CS 246: *Advanced Sound Synthesis*

Fall 2018

Prerequisites

CS 245.

Contact Information

Class schedule:	MW 4:30–5:50pm
Class room:	Hopper
Lecturer:	Jason Hanson, Ph.D.
Office Phone Number:	895–4434
Email Address:	`jhanson@digipen.edu`
Homepages:	`http://www.digipen.edu/~jhanson/` `http://www.distance.digipen.edu`
Office Hours:	TuTh 9:00–11:00am, W 10:30–12:30pm, or by appointment

Course Description [Taken from the course catalog]

This course covers the basic building blocks that go into making a sound engine. Topics may include: audio file formats, sound card architecture, low level sound APIs, high level sound APIs, streaming audio, mixing, digital filters and effects, 3D audio, audio spectra and the Fast Fourier Transform.

Recommended Texts

Designing Audio Effect Plug-Ins in C++, by Will Pirkle; published by Focal Press, 2013; ISBN: 9780240825151. Note that the text can be accessed on–line using Safari Books Online, which is available through the DigiPen Library web site.

Real Sound Synthesis for Interactive Applications, by Perry R. Cook; published by A K Peters, 2002; ISBN: 1568811683. This text can be accessed on–line using Ebrary, which is also available through the DigiPen Library web site.

Course Objectives and Learning Outcomes

Upon successful completion of the course, the student will be able to (1) synthesize sounds using subtractive synthesis, (2) implement audio effects such as echo, convolution reverb, multiple band equalization, wah–wah and other filters, and (3) write real–time audio applications using standard audio libraries.

In–class Lab Work

Roughly once a week, some class time will be set aside for a lab session. Lab work will consist of written problems for the students to solve during the session, and will involve the material discussed during the lectures. The lab assignments will be collected and graded.

Assignments

Programming assignments will also be given on a weekly basis. These should be turned in by midnight of the day that they are due. Late assignments are accepted, but with a ten percent penalty for every week after the due date. All code submitted should adhere to reasonable coding standards. In particular, all files should have a header that contains the name of the student, the course number, the assignment number, and the due date of the assignment. Code should be written in standard C++ (C++11 may be used) that compiles without warnings using the MSVC 2017 and the GNU (whichever version is installed on the DigiPen machines) compilers.

Grading

The final grade for the class will be determined by the following schedule.

Lab: 25% *Programming:* 25% *Midterm Exam:* 25% *Final Exam:* 25%

Individual homework assignments will be considered to be of equal weight in computing the homework average.

Course Organization

The rough plan for the semester is as follows; however, it is entirely possible that temporal deviations will occur.

Week 1: Signal processing, Z–transform, convolution.

Week 2: Impulse response, feedback. Echo and delay.

Week 3: Real–time audio processing.

Week 4: Low pass and high pass filters.

Week 5: Combining filters. Band pass filters. Equalizers.

Week 6: Granular synthesis.

Week 7: Midterm exam.

Week 8: Higher order filters. Subtractive synthesis.

Week 9: Review of complex numbers. Frequency plots.

Week 10: All pass filters. Phase plots.

Week 11: Discrete Fourier transform, fast Fourier Transform.

Week 12: Short–time Fourier transform (STFT), audio spectra.

Week 13: Applications of the FFT and STFT.

Week 14: Additional topics as time permits.

Academic Honesty

Students are welcome to work together, ask the instructor for help, and consult alternate text books; however, all work submitted must the individual students own work. Any student found plagiarizing the work of others, or cheating on exams, will be given the grade of F (0%) for the class and will be subject to disciplinary action.

Disability Support Services

If students have disabilities and will need formal accommodations in order to fully participate or effectively demonstration learning in this class, they should contact the Disability Support Services Office at (425) 629–5015 or `dss@digipen.edu`. The DSS Office welcomes the opportunity to meet with students to discuss how the accommodations will be implemented. Also, if you may need assistance in the event of an evacuation, please let the instructor know.