

BIOMEDE 599: Advanced Optical and Nano Bio/Chemical Sensors

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**Class location:** EECS, 1008  
**Class time:** 2:30 - 4 pm on Tuesdays/Thursdays  
**Office hour:** 4-5 pm Tuesday  
**Credits:** 3

This course is for Master and Ph.D. students and will provide an overview of modern biological and chemical sensing for in-vivo or in-vitro disease diagnosis and molecular analysis based on photonics and micro/nanotechnology. Considerations in bio/chemical sensor design will be described; applications and limitations of each sensing technology will be discussed.

Through lectures, recent literature review, and in-class discussion, students will be familiar with the research frontiers in the bio/chemical sensing field, gain an in-depth understanding of underlying sensing principles, and be able to apply acquired knowledge to their own research projects in bio/chemical sensor development.

This course is complementary to BiomedE 552 (Biomedical Optics) and BiomedE 561 (Bio Micro-&Nanotech) with emphasis on instrumentation and sensing.

**Textbooks:** No textbook is required.

**Course format:** 30% of the class is dedicated to lectures led by the instructor. The remaining 70% is for in-class discussion based on the readings (mainly from the scientific literature) assigned periodically in advance to students.

**Tentative topics:**

1. Overview of photonics and nanotechnology
2. Overview of photonics and nanotechnology in bio/chemical sensing
3. Overview of traditional sensing/detection technology and instruments
4. Overview of microfluidics and optofluidics
5. Liquid sensing and gas sensing
6. Photonic structures in sensing
  - (a) Optical fluorescence detection
  - (b) Optical label-free detection
  - (c) Surface enhanced Raman spectroscopy
7. Optical manipulation and sorting
8. Nanotechnologies for in-vivo and in-vitro sensing
9. Nano-manipulation
10. Single molecule detection (optional)

University of Michigan, College of Engineering  
Department of Biomedical Engineering

**Grading:** Your grade will be determined as follows:

- Class Participation 20%
- Technical Review 30%
- Course Final Project 50% (25% term paper; 25% class presentation)

Note:

1. Class participation consists of contributing meaningfully to class discussions
2. Term paper should be a technical proposal of 6 pages long, including figures. 11-point Times New Roman or 10-point Arial for the main text and 2-point smaller for figure captions. 1-inch margin on all sides.
3. Presentation will be 40 minutes long (tentative, depending on the number of students).

**Calendar:** Please [click here](#) to access our class calendar on Google.