

# MAT120 Syllabus

<b>Semester:</b>	Fall 2018
<b>Course title:</b>	Mathematics of Music and Sound
<b>Instructor:</b>	Professor Matt Klassen
<b>Email:</b>	mklassen@digipen.edu
<b>Phone:</b>	(425) 895-4423
<b>Office hours:</b>	M-W 1:00-2:30 or by appointment
<b>Course Web Page:</b>	<a href="http://azrael.digipen.edu/MAT120">http://azrael.digipen.edu/MAT120</a>
<b>Time/Place:</b>	lectures: W,F 12:00-12:50, Jimbo, lab: F 2:00-3:50, Boulanger

## WEB PAGES AND MOODLE:

The Moodle page for MAT120 will contain a link to the course web page. The web page is the central repository for all course documents, including homework assignments. Updates to homework will be posted on the web page only. Scores for quizzes, homework, exams, and projects, will be posted through perl scripts on the course web page.

The Moodle page will be primarily used for chat, forums, and for submission of projects.

## COURSE MATERIALS: (Not Required)

- Musimathics: The Mathematical Foundations of Music, Volume 1, by Gareth Loy, MIT Press, 2006.
- ChuckK Book: Programming for Musicians and Digital Artists, Ajay Kapur, Ge Wang, and Perry Cook.

## Supplemental Course Materials:

- The Theory and Technique of Electronic Music, by Miller Puckette (available as free pdf online at <http://crca.ucsd.edu/~msp/techniques/latest/book.pdf>)
- Precalculus, by Michael Sullivan (available in the DigiPen library)
- Programming Electronic Music in Pd, by Johannes Kreidler (html version available online: <http://www.pd-tutorial.com/english/>)
- Pd “Pure Data” software package (installed on lab computers)
- Other Pd documentation: <http://puredata.info/docs>, and <http://en.flossmanuals.net/pure-data>
- ChuckK Website: <http://chuck.cs.princeton.edu>

**PREREQUISITES:**

None

**COURSE DESCRIPTION:**

This course explores the mathematical foundations of music and sound. Topics include scale systems, just and tempered intervals, oscillations and trigonometry, sound waves, and basic discrete mathematics.

**COURSE OBJECTIVES AND LEARNING OUTCOMES:**

Students should be able to construct intervals and scales from their basic frequency ratios, understand the classical and modern scale constructions using logarithms, and arithmetic and geometric series, work with the trigonometric functions and their representations of sound waves, and compute with the basic counting functions of combinatorics and finite probabilities.

**ASSESSMENT AND GRADING:**

Midterm Exam	20%
Final Exam	20%
Homework	20%
Quiz	20%
Lab Projects	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

## **HOMEWORK ASSIGNMENTS:**

Homework will be assigned and posted on the web page and collected roughly weekly. You are responsible for checking the web page and noting the assignments and the due date. You may work on homework together, as well as consult the tutors and the instructor. However, the final work that you turn in must be your own work.

## **COMPUTATIONAL RESOURCES:**

To illustrate various mathematical and musical concepts, we will be using the free software packages: Pd, written by Miller Puckette, and ChuckK, written by Ge Wang and Perry Cook.

You are also encouraged to do algebraic and other calculations for the homework using a calculator or symbolic package such as PARI. The symbolic algebra package PARI/GP is free and open-source.

## **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\[at\]digipen\[dot\]edu](mailto: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.

**TENTATIVE WEEKLY TOPICS:**

Week	Dates	Topics
1	Sep 3 - Sep 7	Overview of Numbers: rational, irrational, real, complex; Geometric and arithmetic series, frequency ratios, equal temperament
2	Sep 10 - 14	Logarithms and exponentials; Frequency, pitch, and classical intervals and scales; Loudness, decibels
3	Sep 17 - 21	Just intervals and the harmonic series, Meantone and tempered scales
4	Sep 24 - 28	Cent interval measurements, logarithmic scales
5	Oct 1 - 5	Partch's just scale system and modern just intonation
6	Oct 8 - 12	Trigonometric functions, unit circle, and graphs
7	Oct 15 - 19	Midterm Exam; Amplitude, period, frequency and phase
8	Oct 22 - 26	Interference, beats, addition and multiplication of graphs
9	Oct 29 - Nov 2	Basic Fourier series, partials, harmonics, and inharmonicity
10	Nov 5 - 9	Damped and driven harmonic oscillations, resonance
11	Nov 13 - 16	Combinatorics: enumeration, permutations and combinations
12	Nov 19 - 23	Sets, subsets, and partitions
13	Nov 26 - 30	Cyclical patterns, modular arithmetic
14	Dec 3 - 7	Probability theory, discrete distributions, stochastic processes
15	Dec 10 - 14	Final Exams