PHYSICS 15c, Spring 2012
WAVES
SYLLABUS
(updated January 23, 2012)

PROFESSORS

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TEACHING FELLOWS

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LAB INSTRUCTORS

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STAFF ASSISTANT

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USEFUL TEXTBOOKS

Introduction to Wave Phenomena, by Hirose & Lonngren
Krieger Publishing 2003, ISBN 1-57524-231-1
The Physics of Waves, by Howard Georgi
available **free** online: http://www.people.fas.harvard.edu/~hgeorgi/new.htm
waves, by Frank Crawford
The Physics of Vibrations and Waves, 6th ed., by H. J. Pain
Vibrations and Waves, by A. P. French
Optics, 4th ed., by Eugene Hecht

PREREQUISITES

Physics 15b or 153, or written permission of Dave Morin or Prof. Georgi.
Mathematics at least at the level of Mathematics 21b taken concurrently is required. Linear algebra and differential equations are used extensively. Students taking Mathematics 21b concurrently will likely find that some concepts are introduced in Physics 15c before they have seen them in Mathematics 21b. Some students may wish to postpone Physics 15c until they have completed Mathematics 21b.

LECTURES

Tuesday and Thursday, 1-2:30pm, Science Center A.

You are encouraged to read through the material in advance and bring questions to the lectures. In case you do miss a lecture, the course will be videotaped, and you may contact the teaching staff for access to a particular lecture video.

LABS
The lab component will consist of four 3-hour labs in the first half of the semester, and a final project in the second half. The topics will include driven oscillation and musical instruments, interferometry, Fourier optics and holography. The labs will give you an opportunity to experience a broad range of wave phenomena and learn modern optics. Understanding wave optics is a great basis for a more intuitive understanding of quantum physics in later semesters. In the final project you will take on a small independent project. With plenty help provided, you will explore a topic of your choice, such as trapping particles with a laser beam, holographic measurements, measuring the "aether wind", optical communication, etc. The projects will be presented in a poster session near the end of the semester.

SECTIONS
Sections are taught by the TF, Chad Donahue.
Sections will begin the week of January 30 - February 3. Attendance is strongly advised.

WEBSITE
Course website: http://isites.harvard.edu/icb/icb.do?keyword=k83732
Problem sets, solutions, labs, announcements, and other useful material will be posted on the web site. You are responsible for checking the website regularly.

PROBLEM SETS
There will be one problem set each week, due Wednesday at noon in the boxes outside Science Center 108-112. Solutions will be posted on the website as soon as problem sets are collected. Except in *very unusual* circumstances, we will not accept late problem sets. Any requests for extensions should be made to your TF.

Eleven problem sets will be given during the semester. The 11th problem set is optional and will be due during the Reading Period. If you do complete the 11th set, you may use it to replace the lowest score among the earlier problem sets.

MATHEMATICA
Some problem sets will refer to Mathematica animations which are posted on the course website. You should download, install, and obtain a license for Mathematica ***now***, so that you don't find yourself in a last-minute panic if the licensing takes 24 hours. Download for free from: http://downloads.fas.harvard.edu/download

STUDY GROUPS
You are encouraged to work together on problem sets (but the work that you hand in should be your own, of course). The best way to find a study group is to attend office hours. If in doubt, please ask your TF for assistance finding a study group.

EXAMS
There will be two midterm exams (during the regular 1.5-hour class) and a final exam (3 hours). The midterms will be on Tuesday, March 6 and Tuesday, April 17. The final will be on Wednesday, May 9.

GRADING
Problem Sets 30% (for 10), Labs 20%, Midterms 10% each, Final exam 30%.

TENTATIVE SCHEDULE *(updated Jan 23, 2012 – all finalized except for labs)*

	Date	Lecture topic	Homework	Lab
1	Tues, 1/24	harmonic oscillators, differential equations		
2	Thurs, 1/26	inhomogenous diff. eqns, forced oscillator, energy, resonance		
3	Tues, 1/31	coupled oscillators, Georgi's symmetry trick	HW#1: due Wed, 2/1	driven SHO
4	Thurs, 2/2	continuous wave equation		
5	Tues, 2/7	dispersion relations, phase & group velocities	HW#2: due Wed, 2/8	interferometer
6	Thurs, 2/9	Fourier analysis		
7	Tues, 2/14	sound waves & ears	HW#3: due Wed, 2/15	FT of screen
8	Thurs, 2/16	doppler effect, shock waves		
9	Tues, 2/21	musical instruments, standing waves, strings	HW#4: due Wed, 2/22	hologram
10	Thurs, 2/23	reflections, higher dimensions		
11	Tues, 2/28	2D & 3D boundaries: Can you hear the shape of a drum?	HW#5: due Wed, 2/29	project choice
12	Thurs, 3/1	wrap-up & review		
	Tues, 3/6	**MIDTERM EXAM (covers through lecture #11, HW#5)**		
13	Thurs, 3/8	LC transmission line		
14	Tues, 3/20	E&M waves, polarization	HW#6: due Wed, 3/21	project
15	Thurs, 3/22	reflection, refraction		
16	Tues, 3/27	Fresnel coeffs, Brewster's angle, accelerating charges	HW#7: due Wed, 3/28	project
17	Thurs, 3/29	E&M waves in materials		
18	Tues, 4/3	interference	HW#8: due Wed, 4/4	project
19	Thurs, 4/5	diffraction		
19	Tues, 4/10	geometrical optics	HW#9: due Wed, 4/11	project
20	Thurs, 4/12	wrap-up & review		
	Tues, 4/17	**MIDTERM EXAM (covers through lecture #19, HW#9)**		
22	Thurs, 4/19	microscopes, telescopes		presentations
23	Tues, 4/24	quantum mechanics	HW#10: due Wed, 4/25	
	Thurs, 4/26	Reading period: review session		
	Tues, 5/1	Reading period: review session	HW#11: due Wed, 5/2	
	Wed, 5/9	**FINAL EXAM**		