Course: EENG 4339–CMOS Analog Integrated Circuits (Elective)

Syllabus

Catalog Description:
CMOS device characteristics, fabrication, and modeling; CMOS analog subsystems (switches, current sources, and voltage references), amplifiers, and voltage comparators.

Prerequisites: EENG 4309, EENG 4109

Credits: 3 hours lecture, 0 hours laboratory per week

Text(s): Behzad Razavi, Design of Analog CMOS Integrated Circuits

Additional Material: Access to PSpice

Course Coordinator: David M. Beams

Topics Covered:
1. CMOS device electrical characteristics;
2. CMOS fabrication processes;
3. Modeling of MOS devices;
4. CMOS switches;
5. MOS voltage references;
6. MOS current sources and current mirrors;
7. CMOS amplifiers and operational amplifiers.

Evaluation Methods:
1. Examinations / Quizzes
2. Homework
3. Report
4. Computer Programming
5. Project
6. Presentation
7. Course Participation
8. Peer Review

Course Objectives:
By the end of this course students will be able to:
1. Describe the I-V characteristics of MOS transistors operating in triode and saturation regions [2];
2. Describe the processing steps in the fabrication of CMOS devices [2];
3. Model MOS devices operating in both triode and saturation regions[2];
4. Design CMOS analog switches [2];
5. Analyze and design CMOS voltage references [2];
6. Analyze and design CMOS current sources and current mirrors [2];
7. Analyze and design CMOS operational amplifiers [2];

¹Numbers in brackets refer to method(s) used to evaluate the course objective.
Relationship to Program Outcomes (only items in dark print apply)\(^2\): This course supports the following Electrical Engineering Program Outcomes, which state that our students will:

1. have the ability to apply knowledge of the fundamentals of mathematics, science, and engineering (2) [1-7];
2. have the ability to use modern engineering tools and techniques in the practice of electrical engineering (2) [3-7];
3. have the ability to analyze electrical circuits, devices, and systems (3) [5-7];
4. have the ability to design electrical circuits, devices, and systems to meet application requirements (3) [4-7];
5. have the ability to design and conduct experiments, and analyze and interpret experimental results;
6. have the ability to identify, formulate, and solve problems in the practice of electrical engineering using appropriate theoretical and experimental methods;
7. have effective written, visual, and oral communication skills;
8. possess an educational background to understand the global context in which engineering is practiced, including:
   a. knowledge of contemporary issues related to science and engineering;
   b. the impact of engineering on society;
   c. the role of ethics in the practice of engineering;
9. have the ability to contribute effectively as members of multi-disciplinary engineering teams;
10. have a recognition of the need for and ability to pursue continued learning throughout their professional careers.

\(^2\)Numbers in parentheses refer to the degree to which this course supports the listed Electrical Engineering Program Outcome. 1=minor support; 2=significant support; 3=major support. Numbers in brackets refer to course objective(s) that address the Program Outcome.

Contribution to Meeting Professional Component: (in semester hours)

<table>
<thead>
<tr>
<th>Contribution Area</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics and Basic Sciences</td>
<td>0</td>
</tr>
<tr>
<td>Engineering Sciences and Design</td>
<td>3</td>
</tr>
<tr>
<td>General Education Component</td>
<td>0</td>
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Prepared By: David M. Beams  Date: 30 Aug 2010