

PHO 241 Introduction to Lasers 3 credits
PHO 242 Introduction to Lasers Lab 1 credit
Fall 2011

Course Description

This course is designed to introduce you to the basic principles of laser physics and technology 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. Applications such as laser manufacturing will be included. 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: PHO 101; or permission of the instructor

Co Requisites: TCN 105 and MAT 137

Texts

- Instructors Notes and Handouts (There is no required text)
- An online textbook: *The Laser Adventure*, <http://web.phys.ksu.edu/vqm/laserweb/>
- **Recommended, but not required:** Hitz, Ewing and Hecht, *Introduction to Laser Technology, ed 3*. This book was written for company training and has a lot of nice, easy to understand analogies. It's somewhat dated, but easy to read and understand- a good technician reference.
- Internet research- the best way to get up-to-date knowledge.
- *LIGHT: Introduction to Optics and Photonics* (Donnelly and Massa) for laser physics and types of lasers.

Attendance Policy

Students are expected to attend all classes, be on time and be prepared. Obviously, if you miss classes you will be at a disadvantage. **It is up to you to find out what you missed** and make up assignments. Note that most materials are online in the Blackboard Vista course shell.

Exams, Homework

There will be two hourly tests and a cumulative final exam. A sheet of equations will be allowed for each exam. *Makeup exams will only be given in the case of serious illness or other bona-fide excuse. Students will be expected to have appropriate documentation to schedule a make-up exam.* Note that the lab is a separate grade from the lecture grade. Some labs will be problem based learning (PBL) exercises; all required parts of these will be graded.

Homework will be assigned on a regular basis but will not be collected. Tests are based on homework problems so be sure you understand all the assigned problems.

Job Shadow

We try to arrange a one-day job shadow at a laser-related industry for each student in the course. This is your chance to find out what's new in the industry, what characteristics are important to employers, and what technicians do on the job. The job shadow results in a short paper detailing your experience.

COMMUNICATIONS

Class communications are by email. Please check your email frequently. No I will not send you a text message; email is still industry's method of communication so get used to it. While you're at it, be sure you have a professional email address. And speaking of communications, **turn off cell phones and pagers during class. Multitasking doesn't work. Really.**

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.

TOPICS

Introduction and Physics of Light Sources and Lasers

- energy states
- absorption and gain

Basic Principles of Operation

- Parts of a laser
- Laser operation/loop gain
- Cavity configurations

Test #1

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, a/o switches, optical amplifiers, modulators, etc)
- non-linear optics (harmonic generators, opos, raman shifter)

Test #2

- Types of lasers and applications

Review and Final Exam (cumulative)

Grade Breakdown

Three Exams	60%
Job shadow report	10%
Other stuff*	30%

*Other stuff includes concept maps and reports from any PBL Challenges, occasionally collected homework, or quizzes if I detect that homework is not being done.