Puerto Rico Photonics Institute
UNIVERSIDAD METROPOLITANA

LABORATORY CONTENT

CERTIFICATE IN PHOTONICS & LASERS TECHNICAL SPECIALIST

OPSC 102 – LASER SYSTEMS & APPLICATIONS I

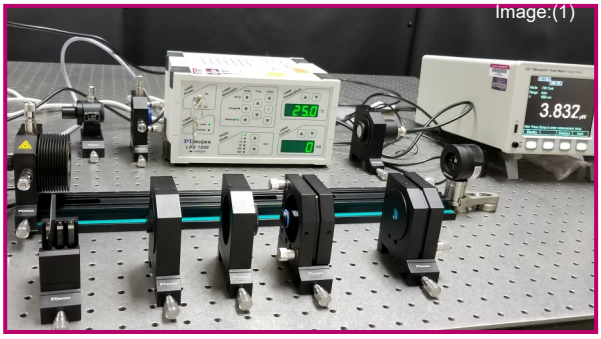
This first Laser Systems and Applications course introduce the student to the theory and practice of CW and pulsed lasers. At the end of the course, the student will understand the principles of laser operation, safety guidelines, measurement of output beam characteristics, basic troubleshooting, and applications. This will allow the student to understand and operate lasers in research, commercial, and industrial settings, and will give him or her the skills to choose appropriate laser systems and the knowledge to setup and operate them.

Laser alignment

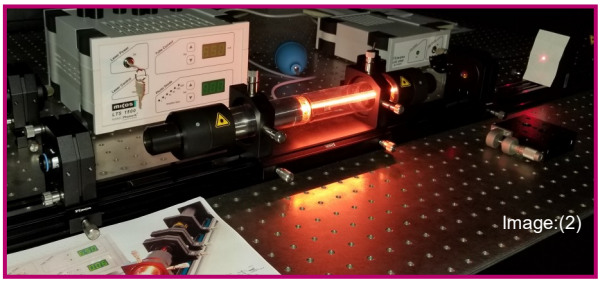
This laboratory introduces laser alignment and wavelength tuning in a HeNe laser, as directed by the PI MiCos(R) user manual. Students will learn the importance of establishing an optical axis and using it as a reference for the laser components. They will learn about how individual laser components should be centered and oriented with respect to that axis in order to ensure successful system alignment and optimum performance, which is crucial for other aspects of the laboratory and laser performance in general. The setup includes a HeNe laser tube and power supply, alignment laser, target, power measurement and cavity mirrors.

Basic Nd:YAG Laser Setup and Frequency doubling efficiency measurements

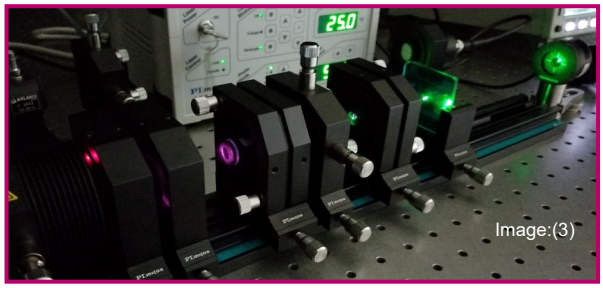
This laboratory requires students to set up, operate, and characterize a PI miCos® diode-pumped Nd:YAG laser, including frequency-doubling to the green. Primary directions for performing these tasks come from the PI miCos® user manual that accompanies this laser, and which forms the basis of the laboratory writeup. This laser demonstrates the architecture of common green laser pointers. It includes an 808 nm diode pump laser, collimating and focusing optics, Nd:YAG rod and cavity mirrors, frequency doubler, as well as both passive and active Q-switches.



Nd:YAG Laser materials



HeNe laser setup, alignment, and characterization



Nd:YAG laser setup, alignment, and characterization with Frequency Doubler

Laser tuning

In the first part of this laboratory, students will exchange the HeNe laser high-reflector mirror with a Littrow prism + mirror combination that enables wavelength tuning of the laser between several lines in the region of the main 632.8 nm emission. In the second part, they will re-install the high reflector mirror and add an intra-cavity Lyot filter, which also enables control of the laser wavelength. The setup includes the HeNe laser setup along with the Littrow prism-mirror combination and Lyot filter.

Q-Switching laser pulsewidth, pulse repetition frequency, and duty cycle measurements

Following setup and characterization of the Nd:YAG laser cavity and output, students will learn how to operate the laser in pulsed mode via Q-switching. They will set up two different Q-switching methods. First, they will use a saturable absorber material to induce passive Q-switching. Later, they will use a Pockels' Cell for active Q-switching.

They will measure and report on pulse width, power/energy, repetition rate/period, peak power, and duty cycle. The laboratory includes the Nd:YAG laser components plus the passive and active Q-switch devices and the active Q-switch driver.

This program is offered at the UMET Cupey campus, with laboratories at the PRPI labs in Barceloneta
Project New Horizons: Puerto Rico Lasers and Photonics Career Pathways
http://umet.suagm.edu/prpi | http://umet.suagm.edu/new_horizons

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