Three Rivers Community College

PHO 242 Introduction to Lasers Lab 1 credit
Fall 2011

Course Description

This is a required laboratory course to accompany PHO 241 for students earning the LFOT degree or certificate. Labs will include experiments in basic laser physics, laser applications and measurement of laser output parameters. Some labs will be problem based learning (PBL) exercises.

Pre requisites: PHO 101; or permission of the instructor
Co Requisites: PHO 241; TCN 105 and MAT 137

Texts

- Instructors Notes and Handouts (There is no required text)
- Internet research- this is especially important for understanding laser instrumentation

Attendance Policy

Students are expected to attend all labs, be on time and be prepared. If you miss a lab you will be responsible for making up the work at a time that we are both available.

Lab Reports

Some labs will have brief written conclusions, others will be more formal. PBL exercises will require concept maps and reports. In some cases group reports will be accepted but you will also be responsible for turning in some individual reports on your own.

LATE WORK IS A REAL PAIN!! To minimize (my) pain, points will be deducted for work turned in past the due date. DO NOT plan to turn everything in on the last day; it won't be accepted.

TOPICS

Labs will be chosen from the list below. Due to limited instrumentation, groups will rotate among some of the experiments over a period of several weeks.

Basic physics		**Outcomes/students will explain, perform**
absorption coefficient	Beer's law, dependence of absorption on thickness and material	Power measurement, graph and interpret exponential curve, explain importance of medium absorption (and gain) to laser operation
photoelectric effect	Use PE to determine Planck's constant	experimental methods (source/meter issues, zeroing meter), interpret graph and use slope to find unknown (h)
emission and absorption	Gas atomic emission and absorption by solids	Explain emission lines (gas) and absorption band (solid laser rod)

Laser output characteristics		**Outcomes/students will explain, perform**
Brewster's angle	Measure %R for two polarizations	Dependence of reflectance on polarization and implications for material processing
Spiricon Laser Beam Analyzer	Measure beam divergence	Use SLBA to measure beam spatial parameters
OSA	Measure diode laser central wavelength and mode spacing	Use OSA to measure wavelength and power
Fabry-Perot Interferometer	Set up the FP interferometer and measure HeNe mode spacing.	How the FP interferometer is used to measure modes of a laser
Gaussian Beams (fiber probe)	Use an optical fiber to map a Gaussian beam profile	Gaussian beam profile, opto-mech: mounting fiber on translation stage
pulsed lasers	Measure pulse width and height and calculate energy and duty cycle	Use detector with oscilloscope, calibration of detector with power meter
Coherence length	Use Michelson Interferometer to measure coherence length	Importance of coherence length to interference phenomena
Fiber Laser	Measure the effect of changing pump power and output coupler ratio on laser output	Dependence of output power on energy input and feedback
Alignment practice		**Outcomes/students will explain, perform**
Spatial filter	alignment of pinhole	Remove optical noise from HeNe beam
Expander/collimator Zygo lab II	Autocollimation/collimation tester Alignment with beam splitter	Telescopes to expand or shrink beams Hand skills
Mach Zehnder Interferometer		Hand skills
Twyman Green Interferometer		Hand skills
Applications		
Bar code scanner	Read simulated bar code on rotating can	Alignment of source, object, detector; use of oscilloscope
Optical Image Processing	Build and experiment with a 4F optical image processing set up;	Alignment ; Study optical Fourier transforms and filters
Laser Material Processing	Effects of focal length, speed, power, frequency on engraving quality	