EEE 335 Analog and Digital Circuits (4) [F,S]

Course Description:
Analog, digital microelectronic circuits and systems. amplifiers, frequency response, gate sizing, timing analysis, sequential digital circuits.

Lecture, Laboratory. Pathway course, required by all majors and minors.

Prerequisite:
EEE 334.

Textbook:
A.S. Sedra and K.C. Smith, *Microelectronic Circuits*, 6th Edition, Oxford University Press.

Supplemental Materials:
PSpice for Windows, books from various authors.

Coordinator:
Profs. Hugh Barnaby and Sule Ozev

Prerequisites by Topic:
1. DC and small signal AC analysis of semiconductor circuits.
2. MOSFET and junction diode models.
3. Understanding of ideal op-amp operation.
4. Inverters and basic CMOS gates

Course Objective:
Students can analyze basic building blocks of analog and digital microelectronics circuits and systems. Students will understand sizing impact of MOSFET and BJTs on circuit performance.

Course Outcomes:
1. Students will be able to design and analyze combinatorial and sequential logic gates and will learn transistor sizing for digital performance.
2. Students will be able to design and analyze midband and high frequency response of common source, common gate, source follower, cascade, and differential amplifiers.
3. Students will analyze Miller effect and its use in compensation.

Course Topics:

Topics	**Suggested Time**	**Book Section**
MOS Operation Review	1 week	Chap 5
Digital Circuits (Inverter, Logic Gates): VTC, Noise Margins, Prop Delay, etc.	2 weeks	Chap 13
Advanced Digital Circuits	2 weeks	Chap 14, 15

Single Stage MOS Amplifiers Low Frequency/Midband Review	1 week	Chap 9.1
Bode Plots	1 week	Instructor's choice
High Frequency Small Signal MOSFET and CS amplifier	2 weeks	Chap 9.2, 9.3
High Frequency Analysis Methods	1 week	Chap 9.4, 9.5
CG and Source Follower HF response	1 week	Chap 9.6, 9.7
Cascode Amplifier Operation and HF Response	1 week	Chap 7.3, 9.6
Differential Amplifier Operation and HF response	2 weeks	Chap 8.1, 8.2, 9.8
Two Stage Operational Amplifier or Feedback (optional)	1 week	Chap 8.6 or 11.1-11.3

Computer Usage:
Cadence simulation of AC and DC circuits.

Laboratory Experiments:
Students meet weekly for a three-hour laboratory under the guidance of a TA.

Lab #1 Cadence Tutorial (weeks 3 & 4)
Lab #2 Inverter DC and dynamic response (weeks 5 & 6)
Lab #3 Design and Analysis of CMOS Gates (weeks 7 & 8)
Lab #4 Design and Analysis of Common Source Amplifier with Active Load (weeks 9 & 10)
Lab #5 Design of a differential amplifier with active and passive loads (weeks 11 & 12)

Assessment:
Through homeworks, quizzes, tests, project and final exam.

Course Contribution to Engineering Science and Design:
EEE 335 contributes to engineering science through electronic circuit analysis, problem solving, computer solutions, and applications of mathematics and physics.

Course Relationship to Program Objectives and ABET Outcomes:
a: Basic circuit analysis is a fundamental skill needed in industry Differential equations and physics backgrounds are utilized.
e: Students are taught problem solving methodologies and some modeling concepts.
d: Laboratory teams feature various engineering majors.
k: PSpice and modern laboratory equipment and contemporary circuit analysis techniques provide a broader perspective and techniques for problem solving.

Person preparing this description and date of preparation: Bertan Bakkaloglu, K. Tsakalis, Apr. 2009.
Updated May 2011 S. Ozev, H. Barnaby