



## DEPARTMENT OF PHYSICS

### **FYP3001 Optical Tweezers and Optical Manipulation, 15 credits**

Optisk Pincett och Optisk Manipulation, 15 högskolepoäng

*Third-cycle level / Forskarnivå*

---

#### **Confirmation**

This syllabus was confirmed by the Department of Physics on 2019-09-19, and is valid from Autumn semester 2019.

#### ***Responsible Department***

Department of Physics, Faculty of Science

#### **Entry requirements**

Students should have a self-motivated interest in optical trapping and optics.

#### **Learning outcomes**

After completion of the course the student is expected to be able to:

##### ***Knowledge and understanding***

- \* Read and understand the scientific literature in optical trapping and optical manipulation.
- \* Describe the design of an optical tweezers.

##### ***Competence and skills***

- \* Calculate optical forces within the geometrical optics and dipole-approximation regimes.
- \* Build an optical tweezers.
- \* Operate an optical tweezers.
- \* Optimize an optical tweezers for applications in soft matter, biophysics, statistical physics and colloidal physics.

##### ***Judgement and approach***

- \* Critically analyse published results in optical trapping and optical manipulation.

## Course content

This course is divided in three modules focusing on the theoretical and experimental understanding of optical trapping and optical manipulation techniques. Specific topics that are included are:

- (1) Theoretical background on optical manipulation, including the theory of optical trapping in the geometrical optics and dipole-approximation regimes.
- (2) Review of application of optical trapping with extensive review of the literature and a focus to applications in colloidal physics, soft matter, statistical physics, and biophysics.
- (3) Laboratory work consisting of the realization and operation of an optical tweezers setup and its use for an experiment.

## Types of instruction

Lectures, laboratory, seminars, group work.

### *Language of instruction*

The course is given in English.

## Grades

The grade Pass (G) or Fail (U) is given in this course.

## Types of assessment

Student evaluations will be based on: (1) participation in course lectures, (2) completion of course exercises; and (3) completion of laboratory mini-projects.

## Course evaluation

The course evaluation is carried out together with the Ph.D. students at the end of the course, and is followed by an individual, anonymous survey. The results and possible changes in the course will be shared with the students who participated in the evaluation and to those who are beginning the course.