

# MUSI 8903: Syllabus

Audio Software Engineering

Spring 2016

## Course Details

**class time** MW 3:00–4:30pm  
**location** Couch 102  
**credits** 3 credit hours

## Instructor Information

**name** Alexander Lerch  
**email** alexander.lerch@gatech.edu  
**location** Couch 205  
**office hours** M 4:30–5:30pm and by appointment

## 1 General Information

### 1.1 Course Description

Introduction to software engineering for audio-related software projects. This course covers the main aspects of software production covering general software design, implementation, and software maintenance with a focus on more audio-specific problems such as real-time software requirements and performance analysis. Assignments and projects provide hands-on experience on the software development process.

### 1.2 Prerequisites

The course will be open to any interested students, but prior coursework or experience in programming is required, experience in C++ and software engineering is recommended, and experience in audio signal processing will be useful.

### 1.3 Learning Outcomes

After successful completion of the class, the students will demonstrate

- an understanding of the concepts of object oriented programming in C++,
- an understanding of the problems and approaches to programming of audio and real-time systems, and
- the ability to implement audio software and audio plugins.

## 2 Grading

The overall grade consists of:

<b>project — scope and code</b>	25%
<b>project — mid-term presentation</b>	5%
<b>project — final presentation</b>	10%
<b>project — video presentation</b>	5%
<b>assignment 1: comb filter class</b>	10%
<b>assignment 2: vibrato class</b>	10%
<b>assignment 3: vibrato plugin</b>	10%
<b>assignment 4: real-time peak meter</b>	10%
<b>assignment 5: fast convolution</b>	10%
<b>class participation</b>	5%

### 2.1 Description of Graded Components

All assignments will require C++ programming of the topic and corresponding test files. Since every class proceeds at different speeds, the assignment topics are subject to change.

The project has to be implemented in C++. It can be an audio plugin, an app, or a stand-alone application.

Both the project work and the assignments will be done in groups of two, unless discussed otherwise with the instructor. The deliverables have to include a note or text file indicating each student's individual contributions.

All grades will be per group.

### 2.2 Grading and Grading Policies

All grading components such as assignments, papers, presentations, projects, quizzes, and exams will be graded in 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 above.

These numbers will be converted into a grade according to the following scale:

<b>A</b>	100–90%
<b>B</b>	89–80%
<b>C</b>	79–70%
<b>D</b>	69–60%
<b>F</b>	59% and below

Grades may be assigned per group or individually as announced (e.g., projects are in most cases per group, quizzes are usually per individual).

## 3 Course Materials

### 3.1 Course Text

There will be no specific text book accompanying the course, but the assignments will be partly based on Matlab code from the following book

<b>Zoelzer, U. (Ed)</b>	“DAFX — Digital Audio Effects” (2011), John Wiley & Sons, 2nd Edition, ISBN: 978-0-470-66599-2
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### 3.2 Recommended Reading

The following books are recommended:

<b>Sutter, H. and Alexandrescu, A.</b>	“C++ Coding Standards. 101 Rules, Guidelines, and Best Practices” (2004). Pearson Education, ISBN: 0-32-111358-6
<b>Meyers, S.</b>	“Effective C++: 55 Specific Ways to Improve Your Programs and Designs” (2005), Addison-Wesley Professional, 3rd Edition, ISBN: 978-0321334879

### 3.3 Software

The assignments, project work, and in-class exercises will be done in C++ in the environment of choice (e.g., Visual Studio, XCode, etc.). Basic familiarity with such tools is expected. Other tools such as CMake, UnitTest++, etc., will be introduced in class.

Additional tools and programming languages can be used if approved by the instructor.

## 4 Course Expectations & Guidelines

### 4.1 Course Schedule

week	topic	tentative due dates	notes
1	introduction		
2	C++ fundamentals		M: National Holiday
3	C++ fundamentals	assignment 1	
4	audio programming concepts — buffering and overlap, ringbuffers		
5	project proposal and discussion	assignment 2	
6	fault prevention, detection, and testing		
7	object orientation and APIs	assignment 3	
8	software design and coding style		W: Guthman
9	plugin interfaces and JUCE		
10	mid-term project presentation and discussion	assignment 4	
11			MW: Spring break
12	threads and semaphores		
13	software project management and processes		MW: WAC2016
14	software project management and processes	assignment 5	
15	guided project work		
16	guided project work		W: Reading Period

Planned exercises include:

- read/write audio files
- ringbuffer
- implement unit tests
- MA filter
- real-time overlapped buffering with variable input size
- convolution
- feature extraction class interface design

Since all classes do not progress at the same rate, it may be necessary to modify the above schedule as circumstances dictate. For example, the number and frequency of assignments may be altered or the schedule of the classes may be changed. In either of these cases, adequate notification will be given and be discussed in class.

### 4.2 Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. For information on Georgia Tech's Academic Honor Code, please visit:

- <http://www.catalog.gatech.edu/rules/18b.php>
- <http://www.catalog.gatech.edu/genregulations/honorcode.php>.

Students are encouraged to support each other, but each submission has to be clearly executed by the individual/group being graded. Any student suspected of cheating or plagiarizing on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

### **4.3 Accommodations for Individuals with Disabilities**

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services (often referred to as ADAPTS) at (404)89-2563 or

- <http://disabilityservices.gatech.edu>

as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

### **4.4 Assignment Turn-In**

All assignments as well as the project work including code have to be turned in as a link to a online repository such as github. Documentation has to be submitted to t-square unless announced otherwise.

### **4.5 Attendance and Participation**

Regular attendance is expected. Missed classes might impact your learning experience and have negative influence on the participatory grade.

### **4.6 Extensions, Late Assignments, Missed Exams**

All assignments, papers and other artifacts are due **ON THE DUE DATE**. The due date will be announced per assignment on t-square. A penalty of **TEN POINTS PER DAY** will be applied to all late assignments and late project papers. Documented illnesses and family emergencies are excepted. Quizzes and exams cannot be made up unless you have a valid, documented excuse.

### **4.7 Student Use of Mobile Devices in the Classroom**

The use of mobile devices in the classroom is not allowed unless explicitly allowed by the instructor.

### **4.8 Student-Faculty Expectations**

At Georgia Tech we believe that it is important to continually strive for an atmosphere of mutual respect, acknowledgment, and responsibility between faculty members and the student body. See

- <http://www.catalog.gatech.edu/rules/22.php>

for an articulation of some basic expectations — that you can have of me, and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.