Course Number  ECE 7570, BME 7470, PHY 7580
Course Title  Smart Sensor Technology II
Credits  4
Prerequisite  Smart Sensors Technology I (ECE 6570, BME 6470, PHY 6570)

Course Description  VLSI design and submission for integration with sensor and microsystem technology. The fabrication process; characterization of sensors; design of associated analog VLSI circuit. The technology of electronic and photonic materials, devices and associated interactive electronics are of critical importance in United States industries and government laboratories. Among the most important areas of research is the integration of electronic processing with sensors. Sensor research presents a strong multidisciplinary challenge. The integration of electronics with sensors provides a smart transducer with an application-specific IC that not only might handle signal amplification, control and feedback, but may also have a custom local-bus network for efficient communication. The importance of this fast growing technological area indicates the need for special educational emphasis by disseminating state of the art research into a curriculum suited to train students. Smart Sensors II will involve the VLSI design and hands on laboratory microfabrication of an integrated sensors system. The topics that will be covered are as follows:

Week 1: Common Drain Amplifier/ LAB Opamp layout
Week 2: Output Stages: Class A, B, and AB/ LAB Opamp layout
Week 3: CMOS Differential Amplifier/LAB Second Order Universal Filter Layout
Week 4: CMOS Comparator/LAB Second Order Universal Filter Layout
Week 5: CMOS Opamp/LAB Complete IC Layout for Submission to MOSIS
Week 6: Continuous-Time Filters/ LAB Complete IC Layout for Submission to MOSIS
Week 7: Wide-Swing Folded Cascode OTA/PROJECT announcement
Week 8: Introduction & Cleanroom safety & procedures given by clean room managers Bill Funk and Dan Durisin/ Office of Environmental Health & Safety (OEH&S) lab safety class
Week 9: Silicon Wafer RCA cleaning/ Deposition of AlN on Si.
Week 10: Spring Break - No classes
Week 11: AlN Characterization: XPS (x-ray photoelectron spectroscopy), AFM (atomic force microscopy), and XRD (x-ray diffraction).
Week 12: Photolithography
Week 13: Microfabrication
Week 14: Electrical measurements of SAW device
Week 15: Final lab notebook and report due
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Objective
The objective of the course sequence is to integrate the ongoing research in integrated technology of smart sensors. Students will design smart sensor devices with the aid of computer simulation. Students will then use a hands-on laboratory experience to actually fabricate a sensor device and associated hybrid VLSI circuitry to form a smart electronic system.

The class will be divided up into groups. Every week each group will watch and take notes through each step of the process required for making a sensor. The week before each step of the process a handout may be given describing each procedure. However, a lab notebook must be kept with notes taken during each process. You will be required at the end of the class to hand in your lab notebook, as well as a final lab report.

Weeks 1-7

Instructors
Dr. Pepe Siy (Weeks 1-7)
Phone: 313-577-3841, p sui@ece.eng.wayne.edu, 3125 Engineering
Office hours: Mondays & Thursdays 12:00 - 5:00 pm, Thursdays 12:00 - 3:00 pm

TA:
Zhen Yang (Weeks 1-7)
Phone: 248-890-9001, ae6876@wayne.edu
Office hours: 3355 Engineering
Thursday 2:30 – 3:30pm
Friday 12:30-1:30 pm

Lecture:
Location: 2409 Engineering Bldg, Multi-Media Room
Time: 3:30-5:20, Wednesday

Lab:
Location: EMIT Computer Simulation Lab Unix lab 2nd Floor, Engineering Bldg
Time: 3:30-5:20, Thursday
1:30-3:30, Friday
3:30-5:20, Friday

Website:
http://webpages.eng.wayne.edu/~cadence

Weeks 8-15

Instructor
Dr. Erik McCullen (Weeks 8-15)
Phone: 313-577-0185, mccullen@ece.eng.wayne.edu, 3126 Engineering
Office hours by appointment only

Clean Room Managers:
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Dan Durisin & Bill Funk
3162 Engineering Bldg.
Phone: 313-577-9387

Lecture:
Location: 2409 Engineering Bldg, Multi-Media Room
Time: 3:30-5:20, Wednesday and Friday

Lab:
Location: As assigned by instructor

Grading:

Weeks 1-7
Group Project: Project Successful Submission to MOSIS (20%)
Individual Take Home Exam: Due Monday, April 24, 2006 on or before 5PM.
(Pspice) (30%)

Weeks 8-15
Lab Notebook: Due Friday, April 21, 2006 on or before 5PM (25%)
Final Lab Report: Due Friday, April 21, 2006 on or before 5PM (25%)
Attendance: University Guidelines for attendance

Deferred Grades A grade of "I" will only be assigned if a student IS NOT currently failing the course and if there is NOT a substantial amount of work to be completed. An "I" grade MUST be made up within one year of assignment of the grade. Assignment of an “I” grade will be at the sole discretion of the instructor.

Expectations You will be expected to attend class and participate in discussions regarding lectures by the instructor and your classmates. In order to do this, you should read the papers given to you prior to attending class. This will include handouts and reference lists or review articles as well as the papers written by your classmates.

Blackboard Blackboard will be used throughout the course for communication among students and with the instructor. Feel free to post both private and common questions. Written assignments will be turned in and distributed to other students via Blackboard. In order to use the system, you must log on through PipeLine. Please activate your Wayne email address, forwarding it to your standard email if you wish. This will be the address with which the class communicates with you.

Withdrawal Policy The last day to drop any class with a tuition refund is the end of the second week of classes. The last day to withdraw from the class, without a notation of W on the transcript, is the end of the fourth week of classes. All drop/add activity during the first 4 weeks should be done through Pipeline. Between the end of the fourth and fifth weeks, withdrawals require the permission of the instructor and must be submitted on a Drop/Add form to the Registrar’s Office.

It is the policy of the College of Engineering not to allow withdrawals from courses after the end of the 5th week except under exceptional circumstances. Failing a class is not an acceptable excuse for
withdrawal after the 5th week. Withdrawals after this time require the permission of the Associate Dean for Academic Affairs.

**Important Dates for Winter 2006:**

1. The LAST day to drop a class with a tuition refund is Monday, January 23, 2006.
2. Within the first four weeks of class (through Friday, February 3), withdrawals should be done Pipeline.
3. Between February 3 and February 10, withdrawal from a course requires approval from the course instructor. This approval should be provided on a Drop/Add form that is then presented to the Registrar’s Office.
4. The College of Engineering DOES NOT ALLOW withdrawal from courses after the FIFTH week of classes except under exceptional circumstances (Friday, February 10). FAILING of a class is NOT an acceptable excuse for withdrawal after the 5th week. All requests for withdrawals after the 5th week must be made to the Associate Dean for Academic Affairs.

**Policy on Cheating** It is the policy of the Electrical and Computer, Biomedical Engineering Programs that any instance of cheating will result in a grade of F for the course. Cheating is defined by the University as “intentionally using or attempting to use, or intentionally providing or attempting to provide, unauthorized materials, information, or assistance in any academic exercise.” This includes any group efforts on assignments or exams unless specifically approved by the professor for that assignment/exam. Evidence of fabrication or plagiarism, as defined by the University in its brochure *Academic Integrity*, will also result in downgrading for the course. STUDENTS WHO CHEAT ON ANY ASSIGNMENT OR DURING ANY EXAMINATION WILL BE ASSIGNED A FAILING GRADE FOR THE COURSE.

Therefore avoid all appearance of improper behavior! Students who witness cheating should report the incident to the instructor as soon as possible. Students are also welcome to discuss any concerns related to cheating with the instructor.

“Academic dishonesty ... tends to compromise the academic integrity of the institution or subvert the education process. All forms of academic dishonesty are prohibited at Wayne State University, as outlined in the Student Due Process Policy.” -- from *Academic Integrity: Important Information for Faculty and Students*