ECE481/581 – Digital Systems Design Lab
ABET Syllabus

Catalog Data: ECE 481/581: Digital Systems Design Lab. One (1) credit hour. Logic design and simulation via hardware description languages, use of electronic design automation tools, and CPU design.

Prerequisite: ECE 383. Corequisite: ECE 480 (ECE580 for ECE581). Prerequisite topics: Each student is expected to have a working knowledge of logic design, microprocessor hardware, and assembly language programming.

Textbook: (Optional) P. Chu, Embedded SOPC Design with NIOS II Processor and VHDL Examples, Wiley, 2011.

Contact Hours and Additional Course Information:

The course meets in an open lab environment with a regular minimum of 150 minutes of lab contact per week. The course is required in the electrical engineering program and is required in the computer engineering option.

Relationship of Course Toward Meeting ABET Student Outcomes:

The course supports instruction for Student Outcomes C, E, and K as required by ABET Criterion 3 and ABET Program Criteria. The relationships are indicated in the Course Learning Objectives.

The course does not include direct assessment for Student Outcomes.

Course Learning Objectives:

The overall course objective is to teach computer engineering students digital systems design with emphasis on a hardware description language approach. At the end of this course, students are expected to:

1. Use techniques, skills and modern engineering tools for large-scale digital systems design including (Outcome K):
    a. Simulation and synthesis of all laboratory/project assignments.
2. Design a system, component, or process to meet needs (Outcome C):
    a. Implement existing SSI and MSI digital circuits with a hardware description language.
    b. Design combinational circuits of increasing complexity according to a stated functional behavior.
    c. Design sequential circuits of increasing complexity according to a stated functional behavior.
    d. Integrate existing digital system cores into larger, more complex designs to meet a specified need/requirement.
    e. Design various arithmetic circuits (both combinational and sequential) for specific needs.
    f. Integrate previously designed components into a large-scale system to meet specified requirements.
3. Apply electronic design automation software to analyze operation and performance of fundamental combinational and sequential circuits. (Outcome K)
    a. Analyze operation and performance of all laboratory/project assignments.
4. Identify, formulate and solve engineering problems in digital systems including (Outcome E):
    a. Design of simple SSI and MSI combinational and sequential circuits for a targeted problem.
    b. Design of a simple microprocessor using a hardware description language and electronic design automation tools.
    c. Design of a, student-specified, digital system integrating the components designed in previous assignments.

Student Outcome Measure Assessments:

The course does not include direct assessment for Student Outcomes.

Contribution of Course to Meeting the ABET Professional Component:

- Skills required, used, and developed include an understanding of digital systems design and test.
- Estimated Content: Engineering Design: 1 credit

Relationship of Course to Program Educational Objectives:

The course supports Program Objective 1 by increasing the ability to identify, formulate, and solve engineering problems; using modern engineering techniques and tools.

Topics Covered During Class:

1. QUARTUS II VHDL Design and Simulation for Combinational and Sequential Circuits
2. Finite State Machine Designs
3. Memory-Based Designs
4. DE Microprocessor Design
5. VHDL-based Video Display Controller
6. NIOS II Processor designs
7. Integrating the DE Processor with Video Display
8. NIOS II Processor and Qsys Component Development

Prepared by: Jeff Jackson Date: 8/2/2015