Date

Spring 2016

Course Number and Title:

MUSI 2526 Introduction to Audio Technology II

Credits and Hours

3 credit hours: lecture

Lecture: Tuesday and Thursday from 1:35 – 2:55 pm in Couch 102

Procedures:

Class will meet two times weekly from 1:35 – 2:55 pm for lecture and activities. Attendance for all lectures is strongly urged. The instructors are under no obligation to make up material presented in class unless the student can provide a reasonable and, if appropriate, documented excuse.

Required prerequisite:

MUSI 2525 Introduction to Audio Technology I

Instructor (office hours upon request)

Dr. Alexander Lerch

* Couch Music Building – 840 McMillan Street – Room 203A – (404) 894-8943
* Office Hours: M/W 1:00 – 2:00 pm.

Course Objectives and Learning Outcomes

Students will gain critical understanding of, and hands-on experience with the fundamentals of digital audio technology. Student learning outcome will include deep understanding and practical familiarity with concepts such as sampling, quantization, digital effects, music information retrieval and audio coding. Upon completion of the course, students will demonstrate:

1. knowledge and critical understanding of the fundamentals of digital audio signals and digital audio signal processing,
2. the ability to analyze block diagrams of digital signal processing systems,
3. the ability to use this knowledge to create a software such as an effect for audio processing.

Course Material

* Richard Boulanger and Victor Lazzarini (eds.), *The Audio Programing Book*, MIT Press, 2010.
* Curtis Roads, *The Computer Music Tutorial*, MIT Press, 1996.

Software

The assignments and project work will be done in Matlab. This will include implementation of functions for signal modification (quantization, sampling), signal analysis (Fourier transform, correlation), and signal processing (convolution, audio effects). Please note the following license information: [www.matlab.gatech.edu](http://www.matlab.gatech.edu). Other tools and programming languages can be used if approved by the instructor.

Grading Policies

Homework assignments are due *by the beginning of class* ON THE DUE DATE. A penalty of one letter grade per day will be applied to all late assignments. Documented illnesses and family emergencies are excepted, of course. Quizzes and exams cannot be made up unless you have a valid, documented excuse.

Method of Evaluation:

The following evaluative tools will be utilized in measuring progress towards obtaining the class objectives:

Homework 30%

Quizzes 30%

Midterm Project 15%

Final Project 25%

TOTAL 100%

All assignments, quizzes, and tests will be graded by points. The final grade for the course will be determined by dividing the total points earned by the number of points possible for each of the categories listed in Method of Evaluation. These numbers will be converted into a grade according to the following scale: A=100-90%, B=89-80%, C=79-70%, D= 69-60%, F= 59% and below.

Academic Integrity

Students must do their own work on assignments, projects, and tests unless collaboration is previously specified and approved by the instructor. Students caught cheating will receive zero credit for that assignment/quiz/test and may be subject to further sanctions through the Office of Student Integrity. Students are expected to abide by the Georgia Tech Honor Code and avoid any instances of academic misconduct, including but not limited to:

1. Possessing, using, or exchanging improperly acquired written or oral information in the preparation of a paper or for an exam.
2. Substitution of material that is wholly or substantially identical to that created or published by another individual or individuals.
3. False claims of performance or work that has been submitted by the student.

Please refer to the published Georgia Institute of Technology Academic Honor Code for further information: osi.gatech.edu/plugins/content/index.php?id=46.

Statement Regarding Students With Disabilities:

In accordance with the Americans with Disabilities Act, students with bona fide disabilities will be afforded reasonable accommodation. The ADAPTS Office will certify a disability and advise faculty members of reasonable accommodations. The web site for a student requesting accommodation is:

* <http://www.adapts.gatech.edu/plugins/content/index.php?id=12>.

Course Outline

Week 1: Introduction to Digital Audio

Week 2: Sampling – Analog to Digital Conversion, Stratification, Clustering, Probability Sampling Weighting, Error Correction, Ratio and Regression Estimation

Week 3: Quantization – Basic Properties and Types, Scalar Quantization, Rounding, Distortion

Week 4: Quantization – Noise Models, Error Model, Rate-distortion Quantize Design, Entropy Constraints

Week 5: Digital Modulation Effects ­– LFO, Chorus, Flangers, Phasers, Tremolo

Week 6: Digital Time Based Effects – Delay Lines, Reverb

Week 7: Advanced Digital Effects – Pitch Shift, Time Stretching, Resonators, Active Noise Control, Wave Field Synthesis

Week 8: Mid Term Project

Week 9: Digital Audio Workstations – Compression and Limiting, Expansion, Gating, Digital Signal Flow, DAW Interface

Week 10: Basic Computation Music Analysis – Time-Frequency Representation, Onset Detection, Pitch and Beat Tracking

Week 11: Advanced Computation Music Analysis – Timbre Analysis, Form Analysis, Segmentation, Genre and Instrument Analysis

Week 12: Fundamentals of Audio Coding – Information Theory and Entropy Coding, Scalar and Vector Quantization, Prediction and Identification of Parametric Models, Spectral Analysis, Models for Voice

Week 13: Advanced Audio codling – Generic Lossless Coding, Audio Lossless Coding, Voice Predictive Coding, Audio Perceptual Coding

Week 14: Final Project Presentation Part 1

Week 15: Final Project Presentation Part 2