BIOENG-444

# Advanced bioengineering methods laboratory

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| Cursus | Sem. | Type |
|---|---|---|
| Bioengineering | MA2, MA4 | Opt. |
| Life Sciences Engineering | BA6, MA2 | Opt. |

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| Language of teaching | 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** |

**It is not allowed to withdraw from this subject after the registration deadline.**

## Remark

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

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| 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*
- *"Introduction to Error Analysis: The Study of Uncertainties in Physical Measurements," Taylor, John R., 1997, University Science Books,*
- *Optical Trapping Review : K.C. Neuman & S.M. Block, "Optical trapping," Rev. Sci. Instrum. 75 (2003).*
- *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 (http://beast-epfl.hosted.exlibrisgroup.com/primo_library/libweb/action/search.do?cs=frb&ct=frb&frbg=&fctN=facet_frbrgr

### 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