# Medical Instrumentation

## BME-ECE 522 – Spring, 2016

**Course Description:** Fundamentals of medical instrumentation systems, sensors, and biomedical signal processing. Example instruments for cardiovascular and respiratory assessment. Clinical laboratory measurements, therapeutic and prosthetic devices, and electrical safety requirements.

**Prerequisites:** Consent of the instructor. Electrical, computer, and biomedical engineering seniors and graduate students may register for the course. Advanced undergraduates and graduate students from other curricula may take this course if they have completed an electronics course covering the use of operational amplifiers and are able to perform signal analysis using MATLAB®.

**Textbook:** John G. Webster (Editor), Medical Instrumentation: Application and Design. Boston: Houghton Mifflin, 1998 (Third Edition). ISBN 0-471-15368-0. Any edition of the textbook can be used.

| **Instructor**: | Troy Nagle, Professor of BME & ECE<br>3080 Eng. Bldg. II<br>919-515-3578<br>nagle@ncsu.edu | **Teaching Assistants:** | Sofie Permana, ECE<br>shperman@ncsu.edu<br><br>Sanket Rege, ECE<br>srege@ncsu.edu |
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**Office Hours:** In-person and by Skype. Request appointment by e-mail.

**Topics:** Basic concepts and principles of measurement, review of amplifiers and signal processing, origin of biopotentials, biopotential electrodes and amplifiers, measuring heath-related physiological parameters (such as blood pressure and sound, blood flow and volume, respiratory performance), chemical biosensors, therapeutic and prosthetic devices, and electrical safety.

**Lectures:** Textbook lectures are posted to the Web in the form of PowerPoint files with sound inserts. Students can download the files from the course Website and view the contents at their convenience. Other class sessions are held to discuss the assigned projects, to hear student project presentations, and for lectures on topics not covered in the text.

**Homework:** No formal homework is required for this course. Suggested end-of-chapter problems are recommended for self-study and evaluation.

**Class Projects:** Student groups (three to five participants) design and build a portion of a medical monitoring device. Each project will interface a specific biomedical sensor to a data acquisition system. The data acquisition system that captures data for the monitoring device should transfer it to a smart phone (e.g., iPhone or Android based), a laptop computer, or a website. Students analyze the acquired data using MATLAB® or other software tools to determine performance metrics. A menu of different projects is offered and students can also submit their own project concepts for approval.

**Tutorial Papers:** Each student group will investigate a medical sensor topic and prepare a tutorial paper for the class. Specific topics will be suggested and the student groups may also suggest their own topic for approval.

**Grading:**

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| Take-Home Midterm Exam | 25% |
| Tutorial Paper and Presentation: | 15% |
| Project Presentation & Demo | 25% |
| Project Report | 35% |