**Advanced bioengineering methods laboratory**

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<table>
<thead>
<tr>
<th>Cursus</th>
<th>Sem.</th>
<th>Type</th>
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<tbody>
<tr>
<td>Bioingénierie</td>
<td>MA2, MA4</td>
<td>Opt.</td>
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<tr>
<td>Ingénierie des sciences du vivant</td>
<td>BA6, MA2</td>
<td>Opt.</td>
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**Language**  English  
**Credits**  4  
**Withdrawal**  Unauthorized  
**Session**  Summer  
**Semester**  Spring  
**Exam**  During the semester  
**Workload**  120h  
**Weeks**  14  
**Hours**  4 weekly  
**Practical work**  4 weekly  
**Number of positions**  18

**Remarque**  
The course is held in an amended format giving more freedom to students to learn plan and perform research.

**Summary**  
Advanced Bioengineering Methods Laboratories (ABML) offers laboratory practice and data analysis. These active sessions present a variety of techniques employed in the bioengineering field and matching a quantitative and technological based approach.

**Content**

**Keywords**  
Atomic force microscopy (AFM), Lab on the chip (LOC), Brownian motion, Optical trapping, Surface Plasmon Resonance, bioanalytics, surface design, writing scientific papers

**Learning Prerequisites**

**Required courses**

**Required background:** Biophysics I, Biothermodynamics, Biomicroscopy I, + mandatory courses of M1

**Learning Outcomes**  
By the end of the course, the student must be able to:

- Demonstrate oral and written communication skills
- Perform experiments
- Coordinate experiments
- Operate the respective instruments of their assigned exercises
- Compose a convincing research paper describing their research project following the style guides of a letter to Nature

**Expected student activities**  
Beyond the work requested during the supervised sessions (practice and analysis), the student will have to:

- *Read the introduction of each topic before the corresponding practice, and summarize this information in his laboratory notebook.*
• Review the data analysis tools needed for the analysis sessions and prepare the required calculations ahead of the corresponding analysis session.
• Fill the laboratory notebook progressively along the semester.
• Develop a research plan for the independent project
• Write the research paper

The workload varies widely with the capabilities of each student. However, we expect, for each of the 6 topics investigated, an approximate working time of

• 2 h : Preparation of the practical session
• 4 h : Practical session

Supervision
Office hours No
Assistants Yes
Forum No

Resources
Bibliography
• Handouts given during the course.
• *Intermolecular and Surface Forces, J. Israelachvili, Academic press*
• *Surface Plasmon resonance Based Sensors, J.Homola et al., Springer*
• *Surface Design: Applications in Bioscience and Nanotechnology, R. Forch, H. Schonherr, A.T. Jenkins, Wiley*
• *Lab on a Chip Technology, Volume 1: Fabrication and Microfluidics, Keith E. Herold and Avraham Rasooly, Caister Academic Press, 2009*
• *Atomic Force Microscopy, Peter Eaton and Paul West, Oxford University Press 2010*

Ressources en bibliothèque
• Intermolecular and Surface Forces / Israelachvili
• Surface Plasmon resonance Based Sensors / Homola
• Surface Design: Applications in Bioscience and Nanotechnology / Forch
• Introduction to Error Analysis / Taylor
• Optical Trapping Review / Neuman
• Lab on a Chip Technology / Herold
• Atomic force microscopy/ Peter Eaton ; Paul West

Ressources en bibliothèque
• *Lab on a chip technology / Herold*
• *Atomic force microscopy / Eaton*
• *Intermolecular and surface forces / Israelachvili*
• An introduction to error analysis: the study of uncertainties in physical measurements / Taylor
• Optical trapping / Neuman
• Surface design: applications in bioscience and nanotechnology / Förch
• Surface plasmon resonance based sensors / Homola

Notes/Handbook
Can be downloaded from http://lben.epfl.ch/Teaching

 Websites
• http://lben.epfl.ch/Teaching