California State University, Bakersfield (CSUB)
Department of Electrical & Computer Engineering & Computer Science
ECE 3070: Analog Circuits

Instructor
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Office: Room 320, Science Building III
Office hours: Wednesday 1:30PM – 3:30PM

Lecture and Lab Sections
Lecture: Tuesday 11:30AM - 12:45PM, Science III, Room 313
Lecture: Thursday 11:30AM - 12:45PM, Science III, Room 240
Lab.: Wednesday 10:00AM - 12:30PM, Science III, Room 313

Prerequisite
MATH 2510, MATH2520, PHYS/ENGR 2070.

Required Textbook

Supplementary Textbook:

Course Description
Design, construction, and debugging of analog electronic circuits, fundamental semiconductor device characteristics including diodes, MOSFETs and bipolar transistors (BJT); small and large signal characteristics and design of linear circuits. Diodes, filters, oscillators, transistors, op-amps, and basic analog circuit design, broadband applications in networking and communications.

Course Objectives/Outcomes
At the end of this course, students should be able

1. To explain the basic operation of semiconductor devices, including diodes, BJT transistors, and field-effect devices.
2. To model semiconductor circuits, including, diode circuits, transistor circuits, multi-stage amplifiers, operational amplifiers, current drivers, and interface circuits.
3. To analyze and evaluate semiconductor circuits and to come up with the solutions to overcome real-world problems and constraints.
4. To simulate analog circuit using computers and electronic design automation (EDA) software.

List of Topics
- Overview on Electric Circuits (Week 1-2)
Course Syllabus

- Operational Amplifiers (Week 3-5)
- Semiconductors (Week 6-7)
- Diodes (Week 8-9)
- The MOS Field-Effect Transistor (MOSFET) (Week 10-12)
- The Bipolar Junction Transistor (BJT) (Week 13-15)

**Homework**
Homework will be assigned on a bi-weekly basis, covering the material discussed in class. It is due at the beginning of class on every other Tuesday. Problems in each homework will be graded on the following basis: a correct answer gets 100%, a reasonable attempt gets 50%, and no attempt or a very poor attempt gets 0%.

**Late policy:** No late submissions will be accepted, as solutions will be posted on the day after it is due.

**Laboratory**
The laboratory of this course consists of a set of experiments to complement the material covered in the class. The experiments are based on the textbook introduced for the course. In each lab session, students will conduct two experiments from the list below.

**Lab Experiments list**

**CHAPTER 2 Operational Amplifiers**
- Lab 2.1 Inverting Op-Amp Configuration
- Lab 2.2 Non-Inverting Op-Amp Configuration
- Lab 2.3 Difference Amplifier
- Lab 2.4 Instrumentation Amplifier
- Lab 2.5 Lossy Integrator
- Lab 2.6 Lossy Differentiator

**CHAPTER 4 Diodes**
- Lab 4.1 Diode I-V Transfer Curve
- Lab 4.2 Fun with Diodes I: Rectifiers
- Lab 4.3 Fun with Diodes II: Limiting and Clamping Circuits

**CHAPTER 5 MOS Field-Effect Transistors (MOSFETs)**
- Lab 5.1 NMOS I-V Characteristics
- Lab 5.2 PMOS I-V Characteristics
- Lab 5.3 NMOS at DC
- Lab 5.4 PMOS at DC

**CHAPTER 6 Bipolar Junction Transistors (BJTs)**
- Lab 6.1 NPN I-V Characteristics
- Lab 6.2 PNP I-V Characteristics
- Lab 6.3 NPN at DC
- Lab 6.4 PNP at DC
Course Syllabus

Attendance in lab is mandatory.

Grading
Your final grade will be the weighted average of the homework, Lab, one midterm exam, and the final exam, as calculate from the formula below:

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignments</td>
<td>10%</td>
</tr>
<tr>
<td>Labs</td>
<td>20%</td>
</tr>
<tr>
<td>Midterm exam 1</td>
<td>15%</td>
</tr>
<tr>
<td>Midterm exam 2</td>
<td>15%</td>
</tr>
<tr>
<td>Final exam</td>
<td>40%</td>
</tr>
</tbody>
</table>

Grade Distribution
A: 100-93         B+: 89-87    C+: 79-77    D+: 69-67   F : Below 60
A-: 92-90         B : 86-83    C : 76-73    D : 66-63   B- : 82-80
B- : 82-80        C- : 72-70   D- : 62-60

Accessibility:
California State University, Bakersfield attempts to guarantee access to all classes by all students. Students can find CSUB's accessibility policies and services by going to the website for the Office of Services for Students with Disabilities. In addition, E-Learning Services at CSUB has its own policy for guaranteeing access to students in online classes:

"California State University, Bakersfield is committed to providing equal access to Web-based information for people with disabilities. This is in accordance with Section 504 of the 1973 Rehabilitation Act, Section 508 of the Rehabilitation Act Amendment of 1998 and the 1990 Americans with Disabilities Act, and Executive Order 926 of California State University."

To achieve the goal of universal accessibility, CSUB uses Blackboard as its Learning Management System (LMS), the first LMS to receive the Nonvisual Accessibility Gold Certification by The National Federation of the Blind. Students can read more about Blackboard's guarantee of accessibility and its accessibility programs at its website.

Technical Requirements and Support:
All of the lectures in this class were given in PDF. Adobe Acrobat Reader is available on every computer on the CSUB campus. If students have difficulty with the content of the class, they need to contact the instructor. If students are having any technical problems with Blackboard, or loading the IPA fonts from Blackboard to their own computers, then students need to contact the Blackboard Help Desk, either by telephone (661) 654-2315 or by email lmssupport@csub.edu. Students may also go to the E-Learning Services Building on the east side of the Walter Stiern Library.

Academic Misconduct:
"ACADEMIC DISHONESTY (CHEATING) is a broad category of actions that use fraud and deception to improve a grade or obtain course credit. Academic dishonesty (cheating) is not limited to examination situations alone, but arises whenever students attempt to gain an unearned academic advantage. PLAGIARISM is a specific form of academic dishonesty (cheating) which consists of the misuse of published or unpublished works of another by claiming them as one’s own. Plagiarism may consist of handing in someone else’s work, copying or purchasing a composition, using ideas, paragraphs, sentences, phrases or words written by another, or using data and/or statistics compiled by another without given appropriate citation. Another example of academic dishonesty (cheating) is the SUBMISSION OF THE SAME, or essentially the same, PAPER or other assignment for credit in two different
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courses without receiving prior approval.” (California State University, Bakersfield Catalog, p.57) In such cases as the above, I will rigorously enforce the University’s policies as set forth in the California State University, Bakersfield Catalog.

Harassment Policy:
Written or spoken statements that can be construed as harassment will not be tolerated and will be reported to the appropriate university office for proper legal investigation and action. This includes, but is not limited to, comments based on race, ethnic origin, religious preferences, gender, disability, or sexual orientation.

Reasonable Accommodations Policy: Any student in this course who has a disability that may prevent him or her from fully demonstrating his or her abilities should contact the Disability Center as soon as possible. I will fully comply with the Center’s recommendations, given the proper documentation.

Classroom Etiquette:
Out of self-respect and respect for others I expect that during lectures or class activities you will refrain from (1) text messaging and receiving cell phone calls, unless there is an emergency, (2) private conversations, (3) reading material for another class, doing crossword puzzles, etc., (4) leaving the classroom during the lecture, and (5) start packing up your belongings before the class is over. Such behavior other than being disrespectful is very disruptive and students who engage in it will be asked to leave the classroom. NOTE: If you need to leave the classroom during the lecture for a serious reason, or you are expecting a phone call due to an emergency let me know in advance.

Class Meeting Cancellation:
In the event that a class meeting is to be cancelled, you will be notified through: (1) an announcement in class prior to the cancellation, (2) an announcement posted on Blackboard, and/or (3) an official notice posted on the classroom door the day of the cancellation. Any cancellation notice posted on the classroom door that is not on official departmental letterhead and not signed by the department chair or the department administrator should be considered fake, and will NOT excuse you from the day’s meeting and assignments. NOTE: The above are designed to discourage potential forgers (individuals who have no real concern or respect for their fellow students and the predicament they may be placing them under). Unfortunately, such safeguards may not always be foolproof. So, if there is a class cancellation of which I have not personally notified you, always check with the department’s administration office.

Make-ups:
In general, make-ups will not be allowed. However, if you miss an exam or a quiz for reasons that were beyond your control (illness, car accident, death in the family) AND you wish to make them up, you must contact me either before class or as soon as possible afterwards. The make-up may be granted upon presentation of proper documentation (a doctor's note, receipt from the mechanic, funeral program; signed notes from family members do NOT count as proper documentation). Failure to do so will result in a zero grade for the missed assignment. NOTE FOR STUDENT-ATHLETES: If you miss an exam or a quiz due to an athletic meeting AND you wish to make them up, your coach MUST send me an email verifying that you indeed attended/participated in the meeting. Simply providing me with a list of the meetings you are required to attend in the beginning of the quarter will NOT suffice. If the athletic meeting you plan on attending is the day your paper is due, you should turn it in before the meeting. Failure to follow my request will result in a zero grade for the missed assignment(s). The final exam is NOT open to the make-up policy. Please make sure you make your holiday plans according to the Finals Schedule.