

# EE 4163 / EL 6183: Digital Signal Processing Lab

Fall 2016

Electrical and Computer Engineering  
Tandon School of Engineering, New York University

This course is an introduction to the real-time implementation of digital signal processing (DSP) algorithms, with an emphasis on audio signal processing and audio effects.

The course will use Matlab and Python programming. Some Matlab experience is expected. No experience in Python required; the course will introduce Python as needed. This course can be taken independently of EL 6113 and EL 7133 (DSP I and DSP II).

Topics include: Audio input-output and buffering. Filtering (recursive and non-recursive filters, structures). Fast Fourier transform and windowed spectral analysis. Digital audio effects (delay line, amplitude modulation, reverberation, distortion, short-time Fourier transform). Students will learn to implement these algorithms for real-time audio processing in software.

## Prerequisites

Signal and Systems (EE 3054 or EL 6113 or equivalent)

## Texts

*Audio Effects: Theory, Implementation and Application*

Joshua D. Reiss, Andrew McPherson

CRC Press, 2014

<http://www.crcpress.com/product/isbn/9781466560284>

## Software

Matlab: [www.mathworks.com](http://www.mathworks.com)

Python : [www.python.org](http://www.python.org)

PyAudio : <http://people.csail.mit.edu/hubert/pyaudio/>

## Outline

1. Review of systems and transforms
2. DSP functions in Matlab
3. Graphical user interfaces (GUI) in Matlab
4. Real-time spectral analysis
5. Python and PyAudio
6. Real-time input/output
7. Delay line audio effects
8. Filter design
9. Finite impulse response (FIR) filters
10. Infinite impulse response (IIR) filters
11. Filter audio effects
12. Amplitude modulation audio effects
13. Dynamics processing
14. Short-time Fourier transform

## Grading Policy (EE 4163)

- 40% Programming assignments (lab)
- 30% Midterm
- 30% Project

## Grading Policy (EL 6183)

- 40% Programming assignments (lab)
- 25% Midterm
- 25% Project
- 10% Paper report

## Instructor

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## Project

Students will complete a real-time audio programming project and make a class presentation. The project may involve producing an 'app' for a smart phone.