

**PHYSICS 15c, Fall 2010**  
**WAVES**  
**SYLLABUS**  
(updated September 1, 2010)

**PROFESSOR**

Jenny Hoffman	jhoffman@physics.harvard.edu	Lyman 334	384-9487
---------------	------------------------------	-----------	----------

**TEACHING FELLOWS**

Tongyan Lin	tongyan@physics.harvard.edu	Jeff. 451 CFA office	384-9349 496-7872
Rudro Biswas	rrbiswas@physics.harvard.edu	Lyman 336	495-4349

**LAB SUPEVISOR**

Rob Hart	hart@physics.harvard.edu	SC 303	495-2039
----------	--------------------------	--------	----------

**LAB TEACHING FELLOW**

Tony Orth	aorth@fas.harvard.edu	Maxwell Dworkin 110A	495-2560
-----------	-----------------------	----------------------------	----------

**STAFF ASSISTANT**

Barbara Drauschke	drauschk@physics.harvard.edu	Jeff. 348	495-4320
-------------------	------------------------------	-----------	----------

**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*, 6<sup>th</sup> ed., by H. J. Pain

*Vibrations and Waves*, by A. P. French

*Optics*, 4<sup>th</sup> 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, 1:30-3pm, Science Center D.

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 of this course will consist of six labs. Four will be in-class, one will be on your own time in the computer lab, and one will be on your own time in your dorm, although in-class help sessions will be available. The first lab will be in-class during the week of September 6-10.

## **SECTIONS**

Sections are taught by the TFs, Tongyan Lin and Rudro Biswas.

Sections will be held on Tuesday/Wednesday afternoon/evening. Exact times and locations to be announced. Sections will begin the week of September 6-10. Attendance is strongly advised.

## **WEBSITE**

Course website: <http://isites.harvard.edu/k73293>

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 Friday at 5pm 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 11<sup>th</sup> 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.

## **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 Thursday, September 30 and Tuesday, November 9. The final will be Thursday, December 16.

## **GRADING**

Problem Sets 32% (for 10), Labs 18% (for 6), Midterms 10% each, Final exam 30%.

Tentative Schedule (updated Sept 1, 2010)

	Date	Lecture topic	Homework	Lab
1	Thurs, 9/2	simple harmonic oscillators, Fourier transforms		
2	Tues, 9/7	math: complex numbers, differential equations, damped oscillator		
3	Thurs, 9/9	inhomogenous diff. eqns, forced oscillator, energy, resonance	HW#1: due Fri, 9/10	single pendulum
4	Tues, 9/14	coupled oscillators, Georgi symmetry		
5	Thurs, 9/16	Georgi symmetry continued, continuous wave eqn	HW#2: due Fri, 9/17	coupled pendulum
6	Tues, 9/21	dispersion relations, phase & group velocities		
7	Thurs, 9/23	Fourier analysis	HW#3: due Fri, 9/24	Fourier series
8	Tues, 9/28	wrap-up & review		
	Thurs, 9/30	<b>MIDTERM EXAM</b> (covers through lecture #7, pset #3, lab #3)		
9	Tues, 10/5	sound waves & ears		
10	Thurs, 10/7	doppler effect, shock waves	HW#4: due Fri, 10/8	
11	Tues, 10/12	musical instruments, standing waves, waves on strings, reflections		
12	Thurs, 10/14	boundaries, higher dimensions	HW#5: due Fri, 10/15	sound & music
13	Tues, 10/19	LC transmission line		
14	Thurs, 10/21	E&M waves	HW#6: due Fri, 10/22	
15	Tues, 10/26	Reflection & refraction		
	Thurs, 10/28	Reflectivity, Brewster's angle	HW#7: due Fri, 10/29	polarization
16	Tues, 11/2	Accelerating charges		
17	Thurs, 11/4	E&M waves in matter	HW#8: due Fri, 11/5	
	Tues, 11/9	<b>MIDTERM EXAM</b> (covers through lecture #15, pset #8)		
18	Thurs, 11/11	<i>Veteran's Day</i>		
	Tues, 11/16	Interference & diffraction		
19	Thurs, 11/18	Geometrical optics	HW#9: due Fri, 11/19	interferometer
20	Tues, 11/23	Microscopes, Telescopes		
21	Thurs, 11/25	<i>Thanksgiving</i>		
22	Tues, 11/30	Applications, current research		
23	Thurs, 12/2	Quantum mechanics	HW#10: due Fri, 12/3	
	Tues, 12/7	review session		
	Thurs, 12/9	review session	HW#11: due Fri, 12/10	
	Thurs, 12/16	<b>FINAL EXAM</b>		