ECE 5325 Syllabus, Fall 2005

No: ECE/AET 5325

Title: Smart Sensors & Fuel Cell.

Credits: 4

WSU Catalog Description:
Prereq: Senior standing in a BS program. This is a 4-credit hour graduate course designed preliminarily for Masters and undergraduate senior students. The course will hold 2 2-hour lectures per week. This course is a required course for both the Graduate Certificate Program and the Masters Degree Program in Alternative Energy Technology in the College of Engineering.

Coordinator:  Pepe Siy, Professor of Electrical and Computer Engineering.

Instructor: Pepe Siy, Professor of Electrical and Computer Engineering
Office Hours: 12:00 Noon – 3:00 PM, Wed & Thu
Office: 3125 Engineering Building
Phone: (313) 577-3841, Email: psiy@ece.eng.wayne.edu
Course Website: http://webpages.eng.wayne.edu/~cadence/ECE5325 Smart Sensors & Fuel Cell

Lecture Meeting Time & Location:
9/7/05 – 10/19/05: Location: 0289 MANO, Time: 3:30-5:20, Wednesday
10/26/05-12/14/05: Location: 2409 Engg. Bldg, Time: 3:30-5:20, Wednesday

Lab Meeting Time & Location:
9/7/05 – 10/19/05: Location: 3350 Engg Bldg, Time: 3:30-5:20 Thursday 3:30-5:20. Friday

TA: Wei Zhang, ECE Ph.D. student (Weeks 1-7)
Office Hours: 2:20 – 3:30 PM, Thu & Fri
Phone: (313)577-5796, Email: wzhang@eng.wayne.edu
10/26/05-12/16/05: Location: Unix Lab 2nd Floor Engg Bldg
Time: 3:30-5:20, Thursday 3:30-5:20. Friday

TA: Zhen Yang, ECE Ph.D. student (Weeks 8-15)
Office Hours: Thursday 2:30 – 3:30pm, Friday 12:30-1:30 pm
Office: 3355 Engg. Bldg. (Across Lab 3350)
Phone: 248-890-9001, Email: ae6876@wayne.edu

Goals: This course provides the knowledge of the multi-domain simulation platform that will enable engineer to study complex systems such as fuel cells, mems, automotive power distribution systems.

Learning Objectives: After completing this course, students should be able to do the following:
1. Simulate any real world systems using differential algebraic equations (DAEs) for continuous
models
2. Provide the knowledge of the multi-domain simulation platform that will enable engineer to study complex systems such as fuel cells, mems, automotive power distribution systems, using VHDL-AMS language (an IEEE standard).
3. Simulate, synthesize, and layout a complete VLSI chip ready for fabrication, using CADENCE CAD tools.

Textbook: Handouts posted on the Web

Reference Texts: none

Prerequisites by Topic: none

Corequisites by Topic: none

Topics:

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<tr>
<th>Week</th>
<th>Session</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Three Laws of Thermodynamics and Fuel Cell(Ch 1)</td>
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<td>2</td>
<td>1</td>
<td>Introduction to Analog Mixed Signal Simulation Language: VHDL(Ch 2)</td>
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<td>2</td>
<td>3</td>
<td>Introduction to Analog Mixed Signal Simulation Language: VHDL-AMS(Ch 2)</td>
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<td>SIMPLORER Environments(Lab 1)</td>
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<td>VHDL &amp; VHDL-AMS Object Classes and Data Types (Ch 3)</td>
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<td>Creating Automotive Electrical Load Model with Different Architectures (Lab 2)</td>
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<td>Packages and Libraries: Creating Shareable Models (Ch 4)</td>
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<td>Creating Automotive Battery Model (Lab 3)</td>
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<td>Model Structure for Digital &amp; Analog Systems(Ch 5): VHDL Operators (Ch 6)</td>
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<td>10</td>
<td>Automotive Powertrain and Alternator Modeling (Lab 4)</td>
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<td>Structural Modeling (Ch 7); Multi-Domain Modeling: Electrical, Mechanical, Thermal (Ch8)</td>
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<td>6</td>
<td>12</td>
<td>12V/42V DC-DC Converter Modeling and Design (Lab 5)</td>
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<td>7</td>
<td>13</td>
<td>Mid-Term</td>
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<td>14</td>
<td>Automotive Dual (12V/42V) Power Distribution Systems Simulation with Various Loading Conditions (Lab 6)/MEM accelerometer</td>
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### Assessment Methods:

**Homework and Assignments** –
- Reading assignments from course handouts and materials from internet pages.

**Laboratory Components** -
- 12 lab sessions (20%)
  - Lab must be completed on the week assigned. Late lab is penalized @ 10% per day excluding weekend.

**Course Projects and Open Ended Problems** –
- Lab project (20%)

**Examinations** -
- One midterm (30%), Take home final (30%)

### Grading Scale:

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<thead>
<tr>
<th>Grade</th>
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<tbody>
<tr>
<td>A</td>
<td>&gt;=95</td>
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<td>A-</td>
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<td>F</td>
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### 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.

### Attendance:

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.

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.

Policy on Cheating: It is the policy of the Electrical and Computer Program 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. Please refer to the “Expectations for Citation in Biomedical Engineering" handout (attached and available on the web) and to the Departmental recommended book on scientific writing, for guidance. 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

Outcome Coverage:

(a) An ability to apply knowledge of mathematics, science, and engineering. The laboratory exercises and exams require knowledge of mathematics, science, and engineering to successfully complete the course.

(b) An ability to design and conduct experiments, as well as to analyze and interpret data. Students are presented with large-scale simulation problems. The student must design the experiments so that it can be simulated within the constraint of the student version software package. In addition, students must analyze the results for accuracy.

(c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. Students learn the process of VLSI chip fabrication through MOSIS. The chip are designed to achieve a design specifications.

(d) An ability to function on multi-disciplinary teams. Students learn multi-domains simulation and modeling using VHDL-AMS. Students work in multi-disciplinary type projects.

(e) An ability to identify, formulate, and solve engineering problems. Students are presented with
engineering problems, like MEMS accelerometer, which require the knowledge of how to convert mechanical acceleration to electrical signal for measurement.

(i) A recognition of the need for, and an ability to engage in life-long learning. Students are exposed to multi-disciplinary type of projects requiring continuous and life-long learning. The students need to learn new discipline to conduct and complete projects.

(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Students learn the skills in creating VLSI layout using state of the art CAD tools (CADENCE software package), learned multi-domain simulation using VHDL-AMS for conducting research in multi-disciplinary project, like sensors in biomedical applications. Learned electronic circuits simulation using SPICE.

Prepared By: Pepe Siy, Professor of Electrical and Computer Engineering

Last Revised: September 14, 2005