ELC 363 (0 .5 CU)
COMPUTER ENGINEERING LABORATORY I

Course Information **Professor: Orlando Hernandez**
Fall 2015
Section L1: M 5:30PM–8:10PM/AR148
Section L2: W 5:30PM–8:10PM/AR148

Course Description:
Hands on laboratory experience to reinforce the concepts covered in ELC 451. Students will do projects involving computer data-path design, micro-code and finite state machine control, and memory and I/O subsystem analysis and design.

Instructor Information:
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Office Hours:
Mondays 3:30 PM - 4:50 PM
Tuesdays 9:30 AM - 10:50 AM
By appointment (send me email)
And whenever my office door is open

Textbook:
No specific text; same as ELC 451, and class/lab manual handouts, and software tools and equipment user and reference manuals.

Corequisite:
Computer Architecture & Organization (ELC 451)

Grading Policy:
Six Labs @ 10% each = 60%
Two Labs @ 20% each = 40%
Grand Total 100%
Labs are handed out at least two weeks before they are due. Due dates are to be announced in class.

Tips for Success:
You do not have to wait until the schedule lab time to do your labs.
Do not procrastinate.
Be neat and organized in your lab reports.
Do not be shy about asking questions, either during class or outside of the class.

College Level Policies:
Attendance Policy: http://www.tcnj.edu/~recreg/policies/attendance.html

Academic Integrity Policy: http://www.tcnj.edu/~academic/policy/integrity.html

Americans with Disabilities Act (ADA) Policy: http://www.tcnj.edu/~affirm/ada.html

Educational Objectives

(What TCNJ ECE engineers should be able to accomplish during the first few years after graduation)

- To contribute to the economic development of New Jersey and the nation through the ethical practice of engineering;
- To become successful in their chosen career path, whether it is in the practice of engineering, in advanced studies in engineering or science, or in other complementary disciplines;
- To assume leadership roles in industry or public service through engineering ability;
- To maintain career skills through life-long learning.

Electrical and Computer Engineering Student Outcomes

(What TCNJ Electrical and Computer Engineering students are expected to know and be able to do at graduation. What knowledge, abilities, tools and skills the program gives the graduates to enable them to accomplish the Educational Objectives)

The Student Outcomes listed below are expected of all graduates of the Electrical or Computer Engineering Program.

ECE graduates will have:

a. an ability to apply knowledge of mathematics, science and engineering;
b. an ability to design and conduct experiments, as well as to analyze and interpret data;
c. an ability to design a system, component, or process to meet desired needs;
Students do design in all labs.
d. an ability to function in multidisciplinary teams;
e. an ability to identify, formulate and solve engineering problems;
Students solve engineering problems in all labs.
f. an understanding of professional and ethical responsibility;
g. an ability to communicate effectively;
Students write formal lab reports with a strong written component.
h. the broad education necessary to understand the impact of engineering solutions in a global and societal context;
i. a recognition of the need for and an ability to engage in life-long learning;
j. a knowledge of contemporary issues;
k. an ability to use the techniques, skills and modern engineering tools necessary for engineering practice;
Students use Verilog, Xilinx ISE, and FPGA devices.

Course Objectives:*

Objective 1	To become familiar with a Hardware Description Language (HDL). [c, e, g, k]
Objective 2	To become familiar with a Field Programmable Gate Array design system. [c, e, g, k]
Objective 3	To understand the various tradeoffs associated with different styles of HDL coding. [c, e, g, k]
Objective 4	To implement various CPU controls. [c, e, g, k]
Objective 5	To explore cache and virtual memory, and I/O-related performance issues in relation to microprocessor system design [c, e, g, k]

Topics Covered:

1. Register Transfer Languages, VHDL or Verilog programming
2. CPU Design
3. Control Unit Design
4. Computer Arithmetic, IEEE Floating Point Standards
5. Memory Organization – Physical vs. Cache, Virtual Memory
6. Input/Output Organization

Evaluation:

A. Project Assignments

Performance Criteria:**

Objective 1	Students will learn how to program in a hardware description language. [A]
Objective 2	Students will author the major components of a microprocessor. [A]
Objective 3	Students will be able to apply digital design principles to machine design. [A]
Objective 4	Students will apply reasoning techniques to the solution of a micro-system design problem. [A]

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* Small letters in brackets refer to the Student Outcomes

** Capital letters in brackets refer to the evaluation methods used to assess student performance

ELC 363: ADDITIONAL INFORMATION

1. DESCRIPTION OF DESIGN ACTIVITY

In this course, students will do at least three design activities from the following list: design of arithmetic modules for microprocessors, design of micro-code for a microprocessor, design of a finite state machine controller for a microprocessor, analysis of cache memory controller schemes, and design of a cache memory controller.

2. ENGINEERING STANDARDS

Verilog or VHDL.

3. REALISTIC CONSTRAINTS

Economic: The cost reduction impact of Very Large Scale Integration (VLSI) semiconductor circuits in the price and performance of modern computers is covered in this course.
Environmental: The impact of smaller and more powerful computers that require less electrical power is discussed in light of the environmental benefits of electronic equipment that requires less energy and less physical space.
Sustainability: Different models for implementing computer control are discussed. These are hardwired and micro-programmed. The different sustainability levels for these models are discussed.

4. MODERN AND PROFESSIONAL ENGINEERING TOOLS USAGE

In terms of engineering tools, students get to use C/C++ Visual Integrated Development Environment to analyze cache memories, and the Xilinx design package for Field Programmable Gate Arrays (FPGAs), which student use to design and simulate the digital logic and controllers design assignments of the course.

5. COMPUTER USAGE

Students use computers to run the engineering tools, and to prepare reports on design assignments.

6. FEEDBACK MECHANISMS

Design Reports: Students are graded on design reports, which include not only the technical aspects, but also the level of communication skills. There are at least three design assignments.