Introduction to
Audio and Music Engineering

Lecture 1

Topics:

• Course overview
• Mathematical readiness
AME140 Course Logistics

- AME140, ECE140, EAS103, MUR141 are the same
- Lectures, T, Th 12:30 – 1:45 PM
- Labs (Hopeman 226 unless otherwise posted)
  - Mon 2:00 – 4:40 PM
  - Weds 2:00 – 4:40 PM
  - Weds 4:50 – 7:00 PM (New section)
  - Friday 2:00 – 4:40 PM
- EAS10X Workshops – not mandatory
  - Seminar: Wednesdays, 4:50–6:05 pm, Hoyt Aud.
- Grading is based on homework, labs, 2 tests
What is Audio and Music Engineering?

Intersection of Music with ECE, CS, and Physics (Acoustics)
Topics covered in Audio and Music Engineering

• Steve Vai video ...
  https://www.youtube.com/watch?feature=player_detailpage&v=xJ7vyFnLv.jw

The Electric Guitar and associated equipment touch on all of the main topics of the course.
Physics

- Vibrations of simple systems
  - Guitar strings
- Frequency – pitch – tuning systems
  - Guitar fret placement
- Modes of more complicated vibrating bodies
  - Drums
- Room acoustics
Electronics

- Amplifiers
- Tone control circuits
- Analog electronic filters
- Distortion effects, tubes
- Pickups, microphones, other transducers
- Loudspeakers
Signals

- Fourier series
  - Building rich timbres from sine oscillations
- Fourier analysis
  - Deconstructing complex sounds
- Time & frequency domains
  - The foundation of signal processing
- Digital signals
  - Sampling and quantization
- Digital signal processing
  - Digital filters
  - Other digital processing
Sound synthesis

• Synthesizing sounds with computers
  – Additive – Fourier series
  – Subtractive – Digital filters
  – Frequency modulation (FM)
  – Physical modeling
    • Creating sounds by simulating musical instruments on computers
Mathematical Preparation

• To understand Audio beyond a superficial level you need to do the math
  – There is a difference between not being prepared for the math and not wanting to do the math!
  – The math we use in AME140 is useful for the next 4 years

• Calculus is not assumed
  – Course will teach everything you need

• Algebra
  – Algebraic manipulation
  – Solving simple systems of equations
  – Complex numbers

• Trigonometry
  – Sine, cosine, unit circle and all that
  – Complex exponential functions – relation to sine and cosine
Math preparedness exam

• Only for assessment purposes
• If there are rough spots in your preparation you can review with Khan Academy videos
  – [https://www.khanacademy.org/](https://www.khanacademy.org/)