

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 ($20 \log_{10} \text{Amplitude}_1 / \text{Amplitude}_2$) 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 \flat .”)
- 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
- 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 $1 / \text{delay time}$.
- Reverberation: Early (or initial) reflections, early reflection pre-delay, reverberation time, wet/dry mix