EE 2301 Introduction to Digital System Design

Updated: Feb. 2 2013

This course outline is to serve as a reference for instructors and students. It gives a general overview of course content and ABET Outcomes. Please consult the semester specific syllabus produced by the course instructor for more detailed information.

Course Prerequisites, Basic Content, and Outcomes

Catalog Description
(4.0 cr; Prereq-MATH 1272 or MATH 1372 or MATH 1572; fall, spring, every year)
Boolean algebra, logic gates, combinational logic, logic simplification, sequential logic, design of synchronous sequential logic, VHDL modeling, design of logic circuits. Integral lab.

Contact Hours:
3 hours of lecture, 1 hour of discussion and 2 hours of laboratory per week.

Text:
Fundamentals of Logic Design Sixth Edition with CD, Charles H. Roth, Jr. & Larry Kinney

Prerequisites by Topic:
Mathematical thinking at the calculus level (Math 1272, 1372, or 1572)

Course Outcomes:
1) An understanding of Boolean algebra sufficient to design combinational and sequential logic circuits.
2) An understanding of logic gates and their properties such as fanin, fanout, high and low voltage ranges, and noise margins.
3) An ability to design combinational logic circuits, multilevel as well as two-level circuits.
4) An ability to use standard minimization techniques for two-level logic circuits including algebraic minimization, Karnaugh maps, Quine-McCluskey algorithm, and prime implicant tables.
5) An ability to model combinational logic circuits using a design language such as VHDL.
6) An ability to design combinational logic circuits using basic programmable logic devices: ROMs, PLAs, and PALs.
7) An understanding of basic combinational logic modules, such as encoders, decoders, and multiplexors, and how to design combinational logic using such modules.
8) An ability to analyze combinational logic circuits for hazards.
9) An understanding of asynchronous sequential circuits sufficient to analyze flip-flops at the gate level
10) An ability to analyze synchronous sequential circuits using next-state equations, transition tables, and state tables.
11) An ability to model and analyze synchronous sequential circuits using a design language such as VHDL.
12) An ability to design synchronous sequential circuits using basic flip-flops.

13) An understanding of basic sequential logic modules, such as counters and shift registers and how to design sequential logic using such modules.
14) An ability to design sequential logic circuits using basic programmable logic devices: ROMs, PLAs, and PALs.

Relationship to Student Outcomes:
In accordance with ABET accreditation criteria, all engineering programs must demonstrate that their students achieve certain outcomes. This list of outcomes may be found on the ABET.org website. Of the outcomes listed in the ABET criteria (enumerated as (a) through (k)), this course teaches skills which help the student achieve the following outcomes:

(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
(e) an ability to identify, formulate, and solve engineering problems
(i) a recognition of the need for, and an ability to engage in life-long learning
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Course Outline

Week	Lecture Topics
1	Introduction, Number Systems and Code; Boolean algebra; binary logic and switching networks, boolean algebra, canonical forms
2	Boolean algebra
3	Two-level circuit design and minimization
4	NAND and NOR gate networks, Multilevel
5	Faults and hazards
6	Combinational logic design with MSI devices
7	Programmable Logic
8	Intro and analysis of sequential logic
9	Design of synchronous sequential circuits
10	Sequential circuit modules: counters and shift registers
11	Sequential design with programmable logic
13	Design with ASM charts
14	Review

Departmental and University Policies

Student Academic Integrity and Scholastic Dishonesty: Academic integrity is essential to a positive teaching and learning environment. All students enrolled in University courses are expected to complete coursework responsibilities with fairness and honesty. Failure to do so by seeking unfair advantage over others or misrepresenting someone else's work as your own, can result in disciplinary action. The University Student Conduct Code defines scholastic dishonesty as follows:

*Scholastic Dishonesty***:** Scholastic dishonesty means plagiarizing; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement; altering forging , or misusing a University academic record; or fabricating or falsifying data, research procedures, or data analysis.

Within this course, a student responsible for scholastic dishonesty can be assigned a penalty up to and including an "F" or "N" for the course. If you have any questions regarding the expectations for a specific assignment or exam, ask.

Incompletes: A grade of I for Incomplete is given at the discretion of the course instructor when, due to extraordinary circumstances, the student who has successfully completed a substantial portion of the course's work with a passing grade was prevented from completing the work of the course on time. Students must fill out an Incomplete Grade Agreement form found in Keller 3-166. The maximum time to remove and replace an incomplete grade is one year.

Makeup Work for Legimate Absensces: Consult university policy here: http://policy.umn.edu/Policies/Education/Education/MAKEUPWORK.html

Personal Electronic Devices: Consult university policy here: http://policy.umn.edu/Policies/Education/Education/CLASSROOMPED.html

Mental Health: As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. University of Minnesota services are available to assist you with addressing these and other concerns you may be experiencing. You can learn more about the broad range of confidential mental health services available on campus via the Student Mental Health Website at http://www.mentalhealth.umn.edu