Prof. Raghuveer Parthasarathy
Dept. of Physics; Univ. of Oregon
Winter 2008

Physics 352 – Foundations of Physics II (Optics + Statistical Mechanics)

SYLLABUS

INSTRUCTOR:
Professor Raghuveer Parthasarathy
(**Par**-tha-**sa**-ra-thī)
174 Willamette Hall
raghu@uoregon.edu

LECTURES
MWF 11.00-11.50am, 30 Pacific Hall
Attendance is not required, but is strongly recommended. Note that class participation forms part of your grade – see below.

OFFICE HOURS
174 Willamette
W 11-12, F 1:30-2:30 pm, or by appointment.
You're strongly encouraged to come to office hours, either with specific questions related to the course, or just to chat about physics, science, and other general topics.

TEACHING ASSISTANT (GTF)
Yan Sang – office hours *TBA*.

COURSE WEB SITE
http://physics.uoregon.edu/~raghu/Physics352Winter2008.html

TOPICS AND AIMS

Optics. Building from Physics 351, we'll briefly explore elementary optics. Optics is a vast topic, and is both very old and very modern – the last decade or two especially has seen a flurry of fascinating developments in microscopy and in atomic optics. If you're interested in learning more, consider taking Phys. 424/425.

Statistical Mechanics. The rest of Physics 352 and all of Phys. 353 will deal with Statistical Mechanics and Thermodynamics – in my opinion the most important and interesting area of Physics! Statistical Mechanics deals with the properties of many-body systems – gases in stars, electrons in a metal, molecules in a soap film – searching for "simple" properties, such as Temperature, that emerge from what may seem to be exceptionally complex systems.

Broader Aims. We hope to develop analytical reasoning and problem solving skills. The problems encountered in this course are less transparent than those in "introductory" courses, and require, like problems in "real-life" science and engineering, deeper thinking skills that our exercises will help practice developing. A still broader aim of the entire Physics 351 series is to enable students to understand some of the issues and excitement of contemporary scientific research – we'll apply this directly in the "Colloquium" exercise for the course. You'll hopefully find, having explored optics and statistical mechanics, that doorways to a

large fraction of current-day science are open to you.

TEXTBOOKS

Optics. *No textbook.* I have not assigned a required textbook, so as not to force you to buy an expensive book for just a few weeks' use in the course.

I have, however, written notes that cover most of the material we will examine; I will distribute these.

I have placed two books on reserve in the Science Library:

- *Optics* by Eugene Hecht (4th edition, 2002) – a "standard" optics textbook. It's quite good, though wordy and expensive. I recommend looking at it.
- *Introduction to classical and modern optics* by Jurgen R. Meyer-Arendt (1995).

If you feel like you need an optics book of your own and only want to spend $10:

- *Inroduction to Modern Optics* by Grant R. Fowles (2nd edition, paperback, Dover, 1989). Not great, but cheap.

Dan Steck has written an extensive set of notes for the optics class he teaches, which can be found at:
http://atomoptics.uoregon.edu/~dsteck/teaching/optics/.
Also, BYU has a publicly available optics textbook at: *http://optics.byu.edu/textbook.aspx* .

Statistical Mechanics.

- *Thermal Physics*, by Charles Kittel and Herbert Kroemer (2nd ed.). This book will also be used in Phys. 353. The text is <u>required</u>, and should be available in the bookstore, and on reserve in the Science Library. Kroemer, by the way, won the Nobel Prize in Physics in 2000 for work on semiconductors.

Also <u>on reserve</u>:

- *Molecular Driving Forces*, by Ken Dill and Sarina Bromberg (2003) – Inspired by increasing applications of statistical mechanics to biological systems, this remarkable book teaches stat. mech. focusing almost exclusively on applications in biology and chemistry.

GRADING

Homework – 30%;
Class Participation – 6%;
Midterm Exam 1 – 15%;
Midterm Exam 2 (a quiz) – 6%;
Colloquium Report – 3%;
Final Exam – 40%

CLASS PARTICIPATION

To improve engagement with the course material, and to assess student understanding, in-class participation will be a graded part of the course. This consists of answering questions in class and also in *asking* them.

HOMEWORK

There will be weekly problem sets – you may hand them in at the start of lecture, deliver them to the teaching assistant, place them in my Physics Department mailbox or a box outside my office). Solutions will be posted on the web page. Except by prior arrangement, <u>late homework will only be accepted until 24 hours after the normal deadline, and will automatically lose 50% of its score</u>.

The problem sets are very important – most of what you learn in this course will be absorbed as you work on them. Think about the derivation of every concept and equation. Review your lecture notes. Feel free to chat with others, but of course, <u>the work you submit should be your own</u>. I encourage you not to talk too much with others, but rather to mull things over in your own mind and let ideas germinate – with practice,

you'll find that your ability to think about physical concepts improves. Of course, I recommend starting the homework assignments, or at least reading them, well in advance.

Another suggestion: ***Sleep!*** *Numerous studies show that sleeping helps both memory and understanding. Moreover, I myself often puzzle over questions, go to sleep, and find the answer remarkably springing to mind the next morning.*

COLLOQUIA

The Physics Department colloquia are Thursdays at 4pm in 100 Willamette Hall. *I encourage you to attend – even if a lot goes over your head, these seminars will provide a flavor of contemporary issues in physics. Each colloquium is preceded by coffee & cookies, which all attendees are welcome to.* ***Note that you'll have to attend a seminar at least once! See below.***

COLLOQUIUM REPORT

Write a short (around 500 Words) report about one of the following Physics Colloquia: Jan. 17, Jan. 24, Feb. 14, Feb. 21, Feb. 28, Mar. 6, Mar. 13. (See the Colloquium web site – linked from the course web page – for details.) You **are not** expected to understand the entire seminar. You should be able to explain the question being pursued and, to some extent, the methods employed and the results of the investigation. Note that some talks are clearer than others, so I recommend attending several to find one that you are comfortable writing about

Organize your report into sections that introduce the issue (and the speaker), explain the methods, and discuss the results / conclusions.

If, for scheduling reasons, you are unable to attend any colloquia, see me – I can state other seminars on campus that you can attend.

The report will be due on the last day of class, though you can certainly turn it in earlier.

STUDENTS WITH DISABILITIES: If there are aspects of the instruction or design of this course that result in barriers to your inclusion, please notify me as soon as possible. You are also welcome to contact Disability Services in 164 Oregon Hall, 346-1155.