University of Toronto
Department of Electrical and Computer Engineering

ECE216 SIGNALS AND SYSTEMS

Information Sheet
Spring 2015

Lecturers

Professor Raymond Kwong (course coordinator)
Office GB343; email `kwong@control.utoronto.ca`
Section LEC0102:

- Mon 11-12noon in BA1190
- Wed 11-12noon in SF1101
- Thu 11-12noon in MS2171

Professor Stark Draper
Office BA4138; email `stark.draper@utoronto.ca`
Section LEC0101:

- Tue 1-2pm in BA1190
- Wed 1-2pm in BA1190
- Fri 1-2pm in BA1190

Professor Joshua Taylor
Office SF1021C; email `josh.taylor@utoronto.ca`
Section LEC01013:

- Mon 1-2pm in MC252
- Tue 2-3pm in MC252
- Thu 1-2pm in MC252

Head Administrative TA

TBA: The name and contact information of the Head Administrative TA will be announced early in the semester.

The Head Administrative TA is the prime contact regarding all adminstrative issues in the course. All administrative requests (e.g., change of tutorial or lab section) or requests for exam re-grades should be submitted to the Head Administrative TA. Please contact the Head Administrative TA by email – from your official University of Toronto account (and not, e.g., from a gmail account) – with any of the above requests, or other problems or concerns with the course.

If you know you will miss some parts of the course for personal reasons, you must inform the Head Administrative TA at least two (2) weeks in advance. The Head Administrative TA will advise you on what action, if any, you need to take.

Welcome to ECE216

This class is an introduction to the basics of signal processing and systems analysis. The course serves as the central building block for students interested in further study of information processing in any form, including specializations in control, communications, and signal processing. Applications that we will likely touch on in ECE216 include audio and image processing, communications, control, machine learning, and finance. The topics we cover in the course include (at a minimum) basic properties of both continuous and discrete time signals and systems, the processing of signals by linear systems, Fourier series and transforms, sampling and storage of continuous waveforms.

Prior courses ECE216 builds on

- ECE212: Circuit Analysis
- MAT188: Linear Algebra
- MAT290: Advanced Engineering Mathematics

Course texts

The course will be taught using a combination of course notes and readings from recommended textbooks. There are three main sources from which readings will be drawn:

1. *ECE216 course notes*. These notes are in development and will incrementally be posted to the course website during the term.

2. *Signal Processing First*, James H. McClellan, Ronald W. Schafer, and Mark A. Yoder, Pearson, 2003. We shall refer to this text as SPfirst.

3. *Signal Processing for Communications*, P. Prandoni and M. Vetterli, CRC Press, 2008. We shall refer to this text as sp4comm. An electronic version of sp4comm is available from `http://www.sp4comm.org/getit.html`.

We anticipate that most readings will be drawn from the course notes and from SPfirst (and fewer from sp4comm). SPfirst has been stocked by the Bookstore, and it is also available from online retailers.

Lectures

Highly interactive lectures are the most useful and engaging. Questions are welcomed and encouraged.

Course website

Course handouts, readings, assignments, and announcements will be posted on the course website. Access will be through Blackboard/Portal:

`http://portal.utoronto.ca.`

Please make sure you can access Blackboard/Portal. Please let the Head Administrative TA know if you have not received course emailings; which will be distributed via Blackboard.

Assigned readings and problem sets

There will be weekly assigned readings corresponding to the material to be covered during the week. Each week's readings (and their source) will be posted on the course website.

Problems will also be assigned most weeks. To gain good understanding of the material, it is essential that you do the assigned problem sets. The problem sets are designed to improve your understanding of the course material. You are expected to do all assigned problems largely on your own. Problem sets will *not* be collected and graded. Some of the problems from each problem set will be reviewed in the weekly tutorials. In making up exams we will assume you have worked and understand all problems.

The problem sets are a crucial part of the learning experience. They are designed to illustrate course concepts and material. Without working through, and often struggling at length with, the problems, you will not develop as deep a facility with the concepts developed in class. Invariably this will have a major impact on the depth of your understanding and final grade.

Tutorials:

There are six tutorial sections, listed below. Tutorials are held every week. The first tutorials will be held in the first week of the term, i.e., the week of 5-9 January. Please do not change tutorial section unless you have received approval from the Head Administrative TA.

- TUT0101, Fri 4-6pm HA403
- TUT0102, Fri 4-6pm SF3201
- TUT0103, Thu 4-6pm SF2202
- TUT0104, Thu 4-6pm GB304
- TUT0105, Thu 4-6pm GB404
- TUT0106, Thu 4-6pm GB412

Labs:

There are six lab sections, listed below. Each section is held once every *two* weeks. The first lab sections will be held in the week of 19-23 January. This is the *third* week of the term. No lab sections are scheduled either for the week of 5-9 January or 12-16 January. Please do not change lab section unless you have received approval from the Head Administrative TA.

- PRA0101, Mon 10-12noon, SF1013, starting 2015/01/19
- PRA0102, Mon 10-12noon, SF1013, starting 2015/01/26

- PRA0103, Mon 1-3pm, SF1013, starting 2015/01/19
- PRA0104, Mon 1-3pm, SF1013, starting 2015/01/26
- PRA0105, Wed 9-11am, SF1013, starting 2015/01/21
- PRA0106, Wed 9-11am, SF1013, starting 2015/01/28

Items of note about the labs:

- **Where:** Per above, all lab sessions will be held in SF1013.

- **When:** Per above, lab sections are scheduled for *alternating* weeks, starting the *third* week of the semester.

- **Matlab:** All labs are based on the Matlab scientific computing software package. Matlab is useful not only for analyzing signals and systems, but also for general numerical computations that arise in solving engineering problems. One objective of ECE216 is to give you deep experience with this very useful computational environment, experience that will, e.g., set you in good stead for many internship positions. If you are taking ECE221 in parallel with ECE216 you will also be receiving heavy exposure to Matlab in ECE221. Indeed, the first ECE216 lab is deferred to the third week of the semester so that you can complete the first ECE221 lab, a basic introduction to Matlab, before starting on the ECE216 labs. The second ECE221 lab continues the introduction to Matlab, and the first ECE216 lab is an introduction to Simulink, which runs on top of Matlab. These latter two labs take place in the third and fourth week of the semester. Thus, between ECE216 and ECE 221, by the end of January you should have a solid introduction to Matlab.

  If you are one of the few students in ECE216 who is *not* taking ECE221, it is your responsibility to develop your capability with Matlab to the level developed in ECE221. We will post the ECE221 labs on the ECE216 website. Please complete these labs.

- **Lab section assignments:** You have been assigned to one particular lab section. Please attend *only* your assigned section. If you have a conflict in a particular week, and would like to attend some other section, you must contact the Head Administrative TA well ahead of time to make arrangements.

- **Work in groups of two:** Labs are done in groups of two. You can select your own partner or ask the TAs for assistance.

- **Complete lab reports and hand in by end of lab period:** The lab reports are designed to be completed and graded *during* each lab period. The number of TAs allocated to the labs has been set sufficiently high to make this possible. At the end of the lab you must hand your lab report in to the TAs for the recording of your lab grade. Thus, lab reports must be handed in by the end of the lab period, one report per lab group. Clearly indicate the names of both partners at the top of the report. If you do not hand in your report you will get a zero for that assignment. No late labs will be accepted.

Examinations and quizzes

There will be two quizzes, one midterm exam, and a final exam:

1. **QUIZZES:** The first quiz will take place before the midterm. The second between the midterm and final exam. The dates, locations, and coverage of the quizzes will be announced via the course website.

2. **MIDTERM:** The date, location, and coverage of the one midterm will be announced via the course website.

3. **FINAL:** The final exam has not yet been scheduled.

Regrade requests are handled by the Head Administrative TA. If you have such a request for one of your quizzes or midterm, please detail your concern clearly and concisely and staple it to the front of your exam. Contract the Head Administrative TA and make arrangements to get him your documents. There will be a finite window after each text that regrades will be considered, so check your exam and initiate the process promptly. We note that during a regrade process a test score may be adjusted up *or* down, or may be left the same. Also, it is a good idea to write your exam using a pen. Regrades of exams written in pencil – other than summation errors in the computation of the total grade – often cannot be considered.

Course Grade

The various course assignments are weighted as follows in determining your course grade.

Labs:	15%
Quizzes:	10%
Midterm Exam:	25 %
Final Exam:	50 %

Reference Materials

Some resources and texts that cover similar material are provided below.

1. Alan V. Oppenheim and Alan S. Willsky with S. Hamid Nawab, *Signals and Systems*, Prentice Hall, 1996. A standard and highly recommended text for a first course in signals and systems.

2. Simon Haykin and Barry Van Veen, *Signals & Systems*, Wiley, 2002. An alternate standard and highly recommended text for a first course in signals and systems.

3. B. P. Lathi, *Linear Systems and Signals*, Oxford University Press, 2004. A third standard text, slightly different ordering of topics from Haykin and Van Veen or Oppenheim, Willsky, and Nawab. Nice introductory section on background material as well as to Matlab.

4. John R. Buck, Michael M. Daniel, and Andrew C. Singer, *Computer Explorations in Signals and Systems using Matlab*, Prentice Hall, 2002. Particularly if you find the computational parts of the labs useful, this text provides further Matlab-based computer exercises that will significantly deepen your knowledge of the material.

Academic Honesty

You are already familiar with the University of Toronto's academic honesty policy, the "Code of Behavior on Academic Matters". This policy deals with issues that include plagiarism and cheating. For a review of the policy please navigate to the following link:

`http://life.utoronto.ca/get-smarter/academic-honesty/`

Tentative Syllabus

Exact topics and week-by-week progress will be tracked on the course website. A tentative syllabus is indicated below.

1. Fundamentals of continuous time signals
2. Fourier series of continuous time periodic signals: the CTFS
3. Fundamentals of discrete time signals
4. Fourier series of discrete time periodic signals: the DTFS
5. Geometric perspectives
6. Discrete time systems
7. Fourier transform of discrete time aperiodic signals: the DTFT
8. Continuous time systems
9. Fourier transform of continuous time aperiodic signals: the CTFT
10. Sampling of CT signals