



**University at Buffalo** *The State University of New York*

**Integrated Sensor Systems**

**3 credit hours**

**Dr. Albert H. Titus**

**Dept of Electrical Engineering**

**Spring 2010**

**Course Description:**

This course builds on the fundamentals of analog integrated circuit design learned in EE591, with a focus on sensors. Beginning with a brief review of analog MOSFET circuits, we will move into the design and layout of interface circuits, such as analog to digital converters, low noise preamplifiers, and lock-in amplifiers. We will then examine various sensing and transducer technologies. Finally, we will combine these to create complete sensing systems that can interface with microcontrollers. Students will complete homework projects (SPICE simulations and IC layout) during the semester, and use these to development their final project: a complete sensor chip.

- Weeks 1-4: Introduction to Sensors and Sensor Applications
- Week 5: Silicon-based Sensors
- Week 6-8: Non-linear Analog Circuits
- Weeks 9 – 11: Data Conversion Circuits
- Weeks 12 – 13: Sensor Interfacing
- Weeks 14 – 15: System Integration
- Week 16 (Final Exam week): Project Presentations

**Learning Outcomes:** By the end of the semester, students will be able to:

- Design a CMOS analog to digital converter (ADC)
- Understand sensing methodologies and technologies
- Discuss sensors and sensing schemes in terms of repeatability, sensitivity and selectivity
- Design interface circuits to extract small signals from sensors
- Layout and design CMOS integrated circuits.

**IMPORTANT:**

Students must have taken EE 491/591 prior to taking this course. If you have not, then contact Dr. Titus via email. It is expected that you know how to use SPICE and MAGIC, as well as some other simulation tool, such as MATLAB, MAPLE, or MATHCAD.