Course Information	
Course title	Introduction to Cellular BioMEMS and Biomicrofluidics
Semester	114-2
Designated for	COLLEGE OF ENGINEERING GRADUATE INSTITUTE OF APPLIED MECHANICS
Instructor	YU-HSIANG HSU
Curriculum Number	AM7166
Curriculum Identity Number	543EM5310
Class	
Credits	3.0
Full/Half Yr.	Half
Required/ Elective	Elective
Time	Thursday 7,8,9(14:20~17:20)
Remarks	The upper limit of the number of students: 20.
Course introduction video	
Table of Core Capabilities and Curriculum Planning	Table of Core Capabilities and Curriculum Planning
Course Syllabus	
Please respect the intellectual property rights of others and do not copy any of the course information without permission	
Course Description	課程名稱: 細胞微機電及微流體導論 (Introduction to Cellular BioMEMS and Biomicrofluidics) Reference textbook: Introduction to BioMEMS, Albert Folch, CRC Press; 1st ed. (August 21, 2012) Ch1 How do we make small things? Ch2 Micropatterning of substrates and cells Ch3 Microfluidics Ch5 Cell-based chips for biotechnology Ch6 BioMEMS for cell biology Ch7 Tissue microengineering Reference textbook：Essential Cell Biology, Bruce Albert, et al. Garland Science, 2nd ed. (September 25, 2003)

	Ch17 Cytoskeleton Ch19 Cell division Introductory Biomechanics - From Cells to Organisms, C. Ross Ethier and Craig A. Simmons, Cambridge University Press (April 9, 2007) Ch2 Cellular biomechanics Ch3 Hemodynamics Ch4 The circulatory system Ch5 Interstitial fluid flow Fundamental of Microfabrication, Marc Madou, CRC Press Ch1 Lithography Ch2 Pattern transfer with dry etching technologies Ch4 Wet bulk micromachining Ch5 Surface micromachining. Theoretical Microfluidics, HenrikBruus, Oxford University Press, (Nov 17, 2007) Ch2 Governing equations Ch3 Basic flow solutions Ch4 Hydraulic resistance and compliance Ch5 Diffusion Course materials: Lecture notes and journal papers 1. Cellular biomechanics: anatomy and physiology of cells, mechanics of cytoskeleton, cell-matrix interaction, focal adhesions, mechanical model, mechanoreceptors, mechanical behavior of cells: mitosis, migration, and introduction to infection induced cell abnormality. 2. Tissue Engineering: microcirculation, capillary anatomy, diffusion and convection, Starling law, osmotic pressure, interstitial flow, basics of angiogenesis and vasculogenesis. 3. BioMEMS: Photolithography, bulk micromachining, surface micromachining, micro-molding, plastic manufacturing. 4. Microfluidics: scaling laws, surface to volume ratio, hydraulic resistance, wall shear stress, diffusion, capillary flow, hydrodynamics in porous media. 5. Special topic: Cell-based chip for biotechnology - bioreactors, studies of mechanics of abnormal cells, cell sorting, cell trapping. 6. Special topic: BioMEMS for cell biology - substrate dependency of cells, cell-cell contact, cell migration. 7. Special topic: Tissue microengineering - 3D culture, angiogenesis, vasculogenesis, organ on a chip.
Course Objective	(1) Introduce how to use microfabrication methods to make masters, microfluidic devices, and micro-structures for cell mechanics, organ-on-a-chip, and microphysiological systems. (2) Discuss the necessary properties of the common materials used for studying cellular behaviors, cell-cell interactions, and developing organ tissue on a chip. (3) Discuss the methods used to study cell mechanics and the importance of their findings for the field of cell mechanics. (4) Explain how to apply cell mechanics to the design of BioMEMS and Biomicrofluidic devices. (5) Understand the applications of BioMEMS and Biomicrofluidics on organ-on-a-chip and microphysiological systems.

<table>
<tr><td>Course Requirement</td><td></td></tr>
<tr><td>Student Workload (Expected weekly study hours before and/or after class)</td><td>After each class, the students should study course materials.
For the final project, students should spend time to read the assign Journal paper and should find reference papers for project presentation and report.</td></tr>
<tr><td>Office Hours</td><td>Appointment required.</td></tr>
<tr><td>Designated reading</td><td>Course lecture notes</td></tr>
<tr><td>References</td><td>Major Reference textbook: Introduction to BioMEMS, Albert Folch, CRC Press; 1st ed. (August 21, 2012)
Ch1 How do we make small things?
Ch2 Micropatterning of substrates and cells
Ch3 Microfluidics
Ch5 Cell-based chips for biotechnology
Ch6 BioMEMS for cell biology
Ch7 Tissue microengineering
Other Reference book：Essential Cell Biology, Bruce Albert, et al. Garland Science, 2nd ed. (September 25, 2003)
Ch17 Cytoskeleton
Ch19 Cell division
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<tr><td>Grading</td><td>
<table>
<tr><th>No.</th><th>Item</th><th>%</th><th>Explanations for the conditions</th></tr>
<tr><td>1.</td><td>Midterm</td><td>50%</td><td>Written exam</td></tr>
<tr><td>2.</td><td>Project presentation</td><td>25%</td><td>Oral presentation</td></tr>
<tr><td>3.</td><td>Project report</td><td>25%</td><td>Written report</td></tr>
</table>
1. NTU has not set an upper limit on the percentage of A+ grades.
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	2. NTU uses a letter grade system for assessment. The grade percentage ranges and the single-subject grade conversion table in the NATIONAL TAIWAN UNIVERSITY Regulations Governing Academic Grading are for reference only. Instructors may adjust the percentage ranges according to the grade definitions. For more information, see the Assessment for Learning Section.
Adjustment methods for students	<table><tr><td>Teaching methods</td><td>Assisted by video</td></tr><tr><td>Assignment submission methods</td><td></td></tr><tr><td>Exam methods</td><td>Written (oral) reports replace exams</td></tr><tr><td>Others</td><td></td></tr></table>

Progress

Week	Date	Topic
No data		