EECE 7026 Biochips and Lab-on-a-Chips

Spring Semester 2024

This syllabus is subject to modification.

INSTRUCTOR: Professor Chong H. Ahn
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Office hours: Wednesday 1:00-2:00 PM in 900 Rhodes

LECTURES: BALDWIN 741, 3:30 PM to 4:50 PM Tuesdays & Thursdays

Goals: This course is designed to introduce the fundamentals of biochips and lab-on-a-chips. Basic concepts of micro/nano fabrication of biochips, microfluidic devices, on-chip analysis and manipulation (separation and immobilization) techniques, on-chip biochemical detection techniques, and integration of lab-on-a-chips will be introduced and discussed. Various biochips, lab-on-a-chips, uTAS and their applications will be covered.

Quarter: Spring 2021

Time: TTh 3:30 – 4:50 pm, online class

Instructor: Professors Chong H. Ahn

Office: Rhodes 900 (9th Floor) and online

Phone: 513-556-4767, ahnch@ucmail.uc.edu

Textbook: Class notes and handouts

Reference: "Lab-on-a-Chip Technology", K. Herold and A. Rasooly, Caister Academic Press, 2009
"Lab-on-a-Chip", R. E. Oosterbroek and A. Van den berg, Elsevier, 2003
"Biochip Technology", J. Cheng and L. Kricka, Harwood Academic Publishers, 2001

Office Hours: Tuesday 1:00 - 2:00 pm, online office via WebEx

Lecture Schedule

1. Introduction to biochips and lab-on-a-chips
2. Micro/nano fabrication technologies of biochips and lab-on-a-chips
3. Micro/nano fluidics and components
4. Biosensing principles in microfluidic systems
5. On-chip analyte manipulation technologies and components
6. DNA/Proteins/Cells on lab-on-a-chips
7. Integration and packaging of biochips and lab-on-a-chips as uTAS
8. Miniaturized chemical/biological analysis systems
9. Case study of biochips and lab-on-a-chips as point-of-care testing (POCT)

Grading:

- Class attendance (10 %), midterm exam (60%) and term paper (30%)
- Detailed guideline on the term paper will be described below.

Class Rules and Regulations:

- No make-up exams will be given unless you have an excusable emergency that can be proven by official certificates and proofs. No credits will be given for a missed exam.

Important Dates:

- Midterm I will be 75 minutes exam on April 1 and Term paper due date is April 20.
- Midterm exam dates are confirmed and are not subject to be changed.

Office Hours: 1-2 pm Tuesday. Online meeting
Question and discussion session will be open vis online WebEx.

Term Paper Guide for EECE 7026 Biochips and Lab-on-a-Chips

Term Paper Topic Selection Guide:

Term paper topics should be specific biochips devices or systems, biochips applications, biosensors in micro- or nano-scale, specific biochips fabrication techniques, microfluidic devices or systems, or lab-on-a-chip systems. In the above stated area, you are free to choose any topic that is related to your research area or that attracts your interest if your topic is approved by the instructor. You must discuss with the instructor during his office hours or by appointment for pre-approval before submission of the topic. The listed topics below are only few examples.

Examples of Acceptable Project Topics:

- DNA analysis devices (e.g., DNA microarray, polymerase chain reaction chips, DNA chips, other)
- Biomolecular devices and actuators
- Protein detection (e.g., protein micorarray, protein lab-on-a-chip devices, etc.)
- Immunoassay on lab-on-a-chip
- Biosensors (e.g., immunosensor, glucose, DNA, protein, cell-based, other. Should be specified.)
- Nano-bio devices
- Drug delivery
- Microchip capillary electrophoresis
- Bioseparation (e.g., cell, DNA, other biomolecules)
- Microfluidic devices (e.g., micropump, microvalve, micromixer, other. Should be specified.)
- Point-of-care diagnosis systems
- Novel Biochips fabrication techniques
- Biochips packaging
- And… there are many others.

After You Submit the Project Topic:

Go to the library or on-line for journal papers that you need to complete your term paper. Several journal titles and most of conference proceedings are not accessible from UC campus so you must request through inter-library circulation, which could take more than weeks. The instructor cannot help you to find the reference papers during this course work. Topic that you chose should be pre-approved by Dr. Ahn, so submit a half page for the chosen topic title and description to Dr. Ahn by Jan 30th.

You need to read and review at least **10 journal/conference papers** closely related to your project topic and you have to submit 10 most important reference papers (either electronic copy or hard copy) along with the term paper.

Term Paper Submission Guide:

Term paper submission due is indicated in the course syllabus. Total 15-30 pages of the written term paper in MS Word and PDF format, and total 20-40 pages of slides in MS PowerPoint format should be submitted. Contents of the term paper and slides may vary depending on the specific topics but the following information must be included: a review of the topic; shortcomings/limitations/challenges, and suggestions for improvement.

The term paper and the slides should be submitted both hard copy (at the class) and electronic copy (in a floppy/zip/compact disk).

Format:

- Use Letter-size (8.5" x 11") paper with 1" margins on top, bottom, left, and right.
- Use single space throughout the document.
- Title should be 14 point and bold face Arial font with upper and lower case letters. After the title, give one blank line in 12 point. Title should be centered.
- Your name (as it appears on the paws account but in the order of Given name(s) and Family name, e.g., John A. Doe) and PAWS email address in 12 point and a bold face Times New Roman font. This line should be centered. After the name, give one blank line.
- Headings in 12 point and a bold face Arial font.
- Subheadings in 11 points and a bold face.
- Type your abstract maximum 500 words (400 ~ 500 words) in 11 point and a regular face Times New Roman font.
- Body text in 11 point and a regular face Times New Roman font. Alignment of the body text should be justified.
- No specific formats for the slides but they should be self-explaining.
- You need to submit both electronic and hard copy of the term paper. Electronic copy should be in a floppy/compact/zip disk. Email submission of the project term paper will not be accepted.
- 10 most important references (do not count web resources) are also need to be submitted along with the term paper. Electronic or hard copies will be accepted.
- All figures/pictures/tables and other researchers' work have to be cited correctly, unless they are your own.
- Electronic copy should also be submitted by the due date in MS Word format and PDF format for the term paper and in MS PowerPoint format for the slides. Give the file name as your Family name First initials (e.g., Doe_A.doc, Doe_J.pdf, Doe_J.ppt).

Term Paper and Slides Grading:

- Do the term paper and the slides give clear description of the topic?
- Do the term paper and the slides include the review on the topic?
- Are current and up-to-date developments included?
- Are shortcomings, limitations, and technical challenges of the topic discussed?
- Are suggestion (or ideas) on the topic given?
- Are all figures/pictures/tables and other researchers' work correctly cited?
- Is the term paper/slide correctly formatted?

Things that you have to avoid:

- Copying any part of the Term Paper from any books, articles, other students' work, or web resources without referring the sources. Student who submits any copied material will face the grade of "C" or below regardless of his/her achievements in the course. There will be no

exception! (If you have any questions, read “Plagiarism Guide” at www.libraries.uc.edu/instruction/students/**plagiarism**.html)