ENGG*3390 Signal Processing
Fall 2013

UNIVERSITY
of GUELPH

School of Engineering
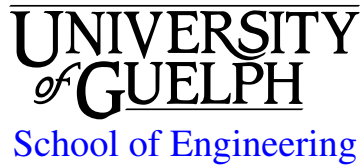
(Revision 0: September 5, 2013)

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1 INSTRUCTIONAL SUPPORT

1.1 Instructor

Instructor:	Bob Dony, Ph.D., P.Eng.
Office:	THRN 2341, ext. 53458
Email:	rdony@uoguelph.ca
Office hours:	TBA on Courselink or by appointment

1.2 Lab Technician

Technician:	Nate Groendyk
Office:	THRN 2308, ext. 53729
Email:	groendyk@uoguelph.ca

1.3 Teaching Assistants

GTA	Email	Office Hours
Kazi Tahsin	ktahsin@uoguelph.ca	TBA on Courselink
Yin Li	yli18@uoguelph.ca	TBA on Courselink

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2 LEARNING RESOURCES

2.1 Course Website

Course material, news, announcements, and grades will be regularly posted to the ENGG*3390 Courselink site. You are responsible for checking the site regularly.

2.2 Required Resources

1. Haykin, S., Van Veen, B., *Signals and Systems*, 2nd edition, Wiley, 2004.

2.3 Resources on Reserve

1. Monson H. Hayes, *Schaum's Outline of Digital Signal Processing*, McGraw-Hill, 1999

2. Hwei P. Hsu, *Schaum's Outline of Signals and Systems*, McGraw-Hill, 1995

2.4 Communication & Email Policy

Please use lectures and lab sessions as your main opportunity to ask questions about the course. Major announcements will be posted to the Courselink site. **It is your responsibility to check the course website regularly.** As per university regulations, all students are required to check their `uoguelph.ca` e-mail account regularly: e-mail is the official route of communication between the University and its student.

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3 ASSESSMENT

3.1 Dates and Distribution

Quizzes: 10% (best 4 of 5)
  Sept 19, in class
  Oct 3, in class
  Oct 17, in class
  Nov 7, in class
  Nov 21, in class

Labs: 30%
  See section 5.3 below for due dates

Midterm: 20%
  Thu Oct 24, 16:00-17:30, in class

Final Exam: 40%
  Tue Dec 10, 08:30-10:30, Room TBA on Webadvisor

3.2 Course Grading Policies

Missed Assessments: If you are unable to meet an in-course requirement due to medical, psychological, or compassionate reasons, please email the course instructor. See the undergraduate calendar for information on regulations and procedures for Academic Consideration:
  http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Accommodation of Religious Obligations: If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor within two weeks of the start of the semester to make alternate arrangements. See the undergraduate calendar for information on regulations and

procedures for Academic Consideration of Religious Obligations:
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml

Missed midterm: If you miss the midterm due to grounds for granting academic consideration or religious accommodation, the weight of the missed midterm will be added to the final exam weight. There will be no makeup midterm test.

Lab Work: You must attend and complete all laboratories. If you miss a laboratory due to grounds for granting academic consideration or religious accommodation, arrangements must be made with the teaching assistant to complete a makeup lab.

Late Lab Reports: Late submissions of lab reports will not be accepted.

Quizzes: Because the quiz grade is calculated using the best 4 out of 5 quizzes, academic consideration will only be granted if you have grounds for missing *2 or more quizzes*. If academic consideration is granted, the quiz weighting will be moved to the final exam weight.

Passing Grade: As per University policy, the minimum passing grade is 50%

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4 Aims, Objectives & Graduate Attributes

4.1 Calendar Description

This course will establish the fundamental analysis and design techniques for signal processing systems. Topics covered include: definition and properties of linear time-invariant systems; impulse response and convolution; continuous-time Laplace transform, Fourier series, Fourier transform; discrete-time Fourier transform, discrete-time Fourier series, fast Fourier transform, Z transform; complex frequency response; filter analysis and design for both continuous and discrete time ststems. Students will be able to design continuous-time filters and both design and implement discrete-time digital filters using computer-based tools.
Prerequisite(s): ENGG*2400

4.2 Learning Objectives

At the successful completion of this course, the student will have demonstrated the ability to:

1. Define the attributes of linear time-invariant systems and use convolution by the impulse response to calculate responses to arbitrary functions.

2. Identify the basic properties of signals and systems and identify what transforms and relationships apply to the various signals and system properties.

3. Define and apply the various continuous-time signal transforms, including: Laplace transform, Fourier series, Fourier transform.

4. Define and apply the various discrete-time signal transforms, including: discrete-time Fourier transform, discrete-time Fourier series, fast Fourier transform, Z transform.

5. Identify the relationships between the transforms, when they are and are not applicable to problems in signal processing systems design and analysis.

6. Design both electronic and digital filters to enhance signal quality; Enumerate the advantages and disadvantages of filter types; Evaluate their general frequency response, and design specific filters to meet performance requirements.

7. Apply the above transforms and design techniques to real systems and applications such as audio processing, communication systems, biological systems and biomedical systems

4.3 Graduate Attributes

Successfully completing this course will contribute to the following CEAB Graduate Attributes:

Graduate Attribute	Learning Objectives	Assessment
1. Knowledge Base for Engineering	1-7	Quizzes, Exams, Labs
2. Problem Analysis	2, 5	Quizzes, Exams, Project
3. Investigation	2, 5, 6	Labs
4. Design	2, 5, 6	Labs, Exams
5. Use of Engineering Tools	6	Labs, Project
6. Communication	-	Labs
7. Individual and Teamwork	-	Labs
8. Professionalism	-	-
9. Impact of Engineering on Society and the Environment	-	-
10. Ethics and Equity	-	-
11. Environment, Society, Business, & Project Management	-	-
12. Life-Long Learning	-	-

4.4 Instructor's Role and Responsibility to Students

The instructor's role is to develop and deliver course material in ways that facilitate learning for a variety of students. Only selected lecture notes will be made available to students on Courselink since much of the course content is best suited to mathematical derivations and examples worked out on the white/black board. Further, the textbook contains more detailed coverage than can be covered in lectures. During lectures, the instructor will expand and explain the content of course material and provide example problems that supplement the textbook coverage. Scheduled classes will be the principal venue to provide information and feedback for tests and quizzes.

4.5 Students' Learning Responsibilities

Students are expected to take advantage of the learning opportunities provided during lectures, labs, and textbook readings. Students, especially those having difficulty with the course content, should also make use of other resources recommended by the instructor. Students who do (or may) fall behind due to illness,

work, or extra-curricular activities are advised to keep the instructor informed. This will allow the instructor to recommend extra resources in a timely manner and/or provide consideration if appropriate.

4.6 Relationships with other Courses & Labs

Previous Courses:

MATH*2270: Solutions of differential equations, Laplace transform

ENGG*2400: Linear systems theory, impulse response, frequency response, transfer function analysis, poles & zeros, stability

Follow-on Courses:

ENGG*4060: Foundations of signal processing

ENGG*4660: Foundations of time domain, one dimensional signal processing

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5 TEACHING AND LEARNING ACTIVITIES

5.1 Timetable

Lectures:

Tues		16:00 - 17:20	RICH 2529
Thur		16:00 - 17:20	RICH 2529

Laboratory:

Tues	Sec 01	11:30 - 13:30	RICH 1532
Thur	Sec 02	11:30 - 13:30	RICH 1532

5.2   Lecture Schedule

Tentative schedule:

Lecture	Lecture Topics	Textbook	Learning Objectives
Thur Sep 5	Introduction, Laplace Review	1.1-1.6, Ch 6	1, 3
Tues Sep 10	Laplace Review, Discrete Time	Ch 6, 1.3.7, 1.4-1.5	1, 2, 3
Thur Sep 12	More signals and systems, Discrete time systems	1.5-1.8, 2.9, 10, 12, 13	1, 2
Tues Sep 17	Z Transform	Ch 7	4
Thur Sep 19	Convolution	2.1, 2.2, 2.3, 2.4	1
Tues Sep 24	More Convolution	2.5	1
Thur Sep 26	Properties of Impulse Response	2.6-2.8	1, 3, 6
Tues Oct 1	Frequency Response, Response from Poles and Zeros	3.2, 7.8, 6.13	6
Thur Oct 3	Filter Design, Standard Filter Types	8.5, extra	6
Tues Oct 8	Passive Filter Synthesis	extra	6
Thur Oct 10	Passive & Active Filters	extra	6
Tues Oct 15	Digital Filters: IIR	8.8, 8.10	6
Thur Oct 17	Digital Filters: FIR	8.9	6
Tues Oct 22	Midterm Review	N/A	-
Thur Oct 24	Midterm	N/A	-
Tues Oct 29	Fourier Representation, Discrete-time Fourier Series	3.1-3.3	4
Thur Oct 31	Continuous-time Fourier Series, Discrete-time Fourier Transform	3.4	4
Tues Nov 5	Continuous-time Fourier Transform	3.5,3.6	3, 4
Thur Nov 7	Properties of Fourier Representation	3.7	3
Tues Nov 12	Mixed Signals	4.1-4.3	3, 4, 5
Thur Nov 14	Sampling	4.4, 4.5	3, 4, 5
Tues Nov 19	Reconstruction	4.6	3, 4, 5
Thur Nov 21	Communication Systems	5.1-5.4	7
Tues Nov 26	End of Term Review	N/A	-

5.3 Lab Schedule

Weeks	Topic	Due
Sep 10, 12	MATLAB and Signals	Sep 17, 19 in lab
Sep 17, 19	Introduction to Lab Equipment and Safety Training	-
Sep 24, 26 - Oct 1, 3	DSP and Signals	Oct 8, 10 in lab
Oct 8, 10 - Oct 15, 17	Filtering and Frequency Response	Oct 22 in class
Oct 22, 24	Midterm Help	-
Oct 29, 31 - Nov 5, 7	FIR Filter Design	Nov 12, 14 in lab
Nov 12, 14 - Nov 19, 21	IIR Filter Design	Nov 26 in class

5.4 Other Important Dates

Fortieth class date: Thursday October 31 – Last day to drop one semester courses

Last Lecture: Tuesday November 26

6 LAB SAFETY

Safety is critically important to the School and is the responsibility of all members of the School: faculty, staff and students. As a student in a lab course you are responsible for taking all reasonable safety precautions and following the lab safety rules specific to the lab you are working in. In addition, you are responsible for reporting all safety issues to the laboratory supervisor, GTA or faculty responsible.

7 ACADEMIC MISCONDUCT

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community faculty, staff, and students to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for

verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member.

7.1 Resources

The Academic Misconduct Policy is detailed in the Undergraduate Calendar:
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

A tutorial on Academic Misconduct produced by the Learning Commons can be found at:
http://www.academicintegrity.uoguelph.ca/

Please also review the section on Academic Misconduct in your Engineering Program Guide.

The School of Engineering has adopted a Code of Ethics that can be found at:
http://www.uoguelph.ca/engineering/undergrad-counselling-ethics

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8 ACCESSIBILITY

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability for a short-term disability should contact the Centre for Students with Disabilities as soon as possible

For more information, contact CSD at 519-824-4120 ext. 56208 or email csd@uoguelph.ca or see the website:
http://www.uoguelph.ca/csd/