

Physics 532/822 – Fundamentals of Photonics (Spring 2005)

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Phys 532/822 will explain the fundamental physics of lasers and some of the optical techniques used with laser beams. It is intended to provide a practical basis for further work in the field. As lasers are used in a variety of disciplines, the course will be directed towards students from a broad range of backgrounds.

The division between 532 and 822 is meant to handle the variation in backgrounds. Physics graduate students are suggested to enroll in 822, and other students in 532. Please inform me with exceptions to this policy. Students in 822 will be given some additional homework problems, and will be graded on a separate curve.

Class Hours: MWF 10:00-10:50 AM, Physics 313

Office Hours: Wednesday 2-4 PM, or by appointment, or just drop by

Text: Saleh and Teich — *Fundamentals of Photonics*

Supplemental texts: (on reserve in Physics Library)

Yariv — *Quantum Electronics* (general photonics, more advanced)

Seigman — *Lasers* (good physical explanations, also advanced topics)

Boyd — *Nonlinear Optics* (more detailed)

Hecht — *Optics* (optics fundamentals)

Prerequisites: Physics 531 Optics, or equivalent.

Homework will be due weekly at class on Fridays, while new assignments are handed out.

Webpage: <http://galileo.phys.virginia.edu/classes/532.wl6t.spring05/Homepage.html>

Grading:

Homework 50%

Your lowest homework score will be dropped.

Midterm and final exam 50%

Your better exam will be weighted 30%, and your worse one 20%

Exams: There will be a midterm and a final exam. The midterm will be take-home, and will be held over the week of March 14-18. The final will be open book, and held in class on Monday, May 9 from 9:00AM to 12:00PM.

Tentative Course Outline:

- I. Physical Optics
ray matrices, Gaussian beams, and optical cavities.
- II. Light and Atoms
interactions of light and matter, spontaneous emission, and line shape.
- III. Lasers
lasing mechanism, laser behavior, and types of lasers.
- IV. Modulation Techniques
electro-optic, acousto-optic.
- V. Nonlinear Optics
phase matching, harmonic generation, and optical parametric amplification.
- VI. Pulsed Lasers
Q-switch, mode-locking
- V. Fiber Optics (if time is allowed)

(refer to the reading topics on class webpage for details)