STATE UNIVERSITY OF NEW YORK COLLEGE AT NEW PALTZ
DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

45230 – DIGITAL LOGIC FUNDAMENTALS – FALL 2007
COURSE SYLLABUS

INSTRUCTOR: MICHAEL OTIS
OFFICE: REH 201
OFFICE HOURS: Monday: 4:00PM – 5:00PM
Tuesday: 4:00PM – 5:00PM
Wednesday: 4:00PM – 5:00PM
Thursday: 4:00PM – 5:00PM
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COURSE DESCRIPTION:
The principal goal of this course is to provide an introduction to digital logic analysis and design, which is the basis for computer hardware development. The student, at the completion of the course, should be able to analyze and design logic circuits by understanding formal foundations and selected design techniques. The course is made of three main topics. The first topic examines the number representations used in today's digital systems and discusses their arithmetic properties and conversion techniques. The second topic deals with combinational switching theory. Here, students learn to analyze and synthesize networks of digital elements in which no feedback is present. The third subject area deals with analysis and design of clocked sequential circuits, in which feedback is present. An introduction to modern programmable logic devices and their programming languages (schematic capture and VHDL) is also presented.

COURSE OBJECTIVES:
- Students will learn the number representations used in today's digital systems and their arithmetic properties and conversion techniques.
- Students will learn to analyze and synthesize networks of combinatorial, digital logic elements.
- Students will learn to analyze and design digital, clocked sequential circuits.
- Students will enhance professional writing and participate in a teamwork process by performing engineering design using modern computer tools and writing a corresponding technical report.

REQUIREMENTS:
Textbook: Digital Design (4th Ed.), Mano/Ciletti, Prentice Hall, 2007,
ISBN 0-13-198924-3

GRADING:

- Mid-term Exam 1 20%
- Mid-term Exam 2 20%
- Final Exam 20%
- Project 20%
- Homework/Quizzes 20%

COURSE OUTLINE:

1. Binary Systems.

Digital Systems. Binary Numbers. Number Base Conversions. Octal and Hexadecimal Numbers. Complements. Signed Binary Numbers. Binary Codes. Binary Storage and Registers. Binary Logic.

2. Boolean Algebra and Logic Gates.

Basic Definitions. Axiomatic Definition of Boolean Algebra. Basic Theorems and Properties of Boolean Algebra. Boolean Functions. Canonical and Standard Forms. Other Logic Operations. Digital Logic Gates. Integrated Circuits.

3. Gate-Level Minimization.

The Map Method. Four-Variable Map. Five-Variable Map. Product of Sums Simplification. Don't-Care Conditions. NAND and NOR Implementation. Other Two-Level Implementations. Exclusive-OR Function. HardwareDescriptionLanguage (HDL).

4. Combinational Logic.

Combinational Circuits. Analysis Procedure. Design Procedure. Binary Adder/Subtractor. Decimal Adder. Binary Multiplier. Magnitude Comparator. Decoders. Encoders. Multiplexers. HDL for Combinational Circuits.

5. Synchronous Sequential Logic.

Sequential Circuits. Latches. Flip-Flops. Analysis of Clocked Sequential Circuits. HDL for Sequential Circuits. State Reduction and Assignment. Design Procedure.

6. Registers ad Counters.

Registers. Shift Registers. Ripple Counters. Synchronous Counters. Other Counters. HDL for Registers and Counters.

TUTORIALS:

- **Xilinx ISE Tutorial**
- **Tutorial (to simulate and verify the design)**
- **Tutorial to Download to Digilab II Board**
- **Xilinx State Editor Tutorial**
- **ModelSim Tutorial**