Biomedical Sensing Systems **Fall 2026**

Delivery: In Person

Instructors: Professor Omer Inan, Office: TSRB 417, inan@gatech.edu

Office Hours: Weekly (1 hour) TBD

1. Course Summary

A study of physiological sensing topics from a systems viewpoint. Pertinent physiological and electro-physiological concepts will be covered. No prior knowledge of physiology or biology is needed.

2. Course Information

Lectures: Tuesday / Thursday

3. Textbook and Optional References

No textbook is required.

The optional reference textbooks are as follows:

- Webster, *Medical Instrumentation: Application and Design*
- Guyton and Hall, *Textbook of Medical Physiology*
- Horowitz and Hill, *The Art of Electronics*
- Despopoulus, *Color Atlas of Physiology*

4. Course Requirements and Grading

Requirements:

- Bi-weekly homework assignments. Homework will normally be assigned on Thursdays and due the following Thursday "in class." **Late homework will not be accepted.** You may work on the homework in small groups, but you must write up your own homework.
- Three in-class quizzes covering material from the lectures or homework. You will be allowed to drop the lowest of the three quiz grades.
- Final project. You will be grouped into small teams, and will propose (written) a research project related to biomedical instrumentation in consultation with the professors. The project consists of an original design, simulation, or lit review of a biomedical sensing system. At the end of the term, you will then present to the class your results in a 10- to 12-minute presentation, including a demo of your design, and provide a project write-up (7 pages maximum length). Grading is typically based on depth of coverage, correctness, originality and quality of the analysis, and the overall clarity of the paper and presentation. ***For graduate students enrolled in ECE6781, there will be additional requirements to be outlined in class in the first three weeks. Note that for all students, the final project presentations may be held fully or partially during the final exam time slot for the course; accordingly, you must plan on being able to attend the presentations at that time, as this will be a requirement for the course.***

- Attendance is optional (but highly encouraged) for normal class time, but required for all presentations.

Grading:

Homework	20%
Quizzes	30%
Final Project Proposal	10%
Final Project Presentation	15%
Final Project Write-Up	25%

5. Prerequisites

ECE 3030 [min C] or ECE 3040 [min C] or ECE 3710 [min C] or ECE3043 [min C]

6. Tentative Outline

A. Basic Concepts of Biomedical Circuits and Systems
B. Applied Biomedical Systems: Orthotics and Prosthetics
C. Fundamentals of Transducers and Interface Circuits
D. Membrane Biophysics
E. Action Potentials
F. Biopotential Electrodes
G. Electrophysiology of the Heart and Neuromuscular System
H. Miscellaneous Electrophysiology
I. Biomedical Transducers
J. Wearable Sensing
K. Measurement of Hemodynamics and Respiration

7. Other Course Expectations & Guidelines

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. For information on Georgia Tech's Academic Honor Code, please visit http://www.catalog.gatech.edu/policies/honor-code/ or http://www.catalog.gatech.edu/rules/18/.

Any student suspected of cheating or plagiarizing on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services at (404)894-2563 or http://disabilityservices.gatech.edu/, as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Student-Faculty Expectations Agreement

At Georgia Tech we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. See http://www.catalog.gatech.edu/rules/22/ for an articulation of some basic expectation that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

8. Course Objectives and Outcomes

Course Objectives

As part of this course, students…

- Apply their knowledge of circuits and systems to biomedical sensing problems [1]
- Engage in a design or critical review focused team-based final project aimed at addressing an important problem in health or wellness [1, 2, 7]
- Develop and demonstrate critical technical writing skills in the area of biomedical sensing systems for engineering, clinical, and expert audiences [4]

Course Outcomes

Upon successful completion of this course, students should be able to…

- Analyze op amp based circuits and systems for biomedical sensing
- Describe challenges in real-world biomedical sensing problems such as motion artifacts, skin-electrode interface, and low signal to noise ratio
- Develop strategies for mitigating these real-world challenges including through the design of multi-modal sensing systems and high performance circuit design
- Design biomedical sensing systems based on discrete analog and embedded systems hardware
- Communicate the design of biomedical sensing systems to a diverse audience of engineers and / or clinicians via written and oral presentation