

EE/CMPEN 416 – Digital Integrated Circuits

Designation: Ee elective course for electrical and computer engineering majors.

University Bulletin Description: EE/CSE 416: (3) Analysis and Design of digital integrated circuit building blocks, including logic gates, flip-flops, memory elements, analog switches, multiplexers and converters.

Prerequisites: CMPEN 271, EE 310.

Prerequisites by Topics:

1. Linear circuit analysis
2. Understanding the techniques of both large-signal and small-signal circuit analysis
3. Understanding the device characteristics and limitations of both MOSFET's and BJT's.
4. Proficiency in the use of PSpice for circuit analysis
5. Proficiency in the use of basic test equipment (oscilloscope, function generator, power supply)

Textbook:

Analysis & Design of Digital Integrated Circuits Third Edition, David A. Hodges, Horace G. Jackson & Resve Saleh, Mcgraw-Hill, 2004, ISBN# 0-07-228365-3

Learning Outcomes:

This course provides education in digital circuit analysis and design to electrical and computer engineering majors. Students should be able to do the following upon completion of this course:

1. Analyze and design basic digital circuits, particularly with applications to combinatorial logic gates, sequential logic and regenerative logic circuits
2. Further improve their circuit simulation skills (e.g. PSpice) for the analysis of logic circuits
3. Develop teamwork skills for working effectively in groups

Topics:

1. Semiconductor BJT's & Diode Logic Circuits
2. MOSFET Structure & Mathematical Modeling Equations
3. MOSFET Logic Circuits
4. Regenerative Logic Circuits
5. Analog-to-Digital & Digital-to-Analog Converters
6. Semiconductor Memories

Class/laboratory schedule: Two 75-minute classes and one 2-hour laboratory per week.

Computer usage:

1. Pspice is used to facilitate analysis and design of digital circuits in the laboratory
2. Laboratory Assignments require circuit simulation.
3. Word processing is used in preparing both the lab reports and the design project report

Laboratory Assignments:

Laboratory Experiments with MOS digital circuits involve the use of basic test equipment (digital oscilloscope, function generator, power supply) and of MOS IC's.

1. Simple Inverters
2. All Discrete & Integrated MOSFET Inverters
3. MOSFET & BJT Inverters Driving a Load
4. Oscillator Signal Distribution
5. MOSFET Transmission Gates, Series Analog Switches & Domino Logic

Contribution to Meeting the Requirements of Criterion 5. Curriculum:

This course contributes to both the engineering topics and design components.

This course provides a design emphasis in the area of digital electronics. It provides a solid background for graduate level courses in digital design.

Relationship to Program Outcomes:

- O.1.1. Graduates will possess mathematics skills necessary for electrical engineering.
- O.1.3. Graduates will have attained computer proficiency.
- O.2.1. Graduates will understand how to analyze and design simple electrical/electronic circuits.
- O.2.2. Graduates will understand electronic devices.
- O.2.5. Graduates will have knowledge of digital systems.
- O.3.1. Graduates will have in-depth technical knowledge in one or more areas of specialization.
- O.3.2. Graduates will have practical understanding of the major electrical engineering concepts and demonstrate application of their theoretical knowledge of the concepts.
- O.4.1. Graduates will interact with industry both within and outside of a classroom setting.
- O.5.1. Graduates will have good teamwork skills.

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