ECE 3580 Syllabus, Fall 2005

Course No: ECE 3580

Title: Electronics Laboratory

Credits: 2 (LCT: 1 LAB: 3)

WSU Catalog Description:
Coreq: ECE 3580. Open only to students enrolled in professional Engineering programs. Experimental investigation of semiconductor devices and their behavior in single-stage amplifier, pulse, and power circuits. Design of simple single-state circuits. Material fee as indicated in the schedule of class.

Coordinator: Dr. Yong Xu, Assistant Professor of Electrical and Computer Engineering.

Instructor: Huan Zhang, GTA of Electrical and Computer Engineering
Office Hours: Friday 12:00—1:00PM, or by appointment
Office: 3330 Eng Building
Phone: (313) 577-4933, Email: ar2709@wayne.edu
Course Meeting Time: Fridays 1:00PM - 5:00PM, 09/06/2005 - 12/22/2005
Course Meeting Location: 3350 Eng Building

Goals: To develop competence in analysis, design, testing and troubleshooting of simple electrical circuits. To prepare students for more advanced courses in circuit analysis.

Learning Objectives: At the end of this course, students will be able to:

1. Measure simple passive electrical circuit parameters
2. Construct various types of electrical circuits (i.e., Operational amplifiers, rectifiers)
3. Analyze experimental data to verify various laws and theorems of electrical circuits
4. Use oscilloscopes and others instruments to monitor and collect experimental data
5. Measure characteristics of some semiconductor devices (i.e., Diode, Bipolar transistor, MOSFET)

Textbook: Laboratory Explorations for Microelectronics Circuits, Fourth Edition
Kenneth C Smith

Reference Texts: none

Prerequisites by Topic: (ECE 3300): Electrical quantities, waveforms, Ohm's law, Kirchhoff's laws, nodal and mesh analysis, Thevenin's theorem and other network theorems.

Corequisites by Topic: (ECE 3570): Open only to students enrolled in professional engineering programs. Graphical and small signal analysis of semiconductor devices; equivalent circuits; gain and bandwidth; multi-state and feedback amplifiers; special-purpose circuits.

Topics:

1. Week 1 Lab 1: Getting started: Instruments and Measurements
2. Week 2 Lab 2: Junction Diode and Zener Diode Characteristics.
<table>
<thead>
<tr>
<th>Week</th>
<th>Lab</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.</td>
<td>Lab 3: Inverting and Non Inverting Amplifiers.</td>
</tr>
<tr>
<td>4.</td>
<td>Lab 4: Differentiators and Integrators.</td>
</tr>
<tr>
<td>5.</td>
<td>Lab 5: Bipolar Transistor Basics.</td>
</tr>
<tr>
<td>6.</td>
<td>Lab 6: Applications of Amplifiers, Junction and Zener Diodes</td>
</tr>
<tr>
<td>7.</td>
<td>Lab 7: Power Supplies.</td>
</tr>
<tr>
<td>8.</td>
<td>Lab 8: MOSFET Measurements &amp; Applications/ Project practice.</td>
</tr>
<tr>
<td>9.</td>
<td>Review all labs</td>
</tr>
<tr>
<td>10.</td>
<td>Exam</td>
</tr>
<tr>
<td>11.</td>
<td>Lab practice for your project (make an appointment in advance).</td>
</tr>
<tr>
<td>12.</td>
<td>Project Demonstrations</td>
</tr>
</tbody>
</table>

**Course Structure:** We will cover one experiment each week. Experiment report is a group work. All reports are due in the following lab session. No late submission will be accepted unless the student notifies the instructor ahead of time showing some reasons for not being able to submit the report on time.

**Lab Report Format:**

1. Front page must display:
   a. Date experiment is performed.
   b. Experiment Number.
   c. Name, Student ID and Group Members.

2. Lab report must contain the following:
   a. Objective.
   b. Components used specifications.
   c. Procedure.
   d. Circuit diagram and graphs.
   e. Observation.
   f. Analysis

**Computer Resources:** Multisim2001 Software Package, PSPICE

**Laboratory Resources:** Resistor Boxes, Prototyping board, DC Power Supply, Function Generator, Oscilloscope, Multimeter.

**Laboratory Policy:** There is absolutely no smoking: eating or drinking in any ECE instructional lab. These labs must be kept neat and each student is responsible for insuring that the equipment on his/her workbench is neatly arranged, the leads and other equipment are put away, and that there are no scraps of paper or other garbage left on or near his/her work station. Coats, briefcases: Knapsacks and other personal belongings are not permitted on or near the benches. These items must be kept on the coat rack near the door, not on the benches, or on the floor near the benches. The door to the lab must be kept locked at all times; unlocking or propping open the door at any time is expressly forbidden. Guests are not permitted in the lab at any time, and no one but the instructor may open the door to admit anyone after the class has begun. *(For further laboratory policies, please look at the laboratory manual.)*

**Equipment Handling Policy:** All students are expected to handle all the equipments in the lab in an
appropriate manner. Mishandling of any equipment will subject to the student being reported to the department.

**Distribution of Points:** Quizzes 20% (10% for each), Exam 25%, Project 25%, Reports 30% of the Final Grade.

**Grading Scale:**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>94-100</td>
</tr>
<tr>
<td>A-</td>
<td>88-93</td>
</tr>
<tr>
<td>B+</td>
<td>81-87</td>
</tr>
<tr>
<td>B</td>
<td>75-80</td>
</tr>
<tr>
<td>B-</td>
<td>70-74</td>
</tr>
<tr>
<td>C+</td>
<td>65-69</td>
</tr>
<tr>
<td>C</td>
<td>60-64</td>
</tr>
<tr>
<td>F</td>
<td>0-59</td>
</tr>
</tbody>
</table>

**Attendance:** You are expected to attend every lab session in its entirety. Do not schedule other classes or commitments that conflict with any part of the time during which your lab section is scheduled. Attendance is recorded and will be used in determining your grade. For each lab session you miss, two (2) points (out of hundred points) will be deducted from your FINAL LAB AVERAGE. In no case will a lab report be accepted for a section for which you were not present. Doing the experiment in another session is expressly forbidden. You may not use another section to "make up" a section for which you were absent. Since arriving late and leaving early are disruptive to the lab, 1/2 point (out of 100 points) will be deducted from your FINAL LAB AVERAGE for each occurrence. Admittance to the lab will begin about 10 minutes before the scheduled starting time and it is suggested that you plan to arrive at least 10 minutes early to facilitate your inventory, and to avoid losing point for being late.

**Schedule:** Quiz#1: 4\textsuperscript{th} week of classes, Quiz#2: 8\textsuperscript{th} week of classes, Final: last week of classes. Exact dates will be announced later on during the semester. All students must take the quizzes and the exams on the scheduled dates. If a student thinks that he/she can't take the quizzes or the exams on the scheduled dates due to some unavoidable circumstances, such as out of town, business trip, sickness, etc., then he/she must notify the instructor before the scheduled exam time. In that case the instructor may give a makeup exam to the student. **NO MAKEUP EXAMS WILL BE GIVEN AFTER A STUDENT HAS TAKEN AN EXAM.**

**Outcome Coverage:**

(a) An ability to apply math, science and engineering knowledge. The laboratory exercises, quizzes and exams require direct application of mathematical, scientific, and engineering knowledge to successfully complete the course. This requires performing various circuit analysis and design methods in a formal manner and many supporting and follow-up calculations.

(b) An ability to design and conduct experiments, as well as to analyze and interpret data. Students conduct simple circuit experiments and process raw data to verify electronic theories.

(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. A project (25% of the final grade) is required for this course. Students are responsible to design and test an electronic system by themselves and meet the need of real world. Any novel ideas are
highly appreciated and praised.

(e) **Identify, formulate and solve engineering problems.** The course is primarily oriented toward electrical circuit analysis but also includes examples of where circuit theory can be applied to other physical domains to model the system. Students must be able to identify the system, formulate a circuit model, and solve the circuit model to determine circuit variables, primarily with electrical circuits. Final design project is given as a set of specifications that the students’ design must meet. Therefore, they must identify the key limiting issues, formulate a solution strategy, research and test their approach, and finally prototype and test the design to prove that it works.

(h) **The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.** In the lecture part of this course, up-to-date technologies will be introduced and explained to deliver the objectives of each laboratory. And the final project will function, too. Student will think seriously about how engineering changed the real world and propose their ideas to let technology serve the people better.

**Cheating Policy and Penalty for Cheating:** The students should not copy each others reports. During examination times no talking and passing papers or other items among the students will be allowed. The instructor will give an overall grade of F (Fail) to a student if that student is caught with any kind of cheating.

**Note:** Students who do not complete the course work, and fail to officially withdraw from the course will receive an X, an I, or an F depending upon how much course work was completed.

**Prepared By:** Huan Zhang, GTA of Electrical and Computer Engineering

**Last Revised:** September 7, 2005