

## Review for Final Exam

General: The final exam is cumulative. It is **strongly** recommended that you review the information on the review sheets for the two midterm exams. You should also review the homework and lab exercises for the entire course.

### Chapter 8 - terms and concepts to know

1. Spherical waves
2. Plane waves
3. Inverse square law:  $\text{dB} = -20 \log(d_i/d_r)$ ; double distance from source = -6dB, halve distance from source = +6dB
4. Reflection - reflection from a plane surface, from a convex surface, from a concave surface
5. Echoes
6. Reverberation and reverberation time:  $T_{60} = k(V/A)$
7. Standing waves
8. Nodes and Antinodes - how to calculate the number of each and how to draw a standing wave pattern with a specific number of nodes and antinodes
9. Resonance in a tube - how to calculate the fundamental and 2nd resonance, 3rd resonance, etc. for both open and closed tubes
10. Refraction
11. Acoustic impedance
12. Diffraction, dispersion, transmission
13. Absorption, absorption coefficient:  $\alpha = I_a / I_i$ ;  $I_a = I_i - I_r$  where "i" represents the incident wave, "r" represents the reflected wave, "a" represents the absorbed wave; how to calculate total absorption (A') for a room.
14. What is an anechoic chamber, a sound isolation room?
15. Beats, how to calculate the beat frequency and perceived pitch
16. Doppler effect, how to calculate the altered frequency for a source moving toward an observer and away from an observer
17. Sonic booms

### Additional Readings - terms and concepts to know

#### Ch. 19 Controlling the Environment & Ch. 21 Auditorium Design

1. Know the terms and concepts on the notes from these lectures
2. Specifically, know the defects to avoid in a concert hall design
3. Know the basic requirements of concert hall/auditorium design and pay particular attention to the techniques used to provide uniform sound energy distribution throughout the room

#### Ch. 44 Recording Media

1. Digital to analog conversion

2. Analog to digital conversion
3. Sampling rate
4. Aliasing

Previous Material and Sample Problems

1. Draw a sinusoid in time (three cycles exactly) with a period of 200 msec., phase angle of 90 degrees, and an RMS amplitude of 7.07  $\mu$ Pa.
2. For the sinusoid in #1, what is the...
 

amplitude	peak-to-peak amplitude
level in dB SPL	intensity
phase angle in radians	wavelength (assuming it is an acoustic wave)
3. Draw the velocity and acceleration of the sinusoid above with the same time scale for easy comparison. No amplitude is given but label the amplitude axis on both the velocity and acceleration graphs with the appropriate physical units.
4. Know potential energy and kinetic energy with reference to some oscillating system. Know the relationship between the mass and resistance and compliance.
5. Know the three types of microphones discussed in the readings and in class.
6. Draw a square, sawtooth, and triangle wave in time with periods of 100  $\mu$ sec and amplitudes of 60 dB SPL.
7. Draw the spectrum for each of the above waves using at least 3 harmonic components in each. Assuming that the first harmonic has an amplitude of 57 dB SPL, label the amplitudes of the other harmonic components.
8. Draw a filtered version of the sawtooth's spectrum if it was filtered with an anti-aliasing (low-pass) filter with a 20kHz cutoff frequency and a 60 dB/octave slope beyond the cutoff.
9. Two sound sources, one at 50 dB SPL and one at 54 dB SPL are produced at the same time. What would the total level be in dB SPL? Also, remember the rule if two sound sources have the same level.
10. Know what signal to noise ratio is and how to calculate it.
11. Lps and SPL calculations for noise:  
 Example: given a white noise with a band-width of 2000 Hz and an SPL of 60 dB SPL, what is the pressure spectrum level (Lps)?  
 Be able to do this with octave bands of noise.
12. Inverse square law: If 5m from the source is 80 dB SPL, what is the SPL at 10m?

13. Resonances in tubes: Calculate the fundamental resonance for a tube length of 1 m for two cases, a tube closed on both ends and one closed only on one end. Calculate the 3rd resonance for the same two tubes.
14. Know what white noise and pink noise are.
15. Know the different types of distortion.
16. Know general features of spectral characteristics of musical instruments (i.e. attack time, steady state). (You don't need to know specific numbers for specific instruments)
17. An incident sound wave of  $10^{-4}$  watt/m<sup>2</sup> hits a wall with an absorption coefficient of 0.5. What is the amplitude of the reflected wave?
18. An incident sound wave of 25  $\mu$ Pa hits a wall with an absorption coefficient of 0.8. What is the amplitude of the reflected wave?