PHYSICS 300 – – SPRING 2007
Waves and Optics

Lecture: MWF 10:40 - 11:35 Rm: PP-130 Lecturer: Harold Metcalf - S225 hmetcalf@notes.cc.sunysb.edu 632-8185 or 8100	TA: Jonathan Kaufman Room: S-140 jkaufman@grad.physics.sunysb.edu 632-8184 Lab: Mon 1:00 - 3:10 and Wed 12:40 - 2:50 Rm: A-124 except 5 & 7 Feb where it's A-119

Texts: French [T], *Vibrations and Waves*, Norton; Fowles [F], *Modern Optics*, Dover

SUBJECT TO CHANGE (as of February 2, 2007)

Week # Date of Monday	Monday	Wednesday	Friday	Lab	Reading	Homework
I 1/22	Complex Notation	Superposition	Harmonic Motion With Decay	none	T 3 - 39	T1: 1, 2, 5, 6 T2: 1-4
II 1/29	Driven Oscillators & Resonance	Coupled Oscillators and Normal Modes	Driven Coupled Oscillators	Resonance (Vibrating Steel Spring)	T 40 - 91, 96 - 107	T3: 1, 2, 3, 6, 9 T4: 1, 3, 8ab, 10, 13
III 2/5	Waves as normal modes	More about Waves Fourier Ideas	Travelling Waves Superposition Sound and Music	Coupled Oscillators	T 118 - 158	T5: 1, 6, 7, 9, 10
IV 2/12	Music and Harmony	Wave Packets Phase and Group Velocity	Brillouin Zones Energy and Momentum	Waves in One Dimension (Speed of Sound)	T 160 - 216	T6: 1, 2, 3, 9 T7: 1, 2, 3, 5, 8
V 2/19	Electromagnetic Wave Equation Paraxial sol'ns	Fields and Waves Polarization	**FIRST HOUR EXAM** (in class)	Waves in Periodic Structures	T 216 - 265	T7: 12, 15, 19 T8: 3, 4
VI 2/26	Jones Matrices	Interference Interferometers	Michelson in great detail	Polarization	F 2 - 56	F1: 1, 2, 3, 5, 6, 11 F2: 2, 5, 8, 10, 12
VII 3/5	Fabry-Perot in great detail	Fourier Spect. Thin Films	Diffraction ripple tank	Michelson Interferometer	F 58 - 103	F3: 2, 3, 6, 7 F4: 1, 7, 9
VIII 3/12	Fresnel zones Arago's spot	Ray Optics Matrices	Optical Instruments Microscope Telescope	Fabry-Perot Interferometer	F 112 - 147	F5: 7, 8, 12, 13 **read** T 288 - 294
IX 3/19	Optical Instruments Micro/Tele/scope reprise	Magnifying Glass Aberrations	**SECOND HOUR EXAM**	Diffraction	F 294 - 305 handout	F10: 1, 3*, 4 * should be: Prove Eq. 10.3 not 10.13
X 3/26	Paraxial Wave Eq.	Gaussian Beam Optics	More Gaussian Beam Optics	Optical Instruments	handout	F 10: 1, 2, 3, 4, 7* (* see many texts) handout 1, 3
	SPRING	**VACATION –**	**YIPPEE ! !**			
XI 4/9	Nonlinear Optics Freq. Doubling	Phase Matching Self Phase Mod. Freq. Chain	Detectors read handout	Gaussian beam optics	F 275 - 280	F 9: 6
XII 4/16	deB. Waves, Bohr View	Waveguides and Fibers	Lasers!	Laser Speckle	F 195 - 199 217 - 233	F 8: 1, 2, 3
XIII 4/23	Lasers! Locking Schemes	Review for Exam	**THIRD HOUR EXAM**	Make up missed labs		
XIV 4/30	human vision	human vision	TBA			

Tentatively - - No Final Exam

Maybe a Term Paper

General Procedures for PHY-300 - Spring 2007

This course is a sequel to your introductory sequence of two or three courses. The purpose of its first part is to amplify and expand on the ideas of vibrations and resonance that were introduced in your previous courses. This topic is chosen because it is so very fundamental to all the physics that follows in your future education. Perhaps the most important example is the physics of wave motion which follows naturally from vibrations and resonance. Understanding wave motion is vital for several areas of advanced physics, including optics and quantum mechanics. Thus the second part of the course is devoted to optics, and culminates with one of the most spectacular applications of modern optics, the invention of the laser. Of course, you need to know *some* quantum mechanics for this, and it is also introduced where needed, in the context of what you have already been taught about waves.

The assignments for each week constitute both reading and homework problems, and are designated the rightmost columns of the assignment sheet in French [T] and Fowles [F]. In addition to the contents of each chapter, ALL the problems are REQUIRED reading. Furthermore, the problems that are not assigned are also *not* forbidden! You can always gain some new insights and understanding by working extra problems. If you choose to simply do the assignments and keep up with the reading, you may very well earn an honor grade, but the true rewards come from deep investigation stimulated by a healthy skepticism. We can't "assign" enthusiasm!

- **CLASSES** We are scheduled to meet for five hours each week. Three hours will be devoted to class where the main material of the course will be presented. Your ability to understand many of these classes will depend on your familiarity with the subjects, so come prepared. This means do the reading **ahead** of time. The lab periods are each two hours and are held in Rm. A-124.

- **GRADES** The grades will be based on credits given approximately as follows: 20% for lab, 20% for homework, 20% for each of three hour exams. There is no final exam, but you **MUST** pass the lab or you will NOT pass the course. Be aware that these percentages are both flexible *and* subject to change. It's **your** responsibility to be aware of announced changes.

  1. **Laboratory** You will be required to perform the experiments described in the lab manual to be distributed in class. Before you can begin these experiments, you must submit a writeup as you enter the lab - nobody can perform an experiment without submitting the writeup **FIRST** for Jonathan's signature. It will be loose sheets to be stapled into your lab notebook later (Jonathan will be grading the previous experiment's report in your lab notebooks). This writeup must describe the physical ideas you plan to explore, the way you will go about exploring them, and your anticipated results. It need not be more than a page or two, but is not length limited either.

     Your lab notebook should have a blank page where you will staple in the preliminary writeup, and this should be followed by your measurements and a description of them, including your estimates of the errors. Then you need to analyze your results and compare with your expectations in your writeup. The lab book with both parts must be submitted in class on the Friday following Wednesday's lab. That is, you have just under two full days to complete it, so you need to be well-prepared beforehand. The combination of preliminary writeup and lab writeup will constitute your lab report and will be the basis for grading. The grade will **NOT** depend on whether you got agreement, but only upon how well you perform your work.
  2. **Homework** The homework will be collected in class on Monday following the week in which it is assigned. It will be graded, and late papers will be severely penalized. You may work together on solving the problems, but cannot hand in the same solutions. We have a small class, and we'll be on the watch for this kind of problem.
  3. **Exams** There will be three one-hour exams. Exams are "closed book", but formulae will be given. We are allowed to ask anything that is in the reading, the lectures, the homework problems, and the labs. You are always responsible for *all* the previous material in the course. Information about a possible term paper will be distributed later.

SPECIAL NEEDS If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Disability Support Services, ECC (Educational Communications Center) Building, room 128, (631) 632-6748. They will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential. Students requiring emergency evacuation are encouraged to discuss their needs with their professors and Disability Support Services. For procedures and information, go to the following web site: http://www.ehs.sunysb.edu/fire/disabilities/asp