EE 568 – VHDL: Digital System Design - 3 hours
Elective Course

1. *2007-2008 Catalog description*
   A structured guide to the modeling of the design of digital systems, using VHDL, a hardware description language. VHDL is designed to fill a number of needs in the design process. It allows description of the structure of a system, and the specification of the function using familiar programming language forms. As a result it allows the design of a system to be simulated and synthesized.

2. *Prerequisites by topic*
   a Fundamental of logic design, including both combinational and sequential circuits.
   b Programming experience using a modern high-level language such as C.
   c Basic computer organization..

3. *Textbook (s) and/or other required material*
   Required : Digital System Design Using VHDL , Charles H. Roth, Jr.,Thomson, 2nd Edition, 2008.
   All course material is posted on Blackboard allowing online student access.

4. *Class/Laboratory Schedule*
   Two sessions per week, each 75 minutes, for 14 weeks plus 2 hour final time slot.

5. *Topics Covered (Outcomes influenced)*
   - Review of Logic Design Fundamentals: Combinational Logic, Boolean algebra, Karnaugh Maps, Sequential circuit timing. (7 a)
   - VHDL hardware description language: Computer-aided design, VHDL modules, process, Data type, operators, libraries, variable, signals, constants, array, loop, delay , simulator, function, procedure, attributes, overloaded operator, generics, generate statements. (7 a , c, d, f, e, f)
   - Introduction to programmable logic devices: simple programmable logic devices, complex programmable logic devices (CPLD) , and field-programmable gate arrays(FPGA). (7 a, b)
   - VHDL design examples for different applications (7 c , d, e, f, g)
   - FPGA architecture and designs with FPGAs (7 c, d)
   - State machine chart and microprogramming (7 g)
   - Hardware testing and design for testability (7 h)

6. *Contribution of course to meeting the curriculum components*
   Engineering Science - 40%, Engineering Design - 60%

7. *Course Outcomes (Program Outcome contributions): In learning the course topics, the student will attain the following outcomes*
   a The students will understand the logic design fundamentals and the timing in sequential circuits. (9A, B, C, D)
   b The students will understand the basic principles in the construction of the programmable devices and how to design with FPGAs (9A, B, C, D)
   c. The student will use computer-aided design tools to synthesize, map, place, routing, and download the digital designs on the FPGA board.
   d The student will develop synthesizable VHDL codes to implement digital systems and test bench VHDL file for the system simulation.(9A,B,C,D)
   e. The student will implement different digital systems: code conversion, traffic light controller, high-speed adder/subtractor, error correcting coding, data encryption/decryption on the FPGA board (9A, B, C, D)
   f. The student will work on an individual project and implement it on the FPGA board. (9A,B,C,D)

g. The student will use state machine chart and microprogramming technique to write VHDL code for digital systems.
h. The student will understand the hardware testing and design for testability.

8. *Grading policy and criteria:*

There will be two exams, each with 100 points, and a comprehensive final exam worth 200 points. In addition to the exams, there will be 6 labs and 1 project, worth 100 points. The final grade will be based on a curve utilizing total points scored. In addition to the exams, the students must also submit an one-page reading assignment discussing a contemporary technical issue related to course material. Students will not receive a passing grade without the submission of the reading assignment. A grade of B- corresponds to meeting the minimum competency required to understand course topics and attain course outcomes.

9. *Relationship of course to program outcomes*

label	Program Outcomes (A Graduate from the program will:)	Contribution
A	have knowledge of the mathematical and scientific foundation of electrical engineering	Strong
B	have knowledge of and the ability to apply techniques and technology of electrical engineering	Strong
C	complete a design project sequence, culminating in a capstone project at or near the professional level	Moderate
D	understand that acquisition of new knowledge is needed for success in the electrical engineering profession	Moderate
E	meet Bradley's general education requirements which are based on the principles of liberal education	NA
F	have experience in communicating technical information and working on teams	Foundational
G	understand the importance of professional and ethical behavior	Moderate

10. *Prepared by*: Yufeng Lu 03/15/2008