

PHYS C2601x Physics III: Classical and Quantum Waves Fall Semester 2009

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Class webpage: <http://www.columbia.edu/~pk2015/2601>

Day and time: Class: Mondays and Wednesdays, 9:15- 10:30 AM , Pupin 428
Optional recitation: Sunday 5 pm, Pupin 428

Credits for course: 3.5

Description: This course is the third part of the introductory physics sequence. The course is preparatory for advanced work in physics and related fields. Following subject will be included: oscillations and resonance, classical waves and the wave equation, interference and diffraction, Fourier series and integrals, normal modes, wave-particle duality, the uncertainty principle, basic principles of quantum mechanics, energy levels, quantum tunneling, the harmonic oscillator.

Prerequisites: PHYS C1402 or C1602; **Corequisite:** MATH V1202 or the equivalent

Homework: Homework will be assigned each week to be handed in the following week (in class). All problems will be checked and a sub-set will be graded in more detail. Homework assignments and solutions will be posted on the course web page.

Exams: There will be a midterm exam in class on Wednesday, Oct. 28, 2009.

Grading: The homework will count for approximately 20% of the grade, the mid-term for approximately 35%, and the final exam for the remaining 45%.

Text for course:

“Vibrations and Waves” by A.P. French, 1971 by M.I.T. publishing. ISBN - 0-393-09936-9
“Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles,” Second Edition by R. Eisberg and R. Resnick, 1985 by John Wiley & Sons, inc. ISBN - 0-471-87373-X.

Tentative Schedule of Lectures, Assignments and Exams

Week of	Lect#	Topics	Assignment	Due (Wed. in class)
9/7	1	Introduction Oscillations, resonance, superposition	HW #1	
9/14	2, 3	Coupled oscillators, normal mode Superposition of normal mode, wave equations	HW #2	HW #1
9/21	4, 5	Classical waves in continuous medium I Standing waves, Fourier analysis	HW #3	HW #2
9/28	6, 7	Classical waves in continuous medium II Propagation of waves, Phase and group velocity	HW #4	HW #3
10/5	8, 9	Energy Transfer, Reflection and refraction Reflection and refraction, Doppler Effect	HW #5	HW #4
10/12	10, 11	Interference/ Diffraction Double slit interference, diffraction in a single slit	HW #6	HW #5
10/19	12, 13	Introduction of Modern Physics Wave Particle Duality I: Black body radiation	HW #7	HW #6
10/26	14	Wave Particle Duality II: Photoemission		
		<i>Midterm exam: Wed., 10/28 in class</i>		
11/2	15	Wave Particle Duality III: Compton Scattering [University holiday, Monday, Nov. 2]		
11/9	16	Formulation of Quantum Physics I de Broglie hypothesis, Uncertainty Relation	HW #8	HW #7
11/16	17, 18	Formulation of Quantum Physics II Bohr's atomic model/ Introduction of Schödinger eq.	HW #9	HW #8
11/23	19, 20	Schödinger eq. in confined space Particle in a box, harmonic oscillator, quantum tunneling	HW #10	HW #9
11/30	21, 22	Hydrogen Atom Schödinger eq. in 3-dimension, angular momentum, spin		
12/7	22, 23	Quantum theory of many particles Fermions and bosons, quantum statistics	HW#11	HW#10 (Monday due)
12/14	24	Atoms, molecules, solids Periodic table, chemical bonding Final Exam		HW#11 (Monday due)