THE UNIVERSITY OF ADELAIDE AUSTRALIA

Course Profile

ELEC ENG 3033 SIGNAL PROCESSING III

1. GENERAL COURSE INFORMATION

1.1 COURSE DETAILS

Course: ELEC ENG 3033 Signal Processing III
Coordinating Unit: School of Electrical & Electronic Engineering, Faculty of Engineering, Computer & Mathematical Sciences

Teaching Period: Semester 1 Year: 2010 Mode: Internal
Level: Undergraduate
Location/s: North Terrace
Units: 3
Contact: Up to 4 hours per week

Prerequisites: ELEC ENG 1009, ELEC ENG 1010, ELEC ENG 2007
Corequisites: Not applicable
Incompatible: Not applicable
Assumed Knowledge: Not applicable
Restrictions: Available to BE(Avionics &El systems), BE(Computer Sys), BE(El &El), BE(Telecom) & associated double degree students only
Quota: Not applicable

Course Description:
This course provides an introduction to digital signal processing. Topics include: limitations of the sampling process; concept and representations of discrete time signals, theory and application of Fourier analysis of discrete-time signals and systems; use of the z-transform for analysis of discrete-time signals and systems; analysis, design and realisation of discrete-time filters; concept and algorithms for Fast Fourier transforms (FFT); discrete-time spectrum analysis with windows; introduction to discrete-time stochastic signals and processes. Throughout this course, there is an emphasis on the application of these techniques and algorithms to solving discrete time signal processing problems.

1.2 COURSE STAFF

Course Co-ordinator & lecturer: Dr. Brian Ng
Email: bwng@eleceng.adelaide.edu.au
Office: EM408
Phone: 8303 5054
Administrative Enquiries: N107, Office of the School of Electrical & Electronic Engineering

1.3 COURSE TIMETABLE

Lectures:

- Wednesday, 2-3pm, Badger Labs, G31, Macbeth Lecture Theatre
- Thursday, 10-11am, Badger Labs, G31, Macbeth Lecture Theatre
- Thursday, 2-3pm, Badger Labs, G31, Macbeth Lecture Theatre

Tutorials:

- Wednesday, 8-9am, EM205/EM212

Practicals:

- Wednesday, 9-12pm, EM127, Intermediate Lab
- Friday, 11-2pm, EM127, Intermediate Lab

Students are required to attend one of the listed Tutorial and Practical classes only.

The full timetable of all activities for this course can be accessed from the Course Planner at http://access.adelaide.edu.au/courses/search.asp?year=2010

2. LEARNING OBJECTIVES

2.1 COURSE LEARNING OBJECTIVES

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

1. describe mathematically the process of sampling and its limitations
2. cite Nyquist's sampling theorem and discuss its practical consequences
3. use and manipulate representations of discrete-time signals in both the time and frequency domains
4. perform convolution of discrete-time signals and understand its role in describing discrete-time, linear time-invariant (LTI) systems
5. compute and interpret the Fourier transform for discrete-time signals
6. compute and interpret the frequency responses of discrete-time LTI systems
7. use the *z*-transform to describe discrete-time signals
8. apply techniques in the z-transform domain to analyse, design and implement discrete-time LTI systems
9. describe the concept of digital filtering and construct several common structures which realise discrete-time filters
10. design and implement both finite and infinite impulse discrete-time filters when provided with a canonical set of specifications
11. define the discrete Fourier transform, discuss its limitations and relations to other Fourier techniques
12. outline the concept underpinning algorithms for performing Fast Fourier transforms (FFT)
13. describe the concept of windowing and its implications in the different application contexts of spectrum estimation and discrete-time filter design
14. explain the basic concepts of stochastic signals and processes and describe their characteristics using statistical measures
15. perform basic statistical spectrum analysis and apply them to the analysis of data
16. implement in MATLAB simple signal processing techniques for the analysis and/or design of discrete-time signals and systems

2.2 UNIVERSITY GRADUATE ATTRIBUTE(S)

This course will provide students with an opportunity to develop the Graduate Attribute(s) specified below:

UNIVERSITY GRADUATE ATTRIBUTE	COURSE LEARNING OBJECTIVE(S)
Knowledge and understanding of the content and techniques of a chosen discipline at advanced levels that are internationally recognised.	all
The ability to locate, analyse, evaluate and synthesise information from a wide variety of sources in a planned and timely manner.	10,13,16
An ability to apply effective, creative and innovative solutions, both independently and cooperatively, to current and future problems.	5,6,8,9,10,13,15,16
A proficiency in the appropriate use of contemporary technologies.	16
A commitment to continuous learning and the capacity to maintain intellectual curiosity throughout life.	5,6,10,13,16

3. LEARNING RESOURCES

3.1 REQUIRED RESOURCES

No required textbooks or specific resources.

3.2 RECOMMENDED RESOURCES

Recommended textbooks:

1. Proakis, John G. and Manolakis, Dimitris G. *Digital Signal Processing*, 4th edition, Prentice-Hall International, 2006, ISBN: 978-0-131-87374-2.
2. Bose, T., *Digital Signal and Image Processing,* Wiley 2004, ISBN: 978-0-471-32727-1.
3. Mitra, Sanjit K. *Digital Signal Processing: A Computer-Based Approach, 2nd edition with DSP Laboratory using MATLAB*, McGraw-Hill, 2002, ISBN: 9780071226073.
4. Lathi, B. P. *Linear Systems and Signals*, 2nd edition, Oxford University Press, 2005, ISBN: 978-0-19-515833-5.
5. Gilat, A. *MATLAB: An Introduction with Applications*, 2nd edition, Wiley 2004, ISBN: 978-0-471-69420-5.

3.3 ONLINE LEARNING

This course uses MyUni exclusively for providing electronic resources, such as lecture notes, assignment papers, sample solutions, discussion boards, ... etc. It is strongly recommended that the students make intensive use of these resources for this course. Link to MyUni login page: https://myuni.adelaide.edu.au/webapps/login/

4. TEACHING & LEARNING ACTIVITIES

4.1 TEACHING & LEARNING MODES

This course relies on lectures as the primary delivery mechanism for the material. Tutorials supplement the lectures by providing exercises and example problems to enhance the understanding obtained through lectures. Practicals are used to provide hands-on experience for students to reinforce the theoretical concepts encountered in lectures. Continuous assessment activities provide the formative assessment opportunities for students to gauge their progress and understanding.

4.2 WORKLOAD

The information below is provided as a guide to assist students in engaging appropriately with the course requirements.

Activity		Contact Hours	Workload Hours
Practical	Signals & Spectra	15	30
Lectures	34 lectures	34	68
Tutorials	6 tutorials	6	18
Problem set/Quiz	5 pieces	2	40
TOTAL			156

Note: Workload Hours include Contact Hours in addition to private study time requirements.

4.3 LEARNING ACTIVITIES SUMMARY

Activity	Sessions	Title
Lectures	1-2	Sampling
	3-4	Discrete-time (DT) signals
	5-6	DT linear time-invariant (LTI) systems
	7-12	Fourier analysis of DT signals and systems
	13-16	z-transforms: analytical tool for the analysis of DT signals and systems
	17-21	DT filters – concept, structures and design
	22-25	Spectral analysis of DT signals
	26-30	DT stochastic signals and systems
Tutorial	1	Sampling & DT signals
	2	DT LTI systems
	3	DT Fourier analysis
	4	z-transforms & DT filters
	5	Spectral analysis
	6	Stochastic signals & systems
Practical	1	Signals & Spectra

4.4 SPECIFIC COURSE REQUIREMENTS

Students are required to have access to Matlab software. This is available at various facilities such as the CATS suite or the undergraduate computer labs of the School of Electrical & Electronic Engineering. It is the individual student's responsibility to ensure his or her access to these facilities at appropriate times is available.

5. ASSESSMENT

The University's policy on Assessment for Coursework Programs is based on the following five principles: 1) assessment must encourage and reinforce learning; 2) assessment must measure achievement of the stated learning objectives; 3) assessment must enable robust and fair judgements about student performance; 4) assessment practices must be fair and equitable to students and give them the opportunity to demonstrate what they have learned; and 5) assessment must maintain academic standards (see: http://www.adelaide.edu.au/policies/700/)

5.1 ASSESSMENT SUMMARY

Assessment activity	Type	Weighting	Due date	Learning objective addressed
Problem sets	Formative	15%	Weeks 3, 7, 10	All
Quiz	Summative	15%	Weeks 5, 11	1-15
Practical	Formative	10%	TBA	1-3,5-6,12-14
Exam	Summative	60%	End of semester	1-15

5.2 REQUIREMENTS

The examination and the quizzes are prescribed summative assessment components and students must achieve a mark of at least 40% in each of these, otherwise the maximum final mark that will be awarded is 44 (Fail).

In addition, if students fail to complete the major part of any of the listed assessment components their assessment will be deemed to be incomplete and they will be assigned a final mark of no more than 44F..

5.3 ASSESSMENT DETAIL

The problem sets require students to submit written responses to selected sets of problems. The submissions may contain any of the following: written answers, mathematical derivations, sketches, graphs and print-outs from appropriate software packages. There will be three separate problem sets, each worth 5% to the overall assessment.

There are two 45 minute closed book quizzes in the course. The quizzes will require students to submit short written responses to a set of questions under examination conditions. Each quiz will be worth 7.5% to the overall assessment.

The practical needs to be conducted during the designated laboratory sessions as listed in Section 1.3 Course Timetable. Students will be required to submit a written report to the practical work, which is assessed. The sole practical report will be worth 10% of the overall assessment.

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5.4 SUBMISSION

All written submissions to formative assessment activities are to be submitted to designated boxes within the School of Electrical & Electronic Engineering and must be accompanied by a signed cover sheet. Copies of blank cover sheets are available from the School office in N107. No late submissions are accepted for the formative assessment activities. All formative assessments will have a two week turn-around time for provision of feedback to students.

Full details can be found at the School policies website:
http://www1.eleceng.adelaide.edu.au/students/undergraduate/policies/

5.5 COURSE GRADING

Grades for your performance in this course will be awarded in accordance with the following scheme: MS6

MS6

Grade	Mark	Description
HD	85-100	High Distinction
D	75-84	Distinction
C	65-74	Credit
P	50-64	Pass
CP	45-49	Conceded Pass
F	0-44	Fail

Further details of the grades/results can be obtained from:
http://www.adelaide.edu.au/student/exams/results.html

Grade Descriptors are available which provide a general guide to the standard of work that is expected at each grade level (see: http://www.adelaide.edu.au/policies/700/)

Final results for this course will be made available through Access Adelaide (https://access.adelaide.edu.au/sa/login.asp)

6. STUDENT FEEDBACK

The University places a high priority on approaches to learning and teaching that enhance the student experience. Feedback is sought from students in a variety of ways including on-going engagement with staff, the use of online discussion boards and the use of Student Experience of Learning and Teaching (SELT) surveys as well as CEQ surveys and Program reviews.

SELTs are an important source of information to inform individual teaching practice, decisions about teaching duties, and course and program curriculum design. They enable the University to assess how effectively its learning environments and teaching practices facilitate student engagement and learning outcomes. Under the current SELT Policy (http://www.adelaide.edu.au/policies/101/), course SELTs are mandated and must be conducted at least once every 2 years. Feedback on issues raised through course SELT surveys is made available to enrolled students through various resources (e.g. MyUni). In addition aggregated course SELT data can be found at: http://www.adelaide.edu.au/clpd/selt/aggregates

In addition, learning and teaching issues related to this course can be raised at any time during the semester through a designated forum on the MyUni discussion board.

7. STUDENT SUPPORT

Academic Support	Maths, writing and speaking skills	http://www.adelaide.edu.au/clpd/students
Counselling Service	Personal counselling for issues affecting study	http://www.adelaide.edu.au/counselling_centre
International Student Care	Ongoing support	http://www.international.adelaide.edu.au/support/isc
Student Care	Advocacy, confidential counselling, welfare support and advice	http://www.auu.org.au/site/page.cfm?u=69
Students with a Disability	Alternative academic arrangements	http://www.adelaide.edu.au/disability
	Alternative Examination Arrangements Policy	http://www.adelaide.edu.au/policies/63
	Reasonable Adjustments to Teaching & Assessment for Students with a Disability Policy	http://www.adelaide.edu.au/policies/64

8. POLICIES & GUIDELINES

This section contains links to relevant assessment-related policies and guidelines. All University Policies can be obtained from: http://www.adelaide.edu.au/policies

Assessment for Coursework Programs	http://www.adelaide.edu.au/policies/700
Cheating in Examinations and Related Forms of Assessment	http://www.adelaide.edu.au/policies/1963
Copyright	http://www.adelaide.edu.au/policies/2643
Examinations	http://www.adelaide.edu.au/policies/465
Plagiarism	http://www.adelaide.edu.au/policies/230
Student Grievance Resolution Process	http://www.adelaide.edu.au/student/grievance/
Unsatisfactory Academic Progress by Coursework Students	http://www.adelaide.edu.au/policies/1803