Winter 2017

Communication Systems
ECE316S

The Edward S. Rogers Sr. Department of Electrical & Computer Engineering
University of Toronto

Instructor

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Course Objectives

Communication systems are an integral part of our modern lives providing unprecedented opportunities to connect, convey and distribute information. Our ubiquitous dependence on such systems have made communication technologies, networks, assets and services essential to our society's health, safety, security and economic well-being. The objective of this course is to provide an introduction to analog and digital communication systems. Topics include analog amplitude, frequency and phase modulation systems, pulse code modulation, baseband and passband digital communications, amplitude, phase- and frequency-shift keying, signal constellations and performance analysis of analog modulation in the presence of noise.

Textbook S. Haykin and M. Moher, *Introduction to Analog & Digital Communications*, 2nd ed., John Wiley & Sons, Inc., 2007. ISBN-13 978-0-471-43222-7.

Lectures

LEC 01	Tuesdays,	noon – 1:00 pm, BA1190
	Thursdays,	noon – 1:00 pm, BA1190
	Fridays,	noon – 1:00 pm, BA1190

Tutorials

TUT 01	Wednesdays,	3:00 pm – 4:00 pm, GB304
TUT 02	Fridays,	5:00 pm – 6:00 pm, GB304

Tutorials will begin the week of January 16, 2017 and will be used to teach problem-solving techniques based on the assigned problem sets. Regular attendance is *strongly recommended*. Problem sets will be assigned weekly, but will not be marked.

Labs

PRA 01 Mondays, 9:00 am – noon, SF 2201
Dates: Lab 0: Jan 23, Lab 1: Feb 6, Lab 2: Feb 27, Lab 3: Mar 13, Lab 4: Mar 27

PRA 02 Mondays, 9:00 am – noon, SF 2201
Dates: Lab 0: Jan 30, Lab 1: Feb 13, Lab 2: Mar 6, Lab 3: Mar 20, Lab 4: Apr 3

PRA 03 Fridays, 9:00 am – noon, SF 2201
Dates: Lab 0: Jan 27, Lab 1: Feb 10, Lab 2: Mar 3, Lab 3: Mar 17, Lab 4: Mar 31

PRA 04 Tuesdays, 9:00 am – noon, SF 2201
Dates: Lab 0: Jan 31, Lab 1: Feb 14, Lab 2: Mar 7, Lab 3: Mar 21, Lab 4: Apr 4

Lab(s) will begin the week of January 23, 2017 and will take place in room SF2201 (Photonics Lab). Lab content can be found at: http://www.comm.utoronto.ca/~bkf/ECE316/. Our lab coordinator is Mr. Bruno Korst, bkf@ece.utoronto.ca. Labs will be executed in teams of at most 2 students. One lab report per group should be prepared and submitted by the end of the lab period (please note that lab preparation is marked individually).

Composition of Final Mark

Labs:	20 %	
2 Tests	30 %	(equally weighted; administered out of class)
Final Exam:	50 %	

Tentative Test Schedule

Test 1:	~~Wednesday, February 15, 2017~~	~~6 pm to 8 pm Room TBA~~
Test 1:	**Tuesday, February 14, 2017**	**12:10 pm (SHARP) to 1 pm, BA 1190 <<- CHANGE!!!!**
Test 2:	~~Wednesday, March 29, 2017~~	~~6 pm to 8 pm Room TBA~~
Test 2:	**Thursdays, March 30, 2017**	**12:10 pm (SHARP) to 1 pm, BA 1190 <<- CHANGE!!!!**

Syllabus:

- Signal and System Representations and Filtering: Review of the Fourier transform and its properties, LTI systems, filtering. (Text, §2.1-2.7)
- Amplitude Modulation: AM, double-sideband suppressed carrier, single-sideband. (Text, §3.1-3.6)
- Angle Modulation: Phase modulation (PM) and frequency modulation (FM), wide-band FM, generation and detection of FM. (Text, §4.1-4.4, 4.6-4.8)
- Pulse Modulation: The sampling theorem, pulse-amplitude modulation, quantization, pulse code modulation (PCM), line codes. (Text, §5.1-5.5)
- Digital Transmission at Baseband: Pulse transmission, intersymbol interference, Nyquist's criterion, raised-cosine pulses, eye-patterns. (Text, §6.1-6.6)
- Digital Modulation Techniques: Amplitude-shift keying, phase-shift keying, frequency-shift keying, M-ary modulation, signal constellations. (Text, §7.1-7.8)
- Communication in the Presence of Noise: White Gaussian noise, power spectral density, filtering of noise, noise analysis: coherent AM demodulators, envelope detector, FM demodulators. (Text, portions of §8.6-8.10, 9.1-9.5, 9.7-9.8).

Course Website and Blackboard

The course will make use of Blackboard (http://portal.utoronto.ca). *All students must register on Blackboard*. Course notices, handouts, office hours and important communications will be administered using this website. In addition, information will be provided at: http://www.comm.utoronto.ca/~dkundur/course/ece-316-communication-systems/.

Course Policies and Information

- All tests and the final exam make use of a non-programmable (**Type 2**) calculator. No programmable calculators are allowed. The final exam is **Type C** (candidates may prepare, bring to the exam and use a single standard aid sheet supplied by the registrar's office).
- The Faculty of Applied Science and Engineering's policy on petitions for course work will be employed for missed tests and late assignments. Students must submit term-work petitions and supporting documentation through the Term-Work Petition (TWP) system, which is accessible through the Engineering Portal. Students must keep all original supporting documentation for one year after the submission date. The Academic Advisor will decide on the validity and the course instructor will select the appropriate accommodation.
- Questions regarding marking must be formally written on a piece of paper and submitted along with the associated test/assignment to the cognizant TA. There is a 48-hour limit (excluding weekends and official holidays) from the time the test/assignment is first returned in which you may request a recheck.
- Please note that late assignments (e.g., lab write-ups) will be deducted 10% per business day.
- Academic integrity is of utmost important. Any issues of plagiarism and inappropriate collaboration will be taken seriously and reported to the appropriate higher authority.
- Students with diverse learning styles and needs are welcome in this course. If you have a disability/health consideration that may require accommodations, please feel free to approach me and/or

Accessibility Services at (416) 978 8060; http://accessibility.utoronto.ca.