

Spring 2009
ME 5390-002
Introduction to Micro/Nanofluidics
(Tentative Syllabus subject to change)

Instructor	Hyejin Moon, Ph.D. Assistant Professor of Mechanical Engineering E-mail hyejin.moon@uta.edu Phone 817-272-2017
Schedule	TTh 5:30 – 6:50 pm, 208 Woolf Hall
Office hours	TTh 1:30 – 3:00 pm or by appointment
Course Description	As going down to micro scales, the basic hypothesis in the macro scale fluid mechanics may not be applicable in such scales. The objectives of this course are: to identify dominant forces and their effects in micro scale fluid systems that are different from those in the macro scales; to understand the fundamentals of micro fluidic phenomena; to discuss various microfluidic applications in research and commercial levels; and to explore new possible microfluidic applications in the emerging fields. Topics include overview of microfluidics, scaling laws, violation limit of the Navier-Stokes equations, surface force, surface tension, electrowetting, electrokinetics, dielectrophoresis, and soft lithography. Letter grading.
Subject	<ul style="list-style-type: none">• Introduction, overview, and applications• Scaling issues• Low Re flows• Intermolecular forces• Kinetic theory of gases• Surface forces• Surface tension• Electrowetting and applications• Electrokinetic forces and applications• Dielectrophoresis and applications• Microfabrications (soft lithography)• Other topics• Term project presentations
Assignments and Tests	<ul style="list-style-type: none">• There will be several homework assignments that are normally due one week after given. <u>Late homework will not be accepted.</u>• <u>Two tests</u> (one midterm and one final exam) will be given. The exact dates and times will be specified and announced later.• The term project includes <u>oral presentation</u> and submission of a <u>term paper</u>. The topic should be chosen by students and informed to the instructor. With regard to the term project, more detailed instruction will be given during the term.
Grading	Homework 10%, Midterm Exam 25%, Final Exam 25%, and Term Project 40% (term paper 20% and oral presentation 20%).
Textbook	No text book required but relevant references on each subject will be specified.

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Lecture Schedule

(Tentative schedule subject to change)

Week	Day	Date	Topics	Notes
1	Tue	1/20	Introduction	
	Thu	1/22	Macro & Microfluidics	
2	Tue	1/27	Scaling issues	
	Thu	1/29	Low Re flows	
3	Tue	2/3	Intermolecular forces (1)	
	Thu	2/5	Intermolecular forces (2)	
4	Tue	2/10	Intermolecular forces (3)	
	Thu	2/12	Kinetic theory of gases (1)	
5	Tue	2/17	Kinetic theory of gases (2)	
	Thu	2/19	Kinetic theory of gases (3)	
6	Tue	2/24	Surface science (1): surface tension, capillarity	
	Thu	2/26	Surface science (2): wetting on rough surface	
7	Tue	3/3	Surface science (3): electrocapillarity, electrowetting	
	Thu	3/5	Gas flow (1): compressible flow	
8	Tue	3/10	Gas flow (2): slip flow	
	Thu	3/12	Midterm test	
			Spring Break	
9	Tue	3/24	Electrowetting (1)	
	Thu	3/26	Electrowetting (2)	
10	Tue	3/31	Electrokinetic forces (1)	
	Thu	4/2	No class	
11	Tue	4/7	Electrokinetic forces (2)	
	Thu	4/9	Electrokinetic forces (3)	
12	Tue	4/14	Dielectrophoresis (1)	
	Thu	4/16	Dielectrophoresis (2)	
13	Tue	4/21	Microfabrications (1)	
	Thu	4/23	Microfabrications (2)	
14	Tue	4/28	Term project presentation	
	Thu	4/30	Term project presentation	
15	Tue	5/5	Term project presentation	
	Thu	5/7	Final exam	