

Fall 2014

Digital Signal Processing

ECE455F

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



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Labs: Mr. Bruno Korst
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Course Objectives

Digital signal processing (DSP) is the mathematical manipulation of a discrete-domain information signal to enhance or simply modify it in some way. The objective of this course is to introduce students to fundamental concepts of digital signal processing including sampling and reconstruction, the z-Transform, discrete-time Fourier transforms and their implementations, FIR and IIR digital filtering, multirate signal processing and digital media. The purpose of the tutorials is to help elucidate lecture concepts and problem set assignments while the labs aim to provide more hands-on-experience of DSP concepts.

Main References

1. Class notes;
2. J. G. Proakis and D. G. Manolakis, *Digital Signal Processing: Principles, Algorithms, and Applications*, 4th ed., Pearson, 2007. ISBN 0-13-187374-1.

Lectures

Mondays	9:00 am – 11:00 am	BA 1220	(LEC 01)
Fridays	9:00 pm – 10:00 am	BA 1220	(LEC 01)

Tutorials

Thursdays	3:00 pm – 4:00 pm	BA 1220	(TUT 01)
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Tutorials will begin the week of September 15, 2013 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.

Labs

Wednesdays	9:00 am – 12:00 pm	SF 2201	(PRA 01)
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Specific Dates: Expt 1: Oct 15, Expt 2: Oct 29, Expt 3: Nov 12, Expt 4: Nov 26

Wednesdays	9:00 am – 12:00 pm	SF 2201	(PRA 02)
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Specific Dates: Expt 1: Oct 8, Expt 2: Oct 22, Expt 3: Nov 5, Expt 4: Nov 19

Composition of Final Mark

Labs:	15 %
Midterm Test	30 %
Final Exam:	55 %

Tentative Syllabus

- Review of ECE355 Concepts: Signal classes, sampling theorem, overview of analog-to-digital and digital to-analog conversion. (Text, §1.1-1.4). Discrete-time signals and systems. (Text, §2.1-2.5). Discrete-time Fourier transform and analysis. (Text, §4.1-4.4, 5.4).
- The z-Transform: definition, properties, rational z-transforms, inverse of z-transform, analysis of LTI systems in the z-domain. (Text, §3.1-3.5).
- Sampling and Reconstruction: Discrete-time processing of continuous-time signals, quantization errors, sampling of bandpass signals. (Text, §6.1-6.4).
- DFT and FFT: Discrete Fourier Transform, complexity of filtering, radix-2 fast Fourier transform (Text, §7.1, 7.2, 7.3, 8.1, 8.4).
- Implementation of Discrete-Time Systems: Structures for the realization of discrete-time systems, FIR systems, IIR systems, representation of numbers. (Text, portions of §9.1-9.3).
- Design of Digital Filters: Design of FIR, IIR filters from analog filters, frequency transformations. (Text, portions of §10.1-10.4).
- Multirate digital signal processing: integer decimation and interpolation, rate conversion by a rational factor. (Text, portions of §11.1-11.4).
- Applications to audio, image and video processing. (supplementary notes).

Course Website

The course will make use of Blackboard (<http://portal.utoronto.ca>) for important course announcements. *All students must register on Blackboard and check it regularly.* Course notices, handouts and general information will be administered using the course website at:

<http://www.comm.utoronto.ca/~dkundur/course/ece-455-digital-signal-processing/>

Course Policies

- 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's policy on Petition for Consider in Course Work will be employed for missed tests and late assignments. Official supporting documentation must be provided and the completed petition must be filed with the EngSci office.
- Questions regarding marking must be written on a piece of paper and submitted with the associated test/assignment to the cognizant TA. There is a 48-hour limit (weekends and holidays excluded) from the time it is first returned in which you may request a recheck.
- Please note that late assignments (e.g., lab write-ups) will be deducted 15% 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. In particular, 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>.