K403/503 Midterm Review Sheet

(please note that the material covered in class and that you are responsible for is extensive and some items appearing on the exam may not appear below—however, the items listed will cover the bulk of what you are responsible for)

Acoustics:
- Please review the Week 2-4 Study Guides—know everything on them
- You will be asked for BOTH formulas for decibels (only difference is x’s 10 vs. x’s 20), but I will ask you to solve a very simple version of the formula for amplitude (20 log₁₀ Amplitude₁/Amplitude₂) For example, if one sound has 100 times the amplitude of another, how many more dB’s is it?

Other acoustic items to attend to:
- acoustics vs. psychoacoustics
- compression / rarefaction
- periodic waveform
- cycle
- period (the duration of a cycle)
- frequency (in Herz, i.e., cycles per second)
- noise (white and pink)
- wavelength
- velocity (speed) of sound in air (1130 feet per second, usually)
- wavelength (in feet) = velocity of sound (feet per second) / frequency (Herz)
- pitch (perception), and its relation to frequency (acoustical property) What’s the nature of the relationship?
- phase (of a periodic waveform)
- constructive and destructive interference
- beats (incl. beat frequency formula)
- standing waves
- amplitude, power, and intensity (See the “putting it all together” chart in the etext.)
- decibel (ratio of two power levels or amplitudes, using a logarithmic scale; one of the power levels is often a standard reference level, as in SPL)
- SPL (Sound Pressure Level, measured in decibels above the “threshold of hearing”)
- the relation of loudness (perception) to intensity (acoustical property)
- Fletcher/Munson equal-loudness contours
  - timbre
  - harmonic and inharmonic (or non-harmonic) partials, overtone series (Note: don’t confuse inharmonic with enharmonic — as in “G# is enharmonically equivalent to A♭.”)
- partial numbering (fundamental frequency is partial #1). Know the musical intervals of the first 7 partials above the fundamental (again, that is partial #1!)
- Fourier’s theorem (acoustics chapter 7:2)
- Formants—what the heck are they?
- localization cues (ITD, IAD)
**Studio equipment:**
- microphone types (dynamic, condenser, ribbon, PZM, etc.)
- microphone patterns (omni-directional, cardioid, hyper-cardioid, figure-eight)
- proximity effect
- bass roll-off switch (on mic)
- x-y coincident mic‘ing (for a stereo pair)
- near-coincident mic‘ing
- inverse-square law
- phantom power
- balanced line
- pre-post fader

**Digital Audio:**
- Please read the digital audio primer chapter very carefully [http://iub.edu/~emusic/etext/digital_audio/chapter5_digital.shtml](http://iub.edu/~emusic/etext/digital_audio/chapter5_digital.shtml)
- DAC (digital to analog convertor)– be able to draw a simple DAC
- Sampling rate
- Sample size (bit depth—how many bits are used in each sample)
- Nyquist theorem (Nyquist frequency). What minimum sampling rate is needed to reproduce a frequency of 10 kHz?
- What is aliasing and how is it avoided? What does it sound like?
- What aspect of the digital audio signal is this responsible for:
  - frequency response (sampling rate)
  - dynamic range (bit depth)
- What is quantization?
- Quantization error (or approximation error). What does this sound like if extreme?
- How many decibels of additional dynamic range do you get from adding 1 bit to the sample (answer: 6 dB)
- CD-quality audio: 44100 Hz sampling rate; 16-bit sampling resolution
- Be prepared to write an essay on the principles of digital audio, including diagrams that clarify your verbal description utilizing all the concepts above

**Audio Effects:**
- Equalization: EQ types:
  - Low-pass, High-pass, Low shelf, High shelf, Peak/notch
- Delay line (delay time, delay feedback)
- Effects of different delay times:
  - > 50 msec → discrete echoes
  - < 50 msec w/ feedback → resonates pitch at frequency of 1 / delay time.
- Reverberation: Early (or initial) reflections, early reflection pre-delay, reverberation time, wet/dry mix