

Music 270a: Digital Audio Processing Fall 2019

Tamara Smyth, trsmyth@ucsd.edu
Department of Music,
University of California, San Diego (UCSD)
November 25, 2019

Course Information

Meeting Time and Place

(Meeting Dates: 09/30/2019 - 12/02/2019)

Lecture: Monday 2:00PM - 4:50PM, CPMC 367.

Office hours: by appointment, CPMC 233.

HOLIDAYS (no class):

- Nov. 11 (week 7), Veterans Day

Course Description

This course introduces the fundamentals of digital audio and sampling theory, digital techniques for analysis, sound synthesis/processing algorithms, and basic digital filter theory. Understanding of theoretical concepts will be consolidated through practical programming assignments in Matlab.

Prerequisites

Music 171 and 172, equivalent, or permission from instructor.

Grading

- Assignments 30%

1

-
- Project presentations (preliminary and final) and class participation 20%
 - Project 50%

Required Textbooks

- Music 270a on-line notes.

Resources

Matlab is available in the Music Lab, the Library, the Price Center, and any number of labs across the campus managed by ACMS. A list of the general access labs on campus is available here.

Reference

- A Digital Signal Processing Primer, Ken Steiglitz, Addison Wesley, 1996, 9780805316841

Schedule and Online Lecture Notes (subject to change)

- Week 1
 - Review: Sound and Audio:
 - Sinusoids: sine/cosine functions, sinusoids and circular motion, projection.
- Week 2
 - Digital Audio: sampled sinusoids, sampling/quantization, Nyquist sampling theorem.
 - Matlab Tutorial 1
 - Matlab Tutorial 2
- Week 3
 - Complex Exponentials and Spectral Representation: Euler's formula, Hilbert transform.
- Week 4
 - Complex Exponentials and Spectral Representation: DFT, LTI systems.
 - Matlab Tutorial 3
- Week 5

2

Projects

To be presented on the final day of class or during exam week (TBD in class). Preliminary project presentations will be week 6.

-
- Modulation: amplitude and frequency modulation.
 - FM examples: bell.m, fmclar.m, adsr.m, twocarbrass.m,

- Week 6
 - Waveshaping: waveshaping synthesis
- Week 7
 - Digital Filters: digital filters, simple lowpass, z-transfers, poles and zeros, biquad section
 - Paper presentations (presentation of literature related to project).
- Week 8
 - Digital Filters II:
- Week 9
 - Signal Analysis: envelope follower, peak detection, linear prediction (LPC), cross synthesis,
- Week 10
 - Project presentations.

Assignments

Assignments will be handed out and due every Monday.

- Assignment 1, due **Monday, October 14, 2019.**
 - We will go over solutions in class.
- Assignment 2, due **Monday, October 21, 2019.**
 - BbClar_ff_D3.wav
- Assignment 3, due **Monday, November 4, 2019.**
- Assignment 4,
 - Instrument sounds are available at <http://theremin.music.uiowa.edu/MIS.html>
- Assignment 5), **optional**

3

4