

**Memorial University of Newfoundland  
Faculty of Engineering and Applied Science**

**Engineering 8821 — Design of Digital Signal Processing Systems — Winter 2013  
Advance Course Information**

**Course Objectives:** To build upon foundational knowledge of basic discrete-time signals and systems and digital signal processing (DSP), e.g. from Engi 4823, 7824 and other courses in ECE; to extend this foundational knowledge to the study of DSP design methods and applications; to illustrate the application of DSP across various areas of engineering and science; and to provide experience in the design of DSP systems.

**Instructor:** Dr. Cecilia Moloney, Email: [cmoloney@mun.ca](mailto:cmoloney@mun.ca)  
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**Classes:** Monday, Tuesday, Thursday, 1:00-1:50pm, in EN-1002

**First Class:** Monday, Jan 7, 2012, 1pm, EN-1002

**Note on Extra Hour Given in the Timetable:** Thursday, 12:00-12:50pm

Although listed in the schedule as a tutorial hour, this extra hour is intended to allow for make-up classes as may be necessary during the term. The extra hour can also be used for occasional tutorials prior to tests and assignment due dates, as appropriate. However, the total number of class hours will not exceed the usual number for a three-credit-hour course.

**Office hours:** TBA

**Course Topics:** The Engr 8821 course material will address the following topics:

1. Introduction to Design of Digital Signal Processing (DSP) Systems (incl. review of DSP)
2. DSP as the DT (discrete-time) processing of CT (continuous-time) signals through sampling
3. Computable transforms, i.e. the Discrete Fourier Transform (DFT) and the Fast Fourier Transform (FFT)
4. Fourier analysis of DT signals (and of CT signals via sampling)
5. Transform analysis of linear, time-invariant (LTI) systems, as a prelude to filter design
6. Finite impulse response (FIR) filter design
7. Infinite impulse response (IIR) Filter Design
8. Practical issues in the design and implementation of DSP systems
9. Examples of the above topics in selected applications of DSP

**Recommended Text:** A.V. Oppenheim and R.S. Schaffer, *Discrete-time Signal Processing*, Third edition, Prentice-Hall, 2010, ISBN 0-13-198842-5 (with a companion website by Mark A Yoder and Wayne T. Padgett).

**Note on Recommended Text:**

For more information on the course text, see the Pearson Prentice-Hall website at <http://www.pearsonhighered.com/educator/product/DiscreteTime-Signal-Processing/9780131988422.page> The text is available for purchase at the MUN bookstore, and is available as a book and/or e-book through Pearson Prentice-Hall (see above link), or amazon.ca, chapters.ca, etc. Although pricey, this textbook is a standard in the DSP world, and is strongly recommended for this course. You can find some of the material of the course in other commonly-used DSP textbooks, notably those listed below (see “*On DSP*” below).

**Some Reference Texts:**

***On Discrete-time Systems and Signals***

1. B.P. Lathi, *Linear Systems and Signals*, 2<sup>nd</sup> edition, Oxford University Press, 2005.

2. A.V. Oppenheim, A.S. Willsky and B.H. Nawab, *Signals and Systems*, 2<sup>nd</sup> edition, Prentice-Hall, 1997.  
**On DSP**

3. A.V. Oppenheim and R.S. Schaffer, *Discrete-time Signal Processing*, Third edition, Prentice-Hall, 2010, ISBN 0-13-198842-5 (with a companion website by Mark A Yoder and Wayne T. Padgett). [Text used in Winter 2010.] Previous edition: 2<sup>nd</sup> ed. 1999.
4. S.K. Mitra, *Digital Signal Processing: A Computer-based Approach*, 3<sup>rd</sup> edition, McGraw-Hill, 2006 (or 2<sup>nd</sup> ed. 2001).
5. J.G. Proakis and D.G. Manolakis, *Digital Signal Processing: Principles, Algorithms, and Applications*, 4th edition, Macmillan, 2007 (or 3<sup>rd</sup> ed. 1996).
6. Richard Lyons, *Understanding Digital Signal Processing*, 3<sup>rd</sup> edition, Prentice-Hall, 2011, ISBN 978-0-13-702741-5.

**Software:** In this course, we will be using Matlab to analyze and design DSP systems. MATLAB Version 7.7.0.471 (R2008b) is available on the MUN Engineering network. Tutorials to review Matlab’s basic functionality, and notes to get you started with its Signal Processing toolbox, will be indicated in class and on the course website. You can also buy a fairly inexpensive but powerful Student Version of Matlab from Mathworks (see details at [http://www.mathworks.com/academia/student\\_version/](http://www.mathworks.com/academia/student_version/) ) or you can use the open-source software GNU Octave which is similar to Matlab in many respects (see details at: <http://www.gnu.org/software/octave/index.html> )

**Things You Can Do Now To Prepare for Engi 8821 (if you wish):**

- Locate your texts and/or notes from previous courses Engi 7824 and Engi 4823—these will be useful as references.
- Browse through some recent issues of *IEEE Signal Processing Magazine* available online on *IEEE Xplore* to scope out the wide range of current areas and applications of DSP. (Access *IEEE SP Magazine* through the MUN Library at <http://ieeexplore.ieee.org/servlet/opac?punumber=79> )
- Think about where your own interests lie in the broad field of signal processing.
- Think about the first Motivating Quote below. Do you think it is just a catchy overstatement? Or if not, then think about why and how DSP is the future of electronics?

**Motivating Quotes**

“the future of electronics is DSP”

- Richard Lyons, *Understanding Digital Signal Processing*, 3<sup>rd</sup> ed, 2011

“Learning digital signal processing is not something you accomplish; it’s a journey you take.”

- Richard Lyons, *Understanding Digital Signal Processing*, 3<sup>rd</sup> ed, 2011

**More Information?**

Take the course!