14/07/2019

Lab in Quantum Optics

86-367

Lecturer: Prof. Patrick SEBBAH

Date: 2019-2020 **semester:** A\B **weekly hours:** 4

Number of weeks: 14

Course WebSite: http://lemida.biu.ac.il/

Aim of the course:

This advanced laboratory course will expose the students to both the modern optical instrumentation and complex optical setups, including YAG-laser, laser diodes, acousto-optic modulator, optical network analyzers, optical fibers, lock-in amplifier.

Details of subjects to be covered:

This unique Lab course consists of advanced optic experiments based on modern optics, laser physics and modern instrumentation. During one semester, 5 pairs of students will be challenged with four different experiments:

1- Building a Nd:YAG laser (free-runnning mode, Q-switch mode, frequency doubling, …)
2- Acousto-Optic Modulation and fiber optics communication (coherent lock-in detection, fiber length determination, …)
3- Laser diodes characterization (temperature and current control, modes, threshold, …
4- Mode beating in a HeNe laser (Homodyne and heterodyne detection, RF spectrum analyzer, polarization…)

Unlike turnkey labs students have been used to in the past, here they will build their own setups from scratch with minimal instructions but well-defined objectives. This course is a major introduction to experimental optics, including basics techniques and fundamental experimental methods, a genuine springboard to future work in the labs. The course will start with a general introduction to the very basic concepts, tools and instruments used on the optical table (lenses, mounts, opto-mechanics, detection, oscilloscope, safety instructions, …).

Prerequisites:

Mathematics for Physics
Waves
Optics
Modern Optics and Lasers (86365 strongly recommended)

Course mandatories and Grading:

Before the first session, the students are requested to prepare the laboratory and master the related skills, including theoretical backgrounds and instrumentation.
During each session, the students will be tested on their knowledge of the fundamentals, their understanding of the phenomena and their familiarity with the instrumentation,
The student evaluation will also include their achievements, their interaction with the instructors and their involvement in the lab.
Each pair will submit a short report for each experiment, including a short theoretical presentation, their results, their conclusions. The reports are mandatory and part of the evaluation.

Bibliography:

A. E. Siegman, “Lasers”, University Science Books, 1986, revised.

Saleh & Teich, Fundamentals of photonics (Wiley, second edition, 2007)