

ENG EC311 Introduction to Logic Design  
Fall 2009

**2009 Catalog Data:**

Coreq: ENG EK 307. Introduction to hardware building blocks used in digital computers. Boolean algebra, combinatorial and sequential circuits: analysis and design. Adders, multipliers, decoders, encoders, multiplexors. Programmable logic devices: read-only memory, programmable arrays. Counters and registers. Fundamental design and verification skills using Verilog HDL and FPGAs. Includes lab. 4 cr.

**Class/Lab Schedule:**

LEC: 4 hrs/wk, LAB 2 hrs/wk,

**Textbooks and other required materials:**

Digital Design by F. Vahid, Wiley 2007;

Verilog for Digital Design by F. Vahid and R. Lysecky, Wiley, 2007

**Reference:**

Randy H. Katz, Gaetano Borriello, Contemporary Logic Design, Second Edition, Prentice Hall, December 2005

**Coordinator:**

Mark Karpovsky, Professor, ECE department

**Prerequisites by topic:**

Prereq or coreq: ENG EK 307 Introductory Circuit Theory

**Goals:**

To provide students with:

- An understanding of the basic tools of logic design
- An understanding of sound design methodologies
- An experience with hardware implementation and the use of CAD tools

**Course Outcomes:**

As an outcome of completing this course, students should be able to:

- 1) *Understand* the applications of logic design
- 2) *Understand* abstraction and hierarchy in digital design
- 3) *Understand* what components are available for logic design
- 4) *Understand* the use of Boolean algebra in logic analysis and design
- 5) *Understand* logic minimization criteria and methods for use in design
- 6) *Understand* the concept of state in digital systems
- 7) *Design* combinational digital logic systems given specifications
- 8) *Design* sequential digital logic systems (finite state machines) given specifications
- 9) *Implement* logic designs in hardware and with CAD tools
- 10) *Discover* component availability and data using the Internet or other resources

### Course Outcomes mapped to Program Outcomes:

<b>Program:</b>	<b>a</b>	<b>b</b>	<b>c</b>	<b>d</b>	<b>e</b>	<b>f</b>	<b>g</b>	<b>h</b>	<b>i</b>	<b>j</b>	<b>k</b>
<b>Course:</b>	1-6	7-9	7-9	7-9	1-10	10	9	10	1-2,10	10	7-10
<b>Emphasis:</b>	5	5	5	3	5	3	3	3	4	3	5

1=not at all; 5=a great deal;

- (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 within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- (d) an ability to function on multidisciplinary teams
- (e) an ability to identify, formulate, and solve engineering problems
- (f) an understanding of professional and ethical responsibility
- (g) an ability to communicate effectively
- (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, 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.

### Topics in Project Assignments:

Lab 0: Xilinx ISE tool tutorial;

Lab 1: Truth table and Logic simplification

Lab 2: Variable Boolean function generator

Lab 3: 7-Segment LED Decoder

Lab 4: 4-Bit Adder

Lab 5: 3-Bit Counter

Lab 6: Refreshing Control of 7-Segment LEDs

Lab 7: Interactive Counter

Group project topics: Calculator; Number Puzzler; Scrolling LED display; PS/2 Keyboard; Playing Card Dealer; Reaction Time Timer; PingPong; Reversi; Loggin System; Word Guess

### Contribution of Course to Meeting the Professional Component:

Engineering topics: 100%

Math & Basic Science: 0%

General Education: 0%

### Status of Continuous Improvement Review of this Course:

**Date Last Reviewed:** September 22, 2009

**Reviewed by:** Mark Karpovsky

**Prepared by:** Mark Karpovsky, Professor

**Date:** September 22, 2009