Three Rivers Community College

**PHO 241 Introduction to Lasers 3 credits**

**Spring 2012**

## 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)
- *LIGHT –Introduction to Optics and Photonics* (Donnelly and Massa) – we'll use a few chapters
- 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, Paper: how the course works

The course will be divided into 9 modules, each lasting about a week. Some more complex modules will be two weeks. Each module will begin with a list of outcomes (what you need to learn) and end with an online quiz. The topic of the module will be explored through reading, online applets and simulations, discussion, examples and homework problems. Homework will be assigned on a regular basis but will not be collected. Each module will end with a quiz. Quizzes are based on homework problems so be sure you understand all the assigned problems.

The final assignment will be a short presentation (8-10 slides) on a specific laser. Details of the assignment will be provided. The presentations will be shared with the class including online members.

Three Rivers Community College

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 addresss. 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

| MODULE | Topics |
|---|---|
| Sources and Measurement of Light | Introduction and Physics of Light Sources and Lasers |
| | • energy states |
| | • Absorption, Spontaneous and Stimulated Emission |
| | • Radiometry and Photometry |
| | • Some non-laser sources |
| Laser Physics | Basic Principles of Operation |
| | • Absorption and gain |
| | • Parts of a laser |
| | • loop gain |
| | • Cavity configurations |
| Laser Output Characteristics I | Longitudinal (wavelength) |
| | • wavelength: cavity modes, linewidth, longitudinal modes |
| Laser Output Characteristics II | Spatial |
| | • TEM modes/modes effects |
| | • Gaussian beam characteristics |
| | • divergence/focused spot size |
| Laser Output Characteristics IIII | Coherence |
| Laser Output Characteristics IV | Polarization |
| Laser Output Characteristics V | CW/pulse (pulse calculations) |
| | creating short pulses: Q switch, cavity dump, modelock |
| Laser Accessories | 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) |
| Types of lasers and applications | |
| | |

Grade Breakdown

| | |
|---|---|
| Quizzes (one will be dropped) | 80 % |
| Laser presentation | 20 % |

Note that the lab is a separate grade from the course.