

BiS 371

Prof. Je-Kyun Park
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Fall 2020

Room 220, E16 Building
Mon and Wed 13:00-14:15
<https://nanobio.kaist.ac.kr>

BiS 371 Biofluidics

Synopsis

This course introduces basic concepts of biological transport phenomena and helps the design of microfluidic devices and organ chips for biomedical and biotechnological applications. This course also covers topics in fluid mechanics, mass transport, and biochemical interactions, with engineering concepts motivated by specific biological problems.

Credit

3 units (3:0:3)

Recommended Prerequisite

BiS200 (*Bioengineering Fundamentals*), BiS223 (*Physical Principles in Biological Systems*), or equivalent.

Grading

Homework 40%, Midterm Exam 30%, and Final Exam 30%

Office Hours

Mon and Wed 15:00 - 17:00

Teaching Assistants

Soo Jee Kim (soojeekim@kaist.ac.kr, Tel: 4355, Room 802, E16); Hwisoo Kim (gnltn333); Hyewon Roh (hyewonr); Dong Hyun Han (honna94)

Textbook

G. A. Truskey, F. Yuan, and D. F. Katz (2009). *Transport Phenomena in Biological Systems (2nd Edition)*, Prentice Hall, ISBN: 978-0135131541

References

1. R. J. Roselli and K. R. Diller (2011). *Biotransport: Principles and Applications*, Springer, ISBN: 978-1441981189
2. R. L. Fournier (2006). *Basic Transport Phenomena in Biomedical Engineering*, 2nd Edition, CRC Press, ISBN: 978-1591690269
3. J. Berthier and P. Silberzan (2009). *Microfluidics for Biotechnology* 2nd Edition, Artech House, Inc., ISBN: 978-1596934436
4. D. Li (Ed.) (2015). *Encyclopedia of Microfluidics and Nanofluidics*, 2nd Edition, Springer, ISBN: 978-1461454885

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Lecture Schedule

Week	Topics	Contents	Chapter
1	<i>I. Introduction</i>	Course Outline / Overview & Units	1
2	<i>II. Fundamentals of Biofluid Mechanics</i>	Fluid Properties / Blood Rheology	2,3
3		Fluid Statics & Kinematics / Conservation of Mass	
4		Momentum Balances / Dimensional Analysis & Scaling	3
5	<i>III. Microfluidics and Biofluidics</i>	Microfluidics Theory	4
6		Micromanipulation & Separation	
7		Lab-on-a-Chip	
8	<i>Midterm Exam. Period</i>		
9	<i>IV. Fundamentals of Mass Transport</i>	Mass Transport in Biological Systems	6,7
10		Transport of Nanoparticles & Biochemical Species	
11	<i>V. Biochemical Interactions</i>	Biochemical Reaction Fundamental	10
12		Biochemical Reactions in Microsystems	10
13		Receptor-Ligand Binding Kinetics	11
14	<i>VI. Transport in Organs</i>	Drug & Organ Transport	15, 16
15		Organ-on-a-Chip	16
16	<i>Final Exam. Period</i>		