MUS 470L Independent Study Syllabus

Semester:	Spring 2020
Course title:	Audio Design Project III Lab
Instructor:	Professor Matt Klassen
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COURSE DESCRIPTION:

This course presents a guided lab environment to pursue project work in audio design and implementation. Particular topics and project work include: parametrized audio components with user interfaces, audio-plugin development, and audio algorithm implementation.

PREREQUISITES and COREQUISITES:

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

Corequisites: MUS 470

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

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.

EXAMS:

There will be no exams, but progress on project work, assigned reading, and milestones, will be checked on a weekly basis.

GRADING:

Assignments	50%
Milestones and Reports	50%

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

ASSESSMENT and RUBRICS:

Programming assignments will be given during the semester and posted on the website. Students are required to complete all but one such assignments, and if all are completed the lowest grade will be dropped. Two project milestones, as well as two pre-milestone reports, must be met on time and be complete in order to receive full credit. Partial credit may be given for aspects which are complete and can run, or stand alone, correctly and independently of missing or not yet functional portions. In some cases partial credit may be given for partially complete work on a given aspect of the milestone requirements, but only if significant and clear progress is displayed.

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 elses 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.

RELIGIOUS ACCOMMODATION: DigiPen Institute of Technology provides reasonable accommodations to students who may be absent from activities or incur significant hardship due to religious holidays or observances. These holidays or observances must be part of a religious denomination, church, or religious organization, and the course instructor must be notified in writing during the first two weeks of the course. The institutes policy for grievances is published in the course catalog.

TENTATIVE WEEKLY TOPICS:

Week	Dates	Topics
1	Sep 3 - 6	Audio components and audio engine design and implementation (guest lecture). Assignment 1: Graphing magnitude response
2	Sep 9 - 13	Spatial sound and human auditory system. Localization cues: interaural time difference (ITD), interaural level difference (ILD), spectral cues. Assignment 2: Modeling ITD with Woodward's formula
3	Sep 16 - 20	Definition of HRTF, time and frequency domain versions. Localization one or more sound sources, stereophonic law of sine, precedence effects. Assignment 3: Panning and stereophonic law with frequency-dependent parameter testing
4	Sep 23 - 27	User Interface Elements for audio design (guest lecture) Spherical harmonics and first-order ambisonics: definitions. Assignment 4: First order Ambisonic encoder
5	Sep 30 - Oct 4	Binaural recording, synthesis, and virtual auditory display, introduction to HRTF measurements. Assignment 5: Deconvolution for impulse response in frequency domain
6	Oct 7 - 11	HRTF equalization, signal generation and processing, quality and errors, far-field HRTF databases. Assignment 6: HRTF data processing and format translation
7	Oct 14 - 18	Near-field HRTF measurements, time and frequency domain features of HRTF, minimum phase. Assignment 7: FIR minimum phase model of HRTF
8	Oct 21 - 25	Higher order ambisonics, sound field rotations (guest lecture). Assignment 8: Ambisonic decoder with rotations
9	Oct 28 - Nov 1	Spatial interpolation for HRTF, principle component analysis (PCA). Assignment 9: Spatial Interpolation of HRTF for elevation zero
10	Nov 4 - 8	Spherical head model for HRTF: far-field calculations, interaural localization cues (guest lecture). Assignment 10: Binaural rendering with convolution
11	Nov 11 - 15	Filter models and approximation, FIR vs IIR, frequency warping
12	Nov 18 - 22	Sound synthesis and physical modeling for 3D sound, numerical techniques
13	Nov 25 - 27	Spatial basis functions, sound-field signal mixing
14	Dec 2 - 6	Binaural reproduction through headphones and loudspeakers, crosstalk cancellation
15	Dec 9 - 13	Final Exams