

PHYSICS 2220 - PHYSICS FOR SCIENTISTS AND ENGINEERS

Course Outline - Spring 2009

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TEXTBOOK: Halliday, Resnick, and Walker, *Fundamentals of Physics, Extended*, 8th Ed. (John Wiley & Sons: 2008)

OUTLINE

1. **Electrostatics:** Electric charge, Coulomb's law, electric fields, electric dipole, Gauss' law, electric potential, capacitance. (Ch. 21, 22, 23, 24, 25, 25)
2. **Electric Current and Circuits:** Current, resistance, Ohm's law, circuits, the loop rule and the junction rule. (Ch. 26, 27)
3. **Magnetic Fields and Induction:** Forces on a moving charges and currents, torque on a current loop, sources of magnetic fields, the Biot-Savart law, Ampere's law, magnetic dipoles, Faraday's law of induction, Lenz's law, RL circuits. (Ch. 28, 29, 30)
4. **Alternating Current:** Reactance, impedance, RLC circuits, resonance. (Ch. 31)
5. **Electromagnetic Waves, Light, and Optics:** Displacement current, Maxwell's equations, magnetism of matter, electromagnetic waves, radiation pressure, polarization, reflection, refraction, Snell's law, dispersion, mirrors, thin lenses, interference, Young's double-slit experiment, thin films, single-slit diffraction, resolution and Rayleigh's criterion, diffraction gratings. (Ch. 32, 33, 34, 35, 36)
6. **Special Theory of Relativity:** Einstein's postulates, simultaneity, time dilation, length contraction, Lorentz transformations, velocity addition, the Doppler effect for light, relativistic momentum and energy, mass and energy. (Ch. 37)
7. **Quantum Physics:** Photons, the photoelectric effect, Compton scattering, probability waves, de Broglie's matter waves, the wave-particle duality, Heisenberg's uncertainty principle, barrier tunneling, particle in a box, quantized energy, the hydrogen atom, the periodic table, the Pauli exclusion principle. (Ch. 38, 39, 40)
8. **Nuclear Physics:** atomic nuclei, radioactivity, alpha and beta decay, nuclear fission and fusion. (Ch. 42, 43)

COURSE POLICY

You are responsible for all material presented in the lectures, reading, and homework assignments. Although attendance is not required, it is strongly recommended. The review sessions before each quiz are devoted to clearing up questions about the course material. The homework is due **before the quiz** on the days listed in the lecture schedule. Late assignments will be accepted, **for half-credit only**, during the week after the due date. **Homework more than one week late will not be accepted.** The homework grades will range from 0 - 2 points per assignment, simply verifying that the problems have been worked.

Before each homework assignment is due, the solutions will be posted on the web. You should carefully review these solutions and use them to make corrections to your work. Above all, be sure you understand how each problem was solved. Questions about the assignments will be answered during the review session before each quiz.

A quiz covering one or two of the homework problems will be given after each review session. Although **no make-up quizzes will be given under any circumstances**, your three lowest quiz scores will be dropped when determining your grade.

Four hour-long exams will be given in the lecture room. **WARNING: No make-up exams will be given without the ADVANCE PERMISSION of the instructor.** Alas, Nature is not kind, and does not pose simple one-step problems with all of the variables labeled. For this reason, the exams will avoid purely plug-in problems. A "cheat sheet" containing only the basic equations will be supplied with each exam. Academic dishonesty on an hour exam or on the final exam will result in a grade of zero being given for that examination. A second violation during the Phys 2210/2220 sequence will constitute failure of the course.

Any student requiring accommodations or services due to a disability must contact Services for Students with Disabilities (SSD) in Room 181 of the Student Service Center. SSD can also arrange to provide course materials (including this syllabus) in alternative formats if necessary.

OFFICE HOURS

MWF: 11:00 am - 12:00 pm
TTh: 1:00 pm - 2:00 pm

GRADING

Homework	5%
Quizzes	10%
Hour Exams (4)	15% (each)
Final Exam	25%

LECTURE SCHEDULE AND READING ASSIGNMENTS

Jan	6	Ch. 21, p. 561 - 573 (21.1 - 21.6)
	8	Ch. 22, p. 580 - 596 (22.1 - 22.9)
Jan	13	Homework #1 due / Quiz #1 (Ch. 21)
		Ch. 23, p. 605 - 615 (23.1 - 23.6)
	15	Ch. 23, p. 615 - 620 (23.7 - 23.9)
Jan	20	Homework #2 due / Quiz #2 (Ch. 22, 23)
		Ch. 24, p. 628 - 638 (24.1 - 24.8)
	22	Ch. 24, p. 638 - 645 (24.9 - 24.12)
		Ch. 25, p. 656 - 662 (25.1 - 25.3)
Jan	27	Homework #3 due / Quiz #3 (Ch. 24)
		Ch. 25, p. 662 - 674 (25.4 - 25.8)
	29	*** EXAM #1 (Ch. 21 - 24) ***
Feb	3	Homework #4 due / Quiz #4 (Ch. 25)
		Ch. 26, p. 682 - 698 (26.1 - 26.9)
	5	Ch. 27, p. 705 - 724 (27.1 - 27.9)
Feb	10	Homework #5 due / Quiz #5 (Ch. 26, 27)
		Ch. 28, p. 735 - 750 (28.1 - 28.7)
	12	Ch. 28, p. 750 - 755, (28.8 - 28.10)
		Ch. 29, p. 764 - 772 (29.1 - 29.3)
Feb	17	Homework #6 due / Quiz #6 (Ch. 28)
		Ch. 29, p. 772 - 780 (29.4 - 29.6)
	19	*** EXAM #2 (Ch. 25 - 28) ***
Feb	24	Ch. 30, p. 791 - 806 (30.1 - 30.7)
	26	Ch. 30, p. 806 - 815 (30.8 - 30.12)
		Ch. 31, p. 826 - 834 (31.1 - 31.4)
March	3	Homework #7 due / Quiz #7 (Ch. 29, 30)
		Ch. 31, p. 834 - 853 (31.5 - 31.11)
	5	Ch. 32, p. 861 - 881 (32.1 - 32.11)
March	9 - 13:	Spring Break
March	17	Homework #8 due / Quiz #8 (Ch. 31, 32)
		Ch. 33, p. 889 - 913 (33.1 - 33.10)
		Ch. 34, p. 924 - 941 (34.1 - 34.7)
	19	*** EXAM #3 (Ch. 29 - 32) ***
March	24	Homework #9 due / Quiz #9 (Ch. 33, 34)
		Ch. 35, p. 958 - 977 (35.1 - 35.7)
	26	Ch. 36, p. 990 - 1012 (36.1 - 36.10)
March	31	Homework #10 due / Quiz #10 (Ch. 35, 36)
		Ch. 37, p. 1022 - 1034 (37.1 - 37.6)

April 2 *** EXAM #4 (Ch. 33 - 36) ***

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April 7 Ch. 37, p. 1034 - 1048 (37.7 - 37.12)
9 Homework #11 due / Quiz #11 (Ch. 37)
Ch. 38, p. 1057 - 1076 (38.1 - 38.9)

April 14 Ch. 39, p. 1083 - 1089, 1097 - 1106 (39.1 - 39.3, 39.8, 39.9)
16 Homework #12 due / Quiz #12 (Ch. 38, 39)
Ch. 40, p. 1112 - 1116, 1122, 1126, 1127
(40.1 - 40.3, 40.7, 40.9)
Ch. 42, p. 1165 - 1182 (42.1 - 42.6)

April 21 Ch. 43, p. 1195 - 1201, 1207 - 1210 (43.1 - 43.3, 43.6, 43.7)
23 Homework #13 due / Quiz #13 (Ch. 40, 42, 43)

FINAL EXAM

Tuesday, April 28
6:00 pm - 8:00 pm in the Lecture Room

BASIC EQUATIONS FROM PHYSICS 2210

It is assumed that you have **memorized** the following basic equations from PHSX 2210. These equations will not be found on the cheat sheets, although they may be needed to work some problems on the exams.

Constant acceleration: $x - x_o = v_o t + \frac{1}{2} a t^2$ $v = v_o + a t$
 $x - x_o = \frac{1}{2} (v + v_o) t$ $v^2 = v_o^2 + 2a(x - x_o)$

Constant angular acceleration: $\theta - \theta_o = \omega_o t + \frac{1}{2} \alpha t^2$ $\omega = \omega_o + \alpha t$
 $\theta - \theta_o = \frac{1}{2} (\omega + \omega_o) t$ $\omega^2 = \omega_o^2 + 2\alpha(\theta - \theta_o)$

Newton's second law: $\sum \mathbf{F} = m\mathbf{a}$

Weight: $W = mg$ ($g = 9.8 \text{ m/s}^2 = 32 \text{ ft/s}^2$)

Centripetal acceleration: $a_c = v^2/r = \omega^2 r$ $T = 2\pi r/v$

Work and Power: $W = Fd \cos \phi$ (constant force) $P = dW/dt = Fv \cos \phi$

Kinetic energy: $K = \frac{1}{2} mv^2$

Newton's law of gravity: $F_g = Gm_1 m_2 / r^2$ ($G = 6.67 \times 10^{-11} \text{ Nm}^2/\text{kg}^2$)

Conservation of energy: $K_i + U_i = K_f + U_f$

Potential energy: gravity (near ground): $U_g = mgy$

gravity (general): $U_g = -Gm_1 m_2 / r$

Torque: $\sum \tau = rF \sin \phi = I\alpha$

Waves: $f\lambda = \omega/k = v$ $\omega = 2\pi f$ $k = 2\pi/\lambda$ $c = 3 \times 10^8 \text{ m/s}$

$T = 1/f = 2\pi/\omega$

Pressure: $P = F/A$

Geometry: Circle: $C = 2\pi r$ $A = \pi r^2$
Sphere: $A = 4\pi r^2$ $V = \frac{4}{3} \pi r^3$
Cylinder: A (side) = $2\pi r\ell$ $V = \pi r^2 \ell$
 A (one end) = πr^2