Physics 101 - Fall 2007

Learning Goals

Week	Topics	Reading assignments	Learning Goals: Students should be able to
1, Sept. 4-7	Density, Pressure in Fluids	Section 15.1,15.2	List macroscopic and microscopic differences between solid, liquid, and gas phase. Define density and pressure. Distinguish between absolute and gauge pressure. Calculate pressure at a given depth inside a liquid. Explain how suction works.
2, Sept, 10-14	Pascal's principle, Hydraulic Lift, Buoyancy, Archimedes' Principle	Sections: !5.3, 15.4	Explain Pascal's principle. Explain how a hydraulic lift works. Explain why a fluid exerts an upward force on an immersed object. Calculate buoyant forces on floating and immersed objects.
3, Sept. 17-21	Fluid Dynamics (Continuity Equation, Bernoulli's Equation)	Sections: 15.5	Derive the equation of continuity for fluids. Demonstrate conservation of energy in Bernoulli's equation. Use Bernoulli's equation to calculate flow speeds of liquids in pipes. Show Bernoulli's principle at work in examples of fluid flow.
4, Sept. 24-28	Simple harmonic Motion, Energy conservation in SHM, The Dynamics of SHM	Sections: 14.1, 14.2, 14.3, 14.4	Interpret oscillations as periodic motion of a single particle. Explain what a restoring force is and why systems oscillate. Distinguish amplitude and displacement. Describe oscillations mathematically and compute displacements. Apply conservation of energy to calculate potential and kinetic energy in simple harmonic motion. Interpret displacement/velocity vs. time graphs for SHM.
5, Oct. 1-5	Vertical Oscillations, Pendulum, Damped Oscillations, Resonance	Sections: 14.5, 14.6, 14.7, 14.8	Describe the relationship between spring constant k (or elastic properties of a material) and natural frequency of an oscillator. Compare ideal simple harmonic motion to damped oscillator and to driven (forced) oscillations. Qualitatively explain resonance.

6, Oct. 8-12	Waves	Sections: 20.1	Distinguish between the wave motion and the motion of the particles of the medium. Identify longitudinal and transverse waves.
7, Oct. 15-19	Waves	Sections: 20.3, 20.4, 20.6	Demonstrate that waves are due to oscillations of single particles and their elastic interaction with neighboring particles. Infer the wavelength from the oscillation period. Connect wave amplitude to particle amplitude. Distinguish displacement of wave from displacement of particle. Distinguish wave speed from particle speed.
8, Oct. 22-26	Sound, Light, Power, Intensity, Doppler Effect	Sections: 20.5, 20.7	List characteristics of sound. Describe differences and similarities between sound and light waves. Calculate Intensity for waves in three dimensions. Explain the underlying physics behind the Doppler effect and calculate the frequency shifts.
9, Oct. 29 – Nov. 2	Superposition, standing waves, musical acoustics	Sections: 21.1, 21.2, 21.3, 21.4	Explain how complicated waveforms can be generated by combining sinusoidal waves. Explain standing waves as superposition of two traveling waves. Describe standing waves on a string open(closed) and one and open(closed) at the other end. Represent possible wave patterns in string instruments in equations and using diagrams.
10, Nov. 5– 9	Decibels, Ear response, Vibrating air columns, Interference	Sections: Giancoli	Calculate sound level for a given intensity and vice versa. Represent possible wave patterns in wind instruments in equations and using diagrams, Describe and calculate interference pattern when sound waves from two sources combine in space.
11, Nov. 12– 16	Mathematics of Interference, Beats	Sections: 21.5, 21.6, 21.7, 21.8	Describe interference mathematically and in diagrams. Distinguish between interference in space and interference in time. Find locations of constructive and destructive interference. Calculate beat frequencies.
12, Nov. 19– 23	Two-slit interference, thin-film interference, Michelson Interferometer.	Sections: 22.1, 22.2	Describe and explain interference of light waves in double slit experiments. Explain thin film interference for various types of thin films. Calculate conditions for constructive and destructive interference for thin films. Explain how a Michelson

			interferometer can be used for precision measurements of distance and refractive indices.
12, Nov. 26– 30	The Diffraction Grating, Single-slit Diffraction, Circular Aperture, resolution	Sections: 22.3,22.4,22.5	Explain how a diffraction grating works. Explain diffraction of waves. Explain diffraction of waves emerging from a single slit or a circular aperture. Define resolution. Calculate resolution of a simple telescope.