



Course guides

32065 - AEOTB - Advanced Experimental Optical Techniques in Biology

Last modified: 13/05/2015

Unit in charge: Barcelona School of Telecommunications Engineering
Teaching unit: 893 - ICFO - Institute of Photonic Sciences.

Degree: DOCTORAL DEGREE IN PHOTONICS (Syllabus 2007). (Optional subject).
MASTER'S DEGREE IN PHOTONICS (Syllabus 2009). (Optional subject).
ERASMUS MUNDUS MASTER'S DEGREE IN PHOTONICS ENGINEERING, NANOPHOTONICS AND BIOPHOTONICS (Syllabus 2010). (Optional subject).

Academic year: 2015 **ECTS Credits:** 2.5 **Languages:** English

LECTURER

Coordinating lecturer: DMITRI PETROV

Others: NIEK VAN HULST
PABLO LOZA

TEACHING METHODOLOGY

Presencial teaching + activities

LEARNING OBJECTIVES OF THE SUBJECT

The course will be centred on several topics covering the application of optics in study of biological objects like cells, tissues. In particular, in this course we suppose to consider the ability of a light beam to exert mechanical forces on objects like living cells and to manipulate its position as well as to measure mechanical properties of single living cells and biological molecules (force spectroscopy). We consider techniques of nonlinear microscopy that permit gain new information on living cells that can not be achieved by conventional microscopy. Linear optical microscopy beyond the diffraction limit as well as scanning probe microscopy will present the hottest topics in imaging of biological objects in the last years. Background will be giving first on theory of the physical processes involved, as well as on experimental tools needed for realization the techniques. We propose that during the course students will perform several basic experiments at the ICFO labs that help to understand more deeply physical mechanisms involved in the techniques.

CONTENTS

-Introduction

-The mechanical action of light & theory of optical trapping

-Experimental aspects of optical trapping



-Combining the optical trap with Raman spectroscopy and fluorescence

-Applications of optical trapping in Physics, Chemistry, and Biology

-Molecular fluorescence and nonlinear optics

-Microscope, image acquisition and fluorescence imaging

-Nonlinear microscopy

-Imaging of living cells

-Microscopy beyond the diffraction limit (optics at the nanometric scale)

-Scanning probe microscopy (STM, AFM, NSOM)

-Single-molecule biophysics

-Experiments in the ICFO labs

GRADING SYSTEM

- . Assistance at the lectures and participation in discussions
- . Elaboration, presentation, discussion, and defence of a small project from a list suggested by professors.

EXAMINATION RULES.

The usual in University teaching



BIBLIOGRAPHY

Basic:

- Prasad, P.N. Introduction to biophotonics. Hoboken, New Jersey: John Wiley & Sons, 2003. ISBN 0471287709.
- Herman, B. Fluorescence microscopy. 2nd ed. Oxford: Bios Scientific Publishers, 1998. ISBN 1872748848.
- 3D imaging of living cells. Vancouver, 2003.
- Greulich, K.O. Micromanipulation by light in biology and medicine: the laser microbeam and optical tweezers. Basel [etc.]: Birkhauser, 1999. ISBN 3764338733.