### Course Description

**Department**

06 Applied Sciences and Mechatronics

**Course title**

Scanning Probe Microscopy

**Hours per week (SWS)**

4

**Number of ECTS credits**

6

**Course objective**

After completing this module successfully, students possess or have improved their competencies in the following fields:
- They have a profound understanding of fundamental scanning probe techniques;
- They know and are able to describe a selection of advanced scanning probe techniques;
- They can explain feedback mechanisms;
- They can point out the potential and technical limitations of scanning probe techniques in order to develop autonomy for the choice of these techniques for individual needs as advanced users.

**Prerequisites**

Basics in physics, especially solid state physics

**Recommended reading**

**Teaching methods**

seminaristic teaching with exercises

**Assessment methods**

written exam, 90min

**Language of instruction**

English

**Name of lecturer**

Gitanjali Kolhatkar

**Email**

christina.schindler@hm.edu

**Link**

Course content

- Brief review of surface and tunneling physics and atomic interaction potentials
- Cantilever mechanics and tip-fabrication
- ip-sample mechanics: extreme cases
- Ambient atmosphere and vacuum approaches

- Basic modes of operation
  -- Scanning tunneling microscopy
  -- Contact mode atomic force microscopy (AFM)
  -- Intermittent mode AFM
  -- Non-contact mode AFM and shear-force AFM
  -- Measuring in liquids

- Functionalized modes
  -- Conductive AFM
  -- Piezoresponse AFM
  -- Scanning capacitance and Kelvin Probe
  -- Magnetic force microscopy and the hard disc drive
  -- Near-field microscopy
  -- Tip-enhanced Raman spectroscopy

**Remarks**

only in summer 19