

## Introduction to Microfluidics

(*Tentative* Syllabus subject to change)

**Instructors: Jennifer H. Shin & Jessie Sungyun Jeon**

**TA: Youngbin Cho**

**Schedule** TTh 10:30-12:00

Homepage: [http://me.kaist.ac.kr/me/newcourse/index.php?code=ME491C\\_2016](http://me.kaist.ac.kr/me/newcourse/index.php?code=ME491C_2016)

**Room:** 2110

### Course Description

In micro scales, the basic laws governing the macro scale fluid mechanics may not be applicable. The objectives of this course are to identify dominant forces and their effects in micro scale fluid systems; to understand the fundamentals of micro fluidic phenomena; to discuss various microfluidic applications; and to explore new possible microfluidic applications in the emerging fields with a special emphasis on biomedical and biological sciences.

**Grading** • 24% Homework, 30% 1 Test, 30% Term Project (Paper 15% and Oral Presentation 15%), 16% Class Participation + Pop quizzes

### Assignments and Tests

1. There will be 3 homework assignments. Late homework will not be accepted.
2. One test will be given. The exact date for the exam will be announced later.
3. The term project includes oral presentation and submission of a term paper. The topic should be chosen by students and informed to the instructor. With regards to the term project, more detailed instruction will be given during the term

### Subject Topics

- Overview of general microfluidics and applications (1 lecture)
- Hydrodynamics (10 lectures)
  - Surface tension & applications
  - Scaling laws and effects in microfluidics
  - Low Re flows & examples
  - Liquid and particle handling in microscale
  - Transports in microscale & Review
- Active microfluidics (10 lectures)
  - Electrohydrodynamics
  - Electroosmosis
  - Dielectrophoresis and applications
  - Optofluidics
  - Acoustofluidics
- Microfabrications (5 lectures) (hard & soft lithography)
  - Fabrication technique overview (2 lecture)
  - Current Trends & Biomedical applications (3 lectures)
- Term project presentations (2 lectures)

# MAE 491 INTRODUCTION TO MICROFLUIDICS

## Tentative Schedule

MARCH	3	Thurs	1	JS/JJ	Introduction	
	8	Tues	2	JS	Microfluidics Overview	
	10	Thurs	3	JS	Scaling	
	15	Tues	4	JS	Basic Principles: What is fluid?	
	17	Thurs	5	JS	Surface tension	
	22	Tues	6	JS	Surface tension	
	24	Thurs	7	JS	Interfacial issues	HW1 OUT
	29	Tues	8	JS	Interfacial issues	
	31	Thurs	9	JS	Interfacial issues	
APRIL	5	Tues	10	JJ	Passive diffusion	
	7	Thurs	11	JJ	Hydrodynamic control of flows	HW1 IN
	12	Tues	12	JJ	Electrohydrodynamics	HW2 OUT
	14	Thurs	13	JJ	Electrohydrodynamics & Electroosmosis	
	19	Tues	14	JJ	Electroosmosis	HW2 IN
	21,26	MIDTERM				
	28	Thurs	15	JJ	Dielectrophoresis	
May	3	Tues	16	JJ	Dielectrophoresis	
	5	Holiday				
	10	Tues	17	JJ	Opto-magneto-fluidics	
	12	Thurs	18	JJ	Opto-magneto-fluidics	HW3 OUT
	17	Tues	19	JJ	Acoustofluidics	
	19	Thurs	20	JJ	Acoustofluidics	
	24	Tues	21	JS	Microfabrication	HW3 IN
	26	Thurs	22	JS	Microfabrication	
	31	Tues	23	JJ	Current problems in microfluidics I: Paper-based microfluidics, Appropriate Technologies, Other integrated systems	
JUNE	2	Thurs	24	Prof. Chang hoon Lee	Current problems in microfluidics II:	
	7	Tues	25	GL	Current problems in microfluidics III:	
	9	Thurs	26	PRES	Final Project Presentation	
	14	Tues	27	PRES	Final Project Presentation	
	16, 21	FINAL				

\*JS: Jennifer Shin, JJ: Jessie Jeon, GL: Guest Lecturer, PRES: Presentations

\*\* Midterm: 4/21, Final: 6/16