course, from Week 1 until the final assessment, including online discussions, face-to-face tutorial-labs and *independent, self-directed study*. In periods where you need to complete assignments or prepare for examinations, the workload may be greater. Over-commitment has been a common source of failure for many students. You should take the required workload into account when planning how to balance this online study with employment and other activities.

Attendance and Online Participation

Weekly participation in online discussion with the assigned tutor is vital for this course. If you do not participate in the weekly discussion you may be removed from this course.

General Conduct and Behaviour

Consideration and respect for the needs of your fellow students and teaching staff is an expectation. Conduct which unduly disrupts or interferes with a class is not acceptable and students may be asked to leave the class.

Work Health and Safety

UNSW policy requires each person to work safely and responsibly, in order to avoid personal injury and to protect the safety of others.

Special Consideration and Supplementary Examinations

You must submit all assignments and attend all examinations scheduled for your course. As of Term 1 2019, assessment of applications for Special Consideration will be managed centrally and the University has introduced a "fit to sit/submit" rule. You will no longer be required to take your original documentation to The Nucleus for verification. Instead, UNSW will conduct source checks on documentation for verification purposes. You can apply for special consideration when illness or other circumstances beyond your control interfere with an assessment performance. If you need to submit an application for special consideration for an exam or assessment, you must submit the application **prior to the start** of the exam or before the assessment is submitted, except where illness or misadventure prevent you from doing so. If you sit an exam or submit an assignment, you are declaring yourself well enough to do so.

Continual Course Improvement

This course is being offered for the first time as an online offering and your feedback is valuable to improve the course. Please forward any feedback (positive or negative) on the course to the course convener or via the myExperience process.

Administrative Matters

On issues and procedures regarding such matters as special needs, equity and diversity, occupational health and safety, enrolment, rights, and general expectations of students, please refer to the School and UNSW policies:
http://www.engineering.unsw.edu.au/electrical-engineering/policies-and-procedures
https://my.unsw.edu.au/student/atoz/ABC.html

Appendix A: Engineers Australia (EA) Professional Engineer Stage 1 Competency

Program Intended Learning Outcomes
1. Knowledge and skill base **Analytical skills**, **understanding of fundamental theory**, specialist and in-depth electrical engineering knowledge, **lifelong independent learning** and research skills
2. Engineering application ability **Complex problem-solving skills**, **effective application of electrical engineering techniques**, **critical thinking**, **design skills**, project management, application of environmentally sustainable practice
3. Professional and personal attributes **Communication skills**, **professional ethics**, team building and **interpersonal skills**, **creativity** and entrepreneurship, leadership skills, safe engineering practice

Those **bold** skills and competencies listed above are addressed by this course.