**Medical Instrumentation**  
**BME/ECE 522 – Spring, 2012**

**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®.


**Instructor:** Troy Nagle, Professor of BME & ECE  
3080 Eng. Bldg. II  
919-515-3578,  
nagle@ncsu.edu

**Teaching Assistant:** Ryan Hodges, PhD  
Student, ECE  
2039 Eng. Bldg. II  
919-515-1096,  
rhodges@ncsu.edu

**Office Hours:** Tuesday and Thursday after class. Others by appointment.

**Topics:** Basic concepts and principles of measurement, review of amplifiers and signal processing, origin of biopotentials, biopotential electrodes and amplifiers, measuring health-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 two 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 identified for self-study and evaluation.

**Class Projects:**  
*Project #1:* First, each student designs, simulates, and builds a prototype ecg amplifier.  
*Project #2:* Student groups (two to four participants) design and build a portion of a medical monitoring device. The data acquisition system that captures data for the monitoring device can 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.

**Grading:**  
- Project #1 Demo & Report 20%  
- Take-Home Midterm Exam 20%  
- Project #2 Presentation & Demo 30%  
- Project #2 Report 30%