ECE355H1F 2017 – Signal Analysis and Communications

Description: Efficient information processing is a core requirement of any complex engineering system. This course presents a mathematical framework for such analysis by introducing two key concepts: signals and systems. The topics include basic properties of signals and systems, processing of signals by linear systems, Fourier series and transforms, sampling, discrete-time processing of continuous-time signals, and application to communication systems.

Textbook: Alan V. Oppenheim, Alan S. Willsky, and S. Hamid Nawab, *Signals & Systems*, 2nd Ed., Prentice-Hall, 1996. (ISBN 0-13-814757-4)

Instructor:
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Lectures:
Mondays 13:00 - 15:00; RS211
Wednesdays 11:00 - 12:00; RS211

Tutorials:
TUT01: Wednesdays 14:00 - 16:00; BA2145
TUT02: Wednesdays 14:00 - 16:00; BA2159

Teaching Assistants:
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Course Website:
The course website is at UofT Portal. Homework, handouts, grades, and announcements will be posted here. Students are required to check it regularly for new information. Please make sure you have a valid email address listed, since the professor and TAs may use it to contact you.

Homework:
ECE355 is a course heavy in mathematics. New concepts are almost always built on those introduced earlier in the course. Therefore, to do well in this course you must ***keep up to date with the class material***. The best way to accomplish this is to practice early and often, through homework and other exercise problems. Homework problems will be announced weekly. They will not be graded, but you are expected to work out the homework problems and come to tutorials prepared.

Tutorials:
In tutorials, teaching assistants will cover homework exercise problems, take questions from students, and present extended examples or applications. The TA may not be able to solve all assigned problems within the time allotted to the tutorial. You are expected to attempt to solve

the assigned problems ***before*** the tutorial. If you have trouble with a specific problem, please ask the TA to solve that problem in the tutorial.

There will be one 15-minute quiz at the end of each tutorial. These quizzes will be closed-book. The purpose of these quizzes is to help keep you up to date with the class material, so they will be designed to be quite easy – you should ace these quizzes if you pay attention in lectures and tutorials. Tutorials begin on Wednesday, September 20. All quizzes will be counted in your course grade calculation. Please follow the new APSC online petition procedure if you expect to miss any quiz for legitimate causes.

You are ***required*** to attend your own tutorial and quiz section registered on ROSI.

Grading Policy:
Quizzes (weekly, 10 in total, closed book, no aid sheet): 15%
Midterm Exam (**November 1**, tutorial time, closed book, no aid sheet): 35%
Final Exam (closed book, single hand-written aid sheet): 50%

Syllabus:

1. Signals and systems (Chapter 1, weeks 1 – 2)
2. Linear time-invariant systems (Chapter 2, weeks 3 – 5)
3. Fourier series (Chapter 3, weeks 6 – 7)
4. Continuous-time Fourier transform (Chapter 4, weeks 7 – 9)
5. Discrete-time Fourier transform (Chapter 5, weeks 9 – 10)
6. Sampling and reconstruction (Chapter 7, weeks 10 -11)
7. Communication systems (Chapter 8, weeks 12 – 13)

Tentative Lecture Schedule:

Week of Sep 10	Course Overview, Introduction to signals (ch 1.1)	Properties of signals (ch 1.2)	Exponential and sinusoidal signals (ch 1.3)
Sep 17	Unit impulse and step functions (ch 1.4)	Introduction to systems (ch 1.5)	Properties of systems (ch 1.6)
Sep 24	Discrete-time LTI systems (ch 2.1)	Continuous-time LTI systems (ch 2.2)	Interconnected LTI systems (ch 2.3)
Oct 1	Properties of LTI systems (ch 2.3)	Properties of LTI systems (ch 2.3)	Linear constant-coefficient differential/difference equations (ch 2.4)
Oct 8	Thanksgiving	Thanksgiving	Singularity functions (ch 2.5)
Oct 15	Introduction to Fourier series (ch 3.2)	Fourier series of periodic signals (ch 3.3)	Convergence of Fourier series (ch 3.4)
Oct 22	Properties of Fourier series (ch 3.5)	Continuous-time Fourier transform (ch 4.1, 4.2)	Properties of Fourier transform (ch 4.3)

Oct 29	Convolution and multiplication (ch 4.4, 4.5)	Convolution and multiplication (ch 4.4, 4.5)	LCCDE and Fourier Transform (ch 4.7); midterm exam (in tutorial time slot)
Nov 5	Discrete-time Fourier series (ch 3.6, 3.7)	Discrete-time Fourier transform (ch 5.1, 5.2)	Properties of DTFT (ch 5.3)
Nov 12	Properties of DTFT (ch 5.4 - 5.8)	Sampling theorem (ch 7.1)	Sampling and reconstruction (ch 7.2)
Nov 19	Under sampling and aliasing (ch 7.3)	DT processing of CT signals (ch 7.4)	DT processing of CT signals (ch 7.4)
Nov 26	Sampling of DT signals (ch 7.5)	Amplitude modulation (ch 8.1)	AM demodulation, FDM (ch 8.2, 8.3)
Dec 3	Single-sideband AM, pulse-train AM, TDM (ch. 8.4, 8.5)	Angle modulation (ch. 8.7)	Narrowband and Wideband FM, digital modulation; Or review lecture