Instructor: James G. Harris, Building 20, Room 305, 756-5708, jharris@calpoly.edu
Office Hours: M, W 10:10-12:00pm
F 10:10-11:00pm
Others available by arrangement

Section 01: Lecture: MWF 8:10am - 9:00 pm  Bldg: 192  Room: 224
Lab: Tuesday 8:10am - 11:00 am  Bldg: 20  Room: 121

Section 03: Lecture: MWF 9:10am-10:00 am  Bldg: 14  Room: 246
Lab: Tuesday 12:10pm - 3:00 pm  Bldg: 20  Room: 121

Course Description:
Design, implementation and testing of programmable logic microprocessor-based systems. Hardware/Software tradeoffs (such as timing analysis and power considerations), system economics of programmable logic and microprocessor-based system design and interfacing hardware components (such as ADCs/DACs, sensors, transducers).

Course Learning Objectives:
1. To be able to determine the best type of digital system, either hardware or microprocessor-based systems.
2. To develop the skills necessary to design, implement, and test programmable logic based systems.
3. To develop the skills necessary to design, implement, and test microprocessor-based systems.
4. To know and evaluate HW/SW system performance tradeoffs such as timing and power dissipation.
5. Determine and evaluate system economics.
6. To develop the skills necessary to interface hardware components (such as switches, switch arrays, programmable I/O interfaces, real-time clocks, counters, ADCs/DACs, sensors, and transducers) to microprocessor-based systems.
7. To develop the skills necessary to work efficiently with partners and participate in the design and development process.

Prerequisite: EE 307/347 (implied CPE 129/169, CPE 229/269, CSC 101, EE 306/346)

Course Format:
This is a combination lecture/lab course in which the lectures and labs are closely integrated and coordinated. The labs are run as “open labs” so that students can work on their projects outside of scheduled lab hours. Lab projects must be electronically submitted on or before the due date for full credit.

Primary Textbook and Lab Manual:
1. CPE 329 Course Reader and Lecture Notes.
CPE 329 Programmable Logic and Microprocessor-Based Systems Design

Spring Quarter 2007

References:

Homework:
There is no formal homework for this course that will be collected and graded. We may give some homework problems or take home quizzes to help prepare students for the in class quizzes and exams.

Labs:
The lab component of this course consists of 4 lab experiments and a final design project. Students will work in groups of two on the lab experiments and final design project. In order to nurture an inter-disciplinary laboratory experience, students are encouraged to select partners from majors other than their own. Students are required to read the lab manual experiment description and reference material before coming to lab. There will likely be lab quizzes at the beginning of lab that will cover the lab reading and knowledge needed to work on the current lab assignment. Students are encouraged to read the lab and prepare themselves for a productive lab period. Due dates for all the lab projects are listed in the course schedule.

Your lab report should include source code, simulation results, wiring schematics, a brief discussion of the algorithms you developed, conclusions, and comments regarding the experiment. Detailed procedures are not required. More details on the lab report are listed on the cpe-329 website. Each group is required to submit a complete working copy of their lab project files so that the instructor or lab assistant can synthesize, compile, download and test your project to verify if it meets the design requirements. Lab project files and reports must be submitted electronically on time to receive full credit for each experiment and the final project. Each group must zip their project files and lab report and electronically submit the zipped file for grading by 11:59pm on the due date. Late lab submissions will be penalized 10% per day for the four days following the due date. Experiments that are submitted after 4 days will receive no credit. If a student would like to have a lab regraded they must fill out the “Regrade Request Form” within one week from the time the graded lab was initially handed back.

You will be required to demonstrate your working final design project during the last lab session of the quarter. Both partners must be present during the lab demonstrations. During your demonstration you and your partner will explain your project to the class and the team will be asked oral questions by the instructors and students to demonstrate your understanding of the project. Either of the lab partners should be able to answer any of the questions. The demonstration, report, and oral questions will determine the grade for the final design project.

Grading Policy: (Tentative)

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<tr>
<td>Quizzes and Participation</td>
<td>5%</td>
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<td>Lab Experiments</td>
<td>35%</td>
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<td>Midterm Exam</td>
<td>25%</td>
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<td>Final</td>
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Spring Quarter 2007

Quizzes:
Pop quizzes will be given in lecture and lab to test the students understanding of material presented in lecture, lab, or the reading. Students are responsible to read the online laboratory experiments before coming to lab and preparing themselves for the lab projects. Quiz questions may be asked on assigned reading in the lab manual which includes the experiment description and reference materials. In addition, participation credit may be given to those that attend and participate in lecture.

Exams:
There will be a midterm exam and a comprehensive final exam. The exams will include material you are responsible for learning in class, from the textbook or from the lab experiments. Dates for the scheduled exams are listed below in the course schedule. If a student would like to have an exam or quiz regraded they must fill out the “Regrade Request Form” within one week from the time the graded material was initially handed back.

Earning your Grade:
The Venn diagram below depicts the manner in which topics are presented in the course. You will be exposed to some material in lecture, some through reading assignments, and some in lab. Test questions are not limited to any one area and may come from anywhere in the Venn diagram. For example, an exam question may come from a topic addressed only in lecture, or may come from a topic addressed in the reading and lab but not in lecture. Additionally, you may be tested on the application of a topic not covered in lecture, the reading or lab.

In order to complete the exams, you must be able to quickly work through problems. This ability comes with practice. Work through the sample problems on your own. Read the textbook. Learn how to read and understand data sheets. Work through examples from lecture. Reread the textbook. Know the underlying theory.

Course Body of Knowledge

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### Tentative Schedule

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<tr>
<th>Wk</th>
<th>Topic</th>
<th>Lab Projects</th>
<th>Exams</th>
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<tr>
<td>1</td>
<td>Course Introduction and Overview&lt;br&gt; – Lecture 1 Notes&lt;br&gt; Introduction to Digital System Design&lt;br&gt; – Lecture 2 Notes&lt;br&gt; – Supplemental Chapter 1&lt;br&gt; Programmable Logic&lt;br&gt; – Lecture 3 Notes&lt;br&gt; – Supplemental Chapter 2</td>
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<td>2</td>
<td>Embedded Systems (The MicroBlaze Processor, General Purpose I/O, Bus Read &amp; Write Cycles, and the LCD)&lt;br&gt; - Lecture 4 Notes</td>
<td>Lab #1 “VHDL Digital Clock”&lt;br&gt; Due 1 October 2007</td>
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<td>3</td>
<td>Xilinx Embedded Developers Kit&lt;br&gt; – Lecture 5 Notes</td>
<td>Lab #2 “Hello World”&lt;br&gt; Due 8 October 2007</td>
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<td>4</td>
<td>MicroBlaze Architecture, ISA, and Interrupts&lt;br&gt; – Lecture 6 Notes&lt;br&gt; Timers and Counters&lt;br&gt; – Lecture 7 Notes</td>
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<td>5</td>
<td>Timers and Counters Continued</td>
<td>Lab #3 “uP Clock”&lt;br&gt; Due 22 October 2007</td>
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<td>6</td>
<td>Analog-to-Digital and Digital-to-Analog&lt;br&gt; – Lecture 8 Notes&lt;br&gt; Exam Review and Exam</td>
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<td>Midterm Friday&lt;br&gt; October 26, 2007</td>
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<td>7</td>
<td>Serial I/O and Programmable Input &amp; Output&lt;br&gt; – Lecture 9 Notes</td>
<td>Lab #4 “Analog I/O”&lt;br&gt; Due 5 November 2007</td>
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<td>8</td>
<td>Other I/O Devices&lt;br&gt; – Lecture 10 Notes</td>
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<td>9</td>
<td>Other Peripheral Devices (Memory and SPI)&lt;br&gt; – Lecture 11 Notes&lt;br&gt; Holiday Monday 11 November 2007</td>
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<td>10</td>
<td>Power and Energy Consumption&lt;br&gt; – Lecture 12 Note&lt;br&gt; Holiday Wed-Fri 21-23 November 2007</td>
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<td>11</td>
<td>Microcontroller Survey&lt;br&gt; – Lecture 13 Notes&lt;br&gt; Ethics (Therac-25 Case Study)&lt;br&gt; – Lecture 14 Notes</td>
<td>Lab #5 “Project”&lt;br&gt; Demo in last Lab Period. Report Due 3 December 2007</td>
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<td>12</td>
<td>Finals Week (see finals schedule)</td>
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<td>Final Exam</td>
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