Department of Electrical and Computer Engineering
University of Massachusetts, Amherst

ECE 221: Introduction to Digital and Computer Systems

Fall 2016

(Required Course for EE and CSE)

Catalog Data: The theory of digital circuits and computer systems stressing general techniques for the analysis and synthesis of combinational and sequential logic systems. Limited to EE and CSE majors

Prerequisite: None

Instructors: Maciej Ciesielski (lectures) and Neal Anderson (discussions)

Textbook: M. M. Mano, M. D. Ciletti, *Digital Design*, 5th ed., Prentice Hall, 2012.

Objectives: Introduction to digital design and its application in the field of electrical and computer engineering. Students completing this course will be able to design and analyze digital electronic circuits. They will learn basics of Boolean algebra that forms the theoretical foundation on which these circuits are built; how information can be represented in a digital system and what common logic functions are used to process it; how to aggregate circuits into larger components to create complex designs; and how to use software tools that will aid you in the process of design and analysis of these circuits. Students will experience the convergence of these goals at the end of the semester when the functionality of a simple microprocessor is discussed.

Topics covered:

- Number Systems and Number Codes
- Binary Logic, Boolean Algebra, and Boolean Functions
- Canonical Forms and Duality
- Karnaugh Maps
- Incompletely Specified Functions
- NAND and NOR Implementations of Digital Logic
- Combinational Circuits (Binary Adders, Subtractors, Multipliers, Decoders and Encoders, Multiplexers, and Comparators)
- Sequential Circuits (Latches and Flip-Flops, Registers, Counters)
- Sequential Circuit Analysis
- Finite State Machines, Sequential Circuit Design
- Timing Analysis
- Memories (RAM, ROM)
- Programmable Logic
- Arithmetic and Logic Units (ALU)
- Design at the Register Transfer Level (RTL)

Schedule: (Weekly workload for students: two 75-minute lectures, one discussion)

Lecture: MW 2:30 - 3:45 PM
Discussion Sections: Tu 10:00-11:15; 11:30-12:45, and 2:30-3:45

Grading policy: Exam I: 25%, Exam II: 25%, Final Exam: 30%, Homework: 20%

Professional Component: Credits of engineering science: 2 Credits of design: 1

Relationship of course objectives to program outcomes:

PROGRAM OUTCOMES	COURSE OBJECTIVES			
	1	**2**	**3**	**4**
a. Able to apply knowledge of mathematics, science, and engineering	Y	Y	Y	Y
b. Able to design and conduct experiments, as well as to analyze and interpret data	N	N	N	Y
c. Able to design a system, component, or process to meet desired needs within realistic constraints	N	N	N	N
d. Able to function on multi-disciplinary teams	N	N	N	N
e. Able to identify, formulate, and solve engineering problems	N	N	N	N
f. Understands professional and ethical responsibility	N	N	N	N
g. Able to communicate effectively	N	N	N	N
h. Understands the impact of engineering solutions in a global, economic, environmental, and societal context	N	N	N	N
i. Recognizes the need for, and is able to engage in, life-long learning	N	N	N	N
j. Has knowledge of contemporary issues	N	N	N	N
k. Able to use the techniques, skills and modern engineering tools necessary for engineering practice	N	N	N	Y