

**PHO 240 Introduction to Lasers 4 credits  
Fall 2008**

**Course Description**

This course is designed to introduce you to the basic principles of laser physics and to provide you with a working knowledge of the various types of laser systems and their applications. Topics will include: properties of laser light, basic laser principles including stimulated and spontaneous emission, modification of the laser output, laser safety, and an exposition of the various laser types and their application to industry. Non-laser light sources will also be covered, and their operation and characteristics will be compared and contrasted to laser sources. Course lectures will be supplemented with instructor handouts and video demonstrations of laser principles. There is a required laboratory course for students earning the LFOT degree or certificate.

**Pre requisites:** TCN 105; MAT 186; PHO 101; EET 105/106; or permission of the instructor

Texts

- Instructors Notes and Handouts (There is no required text)
- Optional: Hitz et al, Introduction to Laser Technology, ed 3 This book was written for company training and has a lot of nice analogies. It's somewhat dated, but easy to read and understand.
- Internet research- the best way to get up-to-date knowledge.
- LIGHT: Introduction to Optics and Photonics (Donnelly and Massa) as needed.

Attendance Policy

Students are expected to attend all classes, to be on time and to be prepared. Excessive absences will have a deleterious effect upon grades. If you are taking the course online, you are expected to keep up with the course calendar.

Exams, Homework, Paper

After each topic there will be a short quiz to check your understanding. There will also be two more comprehensive tests around the middle and end of the course. The details will be available later.

A paper describing a specific laser, its operation and applications, has always been a required part of this course. This semester the project will be posted on the web so everyone can share the information. The exact format will be determined by mid semester, but in the meantime, you can be thinking about your "favorite" laser for this project.

Homework will be assigned on a regular basis but will not be collected.

Students with Disabilities

*If you are a student with a disability and believe you will need accommodations for this class, it is your responsibility to contact the Disabilities Counseling Services at 383-5240. To avoid any delay in the receipt of accommodations, you should contact the counselor as soon as possible. Please note that I cannot provide accommodations based upon disability until I have received an accommodation letter from the Disabilities Counselor.*

**Course Topics**

- Introduction and Physics of Light Sources and Lasers
  - energy states
  - non-laser sources (Ch 3 in Donnelly and Massa)
  - absorption and gain
- Basic Principles of Operation
  - Parts of a laser
  - Laser operation/loop gain
  - Cavity configurations
- Laser Characteristics
  - wavelength: cavity modes, linewidth, longitudinal modes
  - TEM modes/modes effects
  - Gaussian beam characteristics
  - divergence/focused spot size
  - coherence (wave optics review)
  - polarization (wave optics review)
  - CW/pulse (pulse calculations)
- Laser Accessories
  - creating short pulses: Q switch, cavity dump, modelock
  - passive components (windows, filters, splitters, retarders, tuning and wavelength selection, etc)
  - active components (e/o and a/o switches, optical amplifiers, modulators, etc)
  - non-linear optics (harmonic generators, opos, raman shifter)
  - Using PowerPoint, as needed
  - Types of lasers and applications – student projects

**Grade Breakdown**

Two Exams	40%
Paper/Presentation	20%
Quizzes	40%
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	100%