ELEC3400 Introduction to Integrated Circuits and Systems

Course Description

This course presents an overview, applications, fundamentals and design flow of the state-of-the-art integrated circuits (IC) and systems. Course contents include fabrication process; diodes, bipolar transistors and MOS transistors and modes of operations; and fundamental of analog, digital and mixed-signal IC design. *Prerequisite(s):* ELEC 2400 OR ELEC 2410 (prior to 2016-17)

List of Topics

Lecture Outline

Week 1 Introduction to Integrated Circuits and Systems
Week 2 Basics of solid-state devices and IC fabrication; Brief review of PN junction properties
Week 3 Bipolar Junction Transistor (BJT) operation, IV Characteristics & biasing
Week 4 BJT small-signal model and 1-transistor amplifier design
Week 5 Metal-Oxide-Semiconductor Field Effect Transistor (MOSFET) operation, IV Characteristics & biasing
Week 6 MOSFET small-signal model and 1-transistor amplifier design
Week 7 Common-emitter amplifier, Common-base amplifier, Emitter Follower
Week 8 Common-source amplifier, Common-source amplifier, Source Follower
Week 9 Differential amplifier design and introduction to op amp design
Week 10 Current mirrors, active load, two-stage op amp design
Week 11 Op amp applications: Filters, ADCs, DACs, Oscillators
Week 12 Introduction to digital circuits and CMOS logic
Week 13 MOS memory storage circuits

Laboratory Outline

1. AM Radio Receiver (Week 3-4)
2. MOSFET Characterization (Week 6-7)
3. MOS Single Transistor Amplifier (Week 10-11)
4. CMOS Logic Characterization (Week 12-13)

Statement of Objectives/Outcomes:

On successful completion of this course, students will be able to:

CO1 - recognize the operations of diodes and transistors in integrated circuit functional blocks and systems.

CO2 - distinguish and employ large-signal analysis and small-signal analysis in analyzing a circuit.

CO3 - analyze and design basic CMOS analog and digital building blocks and simple mixed-signal systems.

CO4 - analyze, design and debug analog and digital circuit building blocks.

CO5 - apply software tool, such as Pspice, to design, simulate and analyze integrated circuit functional blocks.

Textbook(s):

R. Jaeger and T. Blalock, *Microelectronic Circuit Design*, 4th Edition, McGraw Hill, 2011

Reference Books/Materials:

A.S. Sedra and K.C. Smith, *Microelectronic Circuits*, 5th ed., New York, Oxford University Press, 2004.

Relationship of Course to Program Outcomes:

Please refer to the Report Section 4.3.2 (iii).

Grading Scheme:

Homework	5%
Laboratory	20%
Mid-Term Examination	25%
Final Examination	50%

*Lab. Assessment weighting: Pre lab 30% Lab performance 20% Lab report 50%