PHYSICS 300 – – SPRING 2022
Vibrations, Waves and Optics

Lecture: MWF 11:45-12:40
Rm: Remote from PP-118 - zoom
Lecturer: Harold Metcalf - S225
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TA: Eric Johnson eric.t.johnson@stonybrook.edu
TA: Myles Silfies myles.silfies@stonybrook.edu
Lab: Mon. 2:40; Tues. 3:00, Wed. 8:30, 2:40. Rm: A-124

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

FINAL VERSION (as of December 14, 2021)

Week # Date of Monday	Monday	Wednesday	Friday	Lab	Reading	Homework
I 1/24	Complex Notation	Superposition, Beats	Harmonic Motion With Decay	none	T 3 - 39	T1: 1, 2, 5, 6 T2: 1-4
II 1/31	Driven Oscillators and Resonance	Coupled Oscillators and Normal Modes	Driven Coupled Oscillators	Resonance (Vibrating Steel Spring)	T 40 - 91 96 - 107, 118-134	T3: 1, 2, 3, 4, 6, 9 T4: 1, 3, 8ab, 10, 13
III 2/7	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
	Everything below here is just a space holder. Subject to change.					
IV 2/14	Music, Timbre Musical Instruments	Phase and Group Velocity Wave Packets	**EXAM**	Speed of Sound	T 160 - 265	T6: 1, 2, 3, 9 T7: 1, 2, 3, 5, 8, 12, 15, 19
V 2/21	Waves on Lattices	Electromagnetic Wave Equation	Polarization Jones Matrices	Transmission Line	F 2 - 56	: T8: 3, 4 F1: 1, 2, 3, 5, 6, 11 F2: 2, 5, 8, 10, 12
VI 2/28	More on Jones Matrices	Michelson Int. Fourier Transform Spectroscopy	More on Michelson Intro to Fabry-Perot	Polarization	F 58 - 103	F3: 2, 3, 6, 7 F4: 1, 7, 9
VII 3/7	Fabry-Perot in great detail	Diffraction; Ripple Tank Loops	Fresnel zones Arago's spot	Michelson & Interferometer	F 112 - 147	F5: 7, 8, 12, 13 **read** T 288 - 294
3/14	**SPRING VACATION – YIPPEE ! !**					
VIII 3/21	Refraction Ray Optics Ray Vectors	Thin Lenses Curved Surfaces Ray Matrices	**EXAM**	Fabry-Perot Interferometer	F 294 - 305 handout	F10: 1, 3*, 4 * should be: Prove Eq. 10.3 not 10.13
IX 3/28	Magnifying Glass Optical Instruments Tele- & Micro scope	Lens Aberrations Seidel Sums	Dispersion & Chromat Aberration; Fibers	Diffraction	TBA	TBA
X 4/4	Paraxial Wave Eq. Gaussian Beam Optics	More Gaussian Beam Optics	Gaussian Optics yet again Fabry-Perot again	Optical Instruments	Milonni & Eberly handout	F 10: 2, 7* (* see many texts)
XI 4/11	Gaussian Beams & Ray Matrices	Nonlinear Optics Phase Matching	Start Lasers Einstein A & B HeNe	Gaussian Beam Optics	F 275 - 280 169 - 180	F 9: 6
XII 4/18	Laser Modes Lamb Dip	Molecular Lasers! Bay,Luther,White	Solid State Lasers Ti:Sapph & Diodes	Laser Speckle	F 195 - 199 217 - 233	F 8: 1, 2, 3
XIII 4/25	Modulation Sat. Spec	Mode Locking Freq. Comb	**EXAM**	Make up Missed Labs		
XIV 5/2	Symposium on human vision	Symposium on human vision	Symposium on human vision	none		

General Procedures for PHY-300 - Spring 2021

(Please note - this syllabus is a work in progress)

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 that 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 from the assigned texts, and are designated in the two rightmost columns of the assignment sheet as 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 our remote class where the main material of the course will be presented at the zoom link to be provided. 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.

- **GRADES** The grades will be based on credit given approximately as follows: 25% for lab, 25% for homework, 50% for the short quizzes that will be given almost every week. There is no final exam (tentatively), 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 are expected to perform all assigned experiments described in the lab writeups on Blackboard with sufficient grades to pass the lab. The two hour lab periods will be held in Rm. A-124.

     Prior to your lab period you should read the writeup carefully to fully understand the experiment to be done. Before you can begin each experiment, you must provide a preliminary discussion for the TA's inspection and approval, and it will count at least 20% of your eventual lab grade (maybe more, TBA). It should NOT just repeat the material in the lab writeup, but should contain enough information so that we can see that you have studied and understood the contents of the material. It should be submitted in Blackboard as one of the two documents for the assignment, at least one hour before your lab period, according to instructions from your TA. It is to be prepared well before the lab period, not during its early minutes.

     For your lab report you will need to analyze your data and write a conclusion that should summarize your results and compare with previous expectations. The report, *i.e.,* how well you perform and describe on your work, will be the basis for your grade, which will NOT depend on whether you got agreement. This will be the second document and must also be submitted before you begin the next lab.

  2. **Homework** The homework will be submitted via Blackboard on the Wednesday following the assigned week. It will be graded, and late assignments will be penalized. You may work together on the problems, but cannot submit the same solutions. We have a small class, and we'll be on the watch for this kind of problem. Homework should be submitted to the lecture site, NOT the TA's.

  3. **Quizzes** These obviously cannot be "closed book" but you are advised to spend your short time thinking about the question and not flipping through books and notes, or on-line searching. We may ask anything that is in the reading, the lectures, the homework problems, and the labs. You are always responsible for *all* the previous course material. If you write these out and then photograph them, use an app like camscanner to straighten out your work before submission. These are to be submitted on the lecture page as well as the homework.

SPECIAL NEEDS If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact the Student Accessibility Support Center (SASC), Stony Brook Union Suite 107, (631) 632-6748, or at sasc@Stonybrook.edu. All information and documentation is confidential. They will determine with you what accommodations are necessary and appropriate. Students requiring emergency evacuation are encouraged to discuss their needs with their professors and SASC. For procedures and information, go to the following web site: https://www.stonybrook.edu/sasc/