

MUS 470 Syllabus

Semester:	Fall 2018
Course title:	Audio Design Project III (Lecture)
Instructor:	Professor Matt Klassen
Email:	mklassen@digipen.edu
Phone:	(425) 895-4423
Office hours:	M-W 1:00-2:30 or by appointment
Course Web Page:	http://azrael.digipen.edu/MUS470
Time/Place:	lectures: T 11:00-11:50, in Pascal

COURSE DESCRIPTION:

This course explores advanced topics in audio design and implementation. Lectures address issues that come up in audio programming at several levels: low level algorithms, mid-level components such as plugins and graphs, and high-level programming such as user interfaces and interactive music. Lecture topics include: audio engine design and implementation, spatial audio, and digital signal processing.

PREREQUISITES and COREQUISITES:

Prerequisites: CS 246, MAT 320, MUS 371, MUS 371L

Corequisites: MUS 470L

COURSE GOALS AND OBJECTIVES:

- 1) Students learn the basic definitions and low-level algorithms in spatial audio
- 2) Students will become familiar with mid-level components and plugins
- 3) Students gain experience with user interface design for audio applications
- 4) Students will implement an application related to audio engine design, spatial audio, or digital signal processing

EXAMS:

There will be a midterm exam given during regular class hours, and a final exam.

DISABILITY SUPPORT SERVICES:

If students have disabilities and will need formal accommodations in order to fully participate or effectively demonstrate 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 students need assistance in the event of an evacuation, they should let the instructor know.

GRADING:

Midterm Exam	20%
Homework	60%
Final Exam	20%

Grades will be determined based on total course percentage. Percentage scores will determine letter grades according to the scale: (in the worst case)

A	93 – 100
A-	90 – 92.9
B+	87 – 89.9
B	83 – 86.9
B-	80 – 82.9
C+	77 – 79.9
C	73 – 76.9
C-	70 – 72.9
D	60 – 69.9
F	< 60

ACADEMIC INTEGRITY:

Academic dishonesty in any form will not be tolerated in this course. Cheating, copying, plagiarizing, or any other form of academic dishonesty (including doing someone else's individual assignments) will result in, at the extreme minimum, a zero on the assignment in question, and could result in a failing grade in the course or even expulsion from DigiPen.

All students are asked to help in promoting a culture of academic integrity by discouraging cheating in all forms.

DISABLED STUDENT SERVICES:

If students have disabilities and will need formal accommodations in order to fully participate or effectively demonstrate 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.

GUEST SPEAKERS:

Guest speakers will be invited to speak on various topics relating to audio for games, audio for virtual and augmented reality, and spatial audio. Such guest speakers will come from DigiPen or from the audio community and industry leaders.

MATERIALS:

Reference Materials: (not required)

Head-Related Transfer Function and Virtual Auditory Display, by Bosun Xie.

A User's Guide to Spherical Harmonics, by Martin Mohlenkamp.

Numerical Sound Synthesis, by Stephan Bilbao.

Physical Audio Signal Processing, by Julius Smith.

Immersive Sound: The Art and Science of Binaural and Multi-Channel Audio, edited by Agnieszka Roginska and Paul Geluso.

Spatial Hearing, by Jens Blauert.

Virtual Auditory Space: Generation and Applications, by Simon Carlile.

Immersive Audio Signal Processing, Sunil Bharitkar and Chris Kyriaskakis

TENTATIVE WEEKLY TOPICS:

Week	Dates	Topics
1	Sep 3 - 7	Audio components and audio engine design and implementation (guest lecture)
2	Sep 10 - 14	Spatial sound and human auditory system. Localization cues: interaural time difference (ITD), interaural level difference (ILD), spectral cues
3	Sep 17 - 21	Definition of HRTF, time and frequency domain versions. Localization one or more sound sources, stereophonic law of sine, precedence effects
4	Sep 24 - 28	User Interface Elements for audio design (guest lecture) Spherical harmonics and first-order ambisonics: definitions
5	Oct 1 - 5	Binaural recording, synthesis, and virtual auditory display, introduction to HRTF measurements.
6	Oct 8 - 12	HRTF equalization, signal generation and processing, quality and errors, far-field HRTF databases
7	Oct 15 - 19	Near-field HRTF measurements, time and frequency domain features of HRTF, minimum phase
8	Oct 22 - 26	Higher order ambisonics, sound field rotations (guest lecture)
9	Oct 29 - Nov 2	Sound synthesis and physical modeling, numerical techniques
10	Nov 5 - 9	Spherical head model for HRTF: far-field calculations, interaural localization cues (guest lecture)
11	Nov 12 - 16	Filter models and approximation, FIR vs IIR, frequency warping
12	Nov 19 - 23	Spatial interpolation for HRTF, principle component analysis (PCA)
13	Nov 26 - 29	Spatial basis functions, sound-field signal mixing
14	Dec 3 - 7	Binaural reproduction through headphones and loudspeakers, crosstalk cancellation
15	Dec 10 - 14	Final Exams