

BiS 571

Prof. Je-Kyun Park
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Spring 2023

Room 220, E16 Building
Mon & Wed, 14:30-16:00
<https://nanobio.kaist.ac.kr>

BiS 571 BioElectroMechanics

Synopsis

This course aims to provide students with a fundamental understanding of bioelectromechanical systems (BioMEMS) and lab-on-a-chip technologies. Specifically, the first part of the lecture focuses on the essential techniques for the production of lab-on-a-chip devices, while the second part of the lecture deals with the theoretical principles and practical applications of microfluidics and BioMEMS. A variety of working principles of micro total analysis systems and lab-on-chips are introduced and discussed to explore the fundamental aspects of analytical, biomedical, diagnostic, and therapeutic devices. The course also includes two practical microfluidic experiments that allow students to gain hands-on experiments in the field. On the basis of recent topics on biomolecular manipulation, separation, and detection technologies, each student is expected to choose a presentation topic and lead a discussion session.

Credit

3 units (3:0:3) (This course is mutually recognizable between Bachelor or Master programs.)

Prerequisite

Senior or Graduate standing is required. Recommended prerequisite courses include BiS377 (Biomechanics), BiS371 (Biofluidics), or equivalent.

Grading

Midterm Exam. 30%, Final Exam. 30%, Assignments 10%, and Final Term Paper 30%

Office Hours

Mon & Wed 16:00-18:00

Teaching Assistants

Soo Jee Kim (soojeekim@kaist.ac.kr, Tel.4355, Room: 801, E16); **Yejin Choi** (yejin9343);
Jongho Park (park9499);

Textbooks

- 1) (TA) S.-J. J. Lee and N. Sundararajan (2010). *Microfabrication for Microfluidics*, Artech House, ISBN: 978-1-59693-471-9.
- 2) (TB) A. Manz, P. Neuzil, J.S. O'Connor, and G. Simone (2021). *Microfluidics and Lab-on-a-chip*. Royal Society of Chemistry, UK, ISBN: 978-1-78262-833-0.

References

- 1) A. Folch (2012). *Introduction to BioMEMS*, CRC Press, ISBN: 978-1-4398-1839-8, <http://www.crcpress.com/product/isbn/9781439818398>.
- 2) D. Li (Ed.) (2015). *Encyclopedia of Microfluidics and Nanofluidics*, 2nd Ed., Springer, ISBN: 978-1-4614-5491-5 (on line)

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Lecture Schedule

Week	Topics	Contents	Chapter
1	Introduction	Course Outline / Overview	
2	Fundamentals of Micro/Nano Fabrication	Materials for Microfluidic Devices	TA-3
3		Photolithography	TA-4
4		Soft Lithography	TA-5
5		Subtractive Processes	TA-6
6		Additive Processes & 3D Printing	TA-7
7		Substrate Bonding & Fluidic Interfacing	TA-9
8	<i>Midterm Exam.</i>		
9	Theory of Microfluidics	Basics of Microfluidics	TB-1
10		Design of Microfluidic Devices/ Forces in Microfluidics	TB-3,5
11	Microfluidics & BioMEMS Applications	Flow Control in Microfluidics	TB-6,7,8
12		Droplet Formation & Manipulation	TB-9
13		On-Chip Reactions & Separations	TB-10,11
14	Microfluidics Experiments: Hands-on Experience (1), (2)		
15	Student Presentations (1), (2)		
16	<i>Final Exam.</i>		