

**Department of Mechanical Engineering**  
University of California, Santa Barbara,  
ME 6 BASIC ELECTRICAL AND ELECTRONIC CIRCUITS (Winter 2016)

**Instructor:** Dr. Kyriakos G. Vamvoudakis

**Classroom:** Webb Hall, Room 1100, Mon and Wed 12:00pm-12:50 pm

**Office and Office Hours:** By appointment at Room 5156, Harold Frank Hall

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**TA Names and Office Hours:** Jin Kim (hkim00@engr.ucsb.edu), EII 2218 Wed. 9:00am-11:00am

Marcela Areyano (m\_areyano@engr.ucsb.edu), EII 2218 Mo. 1:15pm-3:15pm

Mike Garcia (mikegarcia@engr.ucsb.edu), ESB 2413 Mo. 4:00pm-5:00pm

Matthew Kim (matthew\_kim@engr.ucsb.edu), EII 3361 Th. 2:00pm-3:00pm

**Lab Manager:** Trevor Marks (tmarks@engr.ucsb.edu)

### **Course Description**

The course has been designed to introduce fundamental principles of circuit theory commonly used in engineering research and science applications. Techniques and principles of electrical circuit analysis including basic concepts such as voltage, current, resistance, impedance, Ohm's and Kirchoff's law; basic electric circuit analysis techniques (e.g. Methods of Analysis and Transformations, Thevenin and Norton Equivalent circuits), operational amplifiers, first order circuits, filters, second order circuits.

### **Course Prerequisite**

Physics 3-3L and Mathematics 3C or 4A (open to ME majors only)

### **Text, References & Software**

*Title: Fundamentals of Electric Circuits 5th Edition*

Authors: Charles Alexander, Matthew Sadiku

Publisher: McGraw-Hill Higher Education, 2012

ISBN 0077575911, 9780077575915

### **Course Learning Outcomes**

To develop problem solving skills and understanding of circuit theory through the application of techniques and principles of electrical circuit analysis to common circuit problems.

Specifically:

- 1) Apply knowledge of linear differential equations and basic physics to circuit design.
- 2) Ability to conduct electronics experiments using laboratory equipment, analyze data.
- 3) Ability to design op-amp circuits to implement amplifiers and sensors interfaces.
- 4) An understanding of professional and ethical responsibility in lab team environments.
- 5) An ability to communicate effectively with lab reports.

### **Topics Covered**

- Kirchoff's and Ohm's laws. DC analysis
- Circuit elements; independent and dependent sources, R, L, C
- Methods of Analysis including Nodal, Mesh, Source transform and Superposition principles
- Thevenin and Norton equivalent circuit
- Operational amplifiers and application circuits
- Impedance; low pass, high pass filters
- First order circuits
- Second order circuits
- AC analysis and frequency response

### **Class/Laboratory Schedule:**

1 hr 40 minutes/week.

3 hours/week

### **Course Assignments**

Weekly homework and lab reports.

- ✓ **Homework:** is due at the beginning of the class on the due date. Solutions to the home-works will be posted on the web at the time that they are due. Therefore NO LATE HOMEWORK will be accepted. Best 5 out of 7 Homework will count towards your grade.
- ✓ **Lab:** Prelab questions are due at the beginning of the lab session and will count for 20% of your lab grade

### **Grading Policy**

Homework – 10% (5 out of 7 sets, 2% each)

Lab - 24% (8 sets, 3% each)

Mid Term – 26%

Final Examination – 40%

### **Contribution of the course to meeting requirements of Criterion 5 - Curricular Requirements**

This course contributes to item (b), in that it counts as four (4) units of an engineering science topic appropriate to the student's field of study, mechanical engineering.

### **Relationship to Program Objectives**

This course most closely ties into program outcome, that a student should possess a solid foundation in, and be able to apply the principles of, mathematics, science, and engineering to solve problems and have the ability to learn new skills relevant to the discipline. This course prepares students to integrate basic electronic components in mechanical systems. In particular they learn the function of electronic devices and interfaces to sensors. This course also prepares students to work with laboratory equipment in laboratories and provides students with a solid background in basic circuit theory and devices to that they can take the FE examination.

**Course Policies:** 1. NO CELL PHONES are allowed during lecture. 2. Be on time to class. Tardy is discouraged. 3. No late assignments will be accepted. Medical or family emergency will be considered on case-by-case basis. 4. No make-up exams/quizzes. If you miss the exam, a zero score will be assigned to the missed exam/quiz. No electronic devices other than a calculator will be allowed. 5. If you miss a class due to personal emergency or medical reasons, please be sure to inform the instructor by e-mail. 6. Homework assignments are to be submitted by the due date. You may discuss homework problems with your classmates, but you are responsible for your own works. 7. You are encouraged to read the sections in the textbooks related to the covered topics prior to the lecture as well as after. 8. After an assignment grade has been posted online, students must see the instructor within one week if they wish to discuss the assignment and their work. 10. University's rules on academic honesty concerning exams and individual assignments will be strictly enforced.

**Statement:** a. Each student in this course is expected to abide by the University of California, Santa Barbara's Academic Honesty Policy. Any work submitted by a student in this course for academic credit will be the student's own work. b. You are encouraged to study together and to discuss information and concepts covered in lecture and the sections with other students. You can give "consulting" help to or receive "consulting" help from such students. However, this permissible cooperation should never involve one student having possession of a copy of all or part of work done by someone else, in the form of an e mail, an e mail attachment file, or a hard copy. Should copying occur, both the student who copied work from another student and the student who gave material to be copied will both automatically receive a zero for the assignment. Penalty for violation of this Policy can also be extended to include failure of the course and University disciplinary action. c. During examinations, you must do your own work. Talking or discussion is not permitted during the examinations, nor may you compare papers, copy from others, or collaborate in any way. Any collaborative behavior during the examinations will result in failure of the exam, and may lead to failure of the course and University disciplinary action.

**Accommodations for Students with Disabilities:** The University of California Santa Barbara is committed to ensuring equal academic opportunities and inclusion for students with disabilities based on the principles of independent living, accessible universal design and diversity. I am available to discuss appropriate academic accommodations that may be required for student with disabilities. Requests for academic accommodations are to be made during the first weeks of the quarter, except for unusual circumstances. Students are encouraged to register with Disability Services Center to verify their eligibility for appropriate accommodations.

Winter 2016 (ME 6 - Circuits)							
Num	date	day	Topic	details	HW out	HW due	Lab out
			Logistics, basic laws				
1	4-Jan	mon		ch 1			
2	6-Jan	wed	basic laws	ch 2	HW1		
			methods of analysis				
3	11-Jan	mon		ch 3			
			methods of analysis		HW2	HW1	
4	13-Jan	wed		ch 3			
			No lecture - MLK Holiday				
	18-Jan	mon		-			lab 1 equipment
			methods of analysis		HW3	HW2	
5	20-Jan	wed		ch 3			
6	25-Jan	mon	Circuit theorem	ch 4			lab 2 ohms law, voltage divider
7	27-Jan	wed	Circuit theorem	ch 4	HW4	HW3	
8	1-Feb	mon	capacitors and inductors	ch 6			lab 3 superposition
9	3-Feb	wed	capacitors and inductors + concept of impedance Z	ch 6	HW5	HW4	
10	8-Feb	mon	Op - amps	ch 5		HW5	lab 4 capacitors and inductors
11	10-Feb	wed	Op - amps --- Midterm	ch 5			
12	15-Feb	mon	No lecture - President's Day				lab 5 opamps
13	17-Feb	wed	Op - amps	ch 5	HW 6		
	22-Feb	mon	first order circuits	ch 7			lab 6 opamps
14	24-Feb	wed	first order circuits	ch 7		HW6	
15	29-Feb	mon	first order circuits + High Pass/Low Pass filters	ch 7			lab 7 first order circuit
16	2-Mar	wed	second order circuits	ch 8	HW7		
17	7-Mar	mon	second order circuits	ch 8			lab 8 second order circuit
			second order circuits - wrap up				
18	9-Mar	wed		ch 8		HW7	
					HW	10%	5 out of 7 homeworks (2% each)
					Lab	24%	8 labs (3% each)
					midterm	26%	
					final	40%	

*These descriptions and timelines are subject to change at the discretion of the Instructor.*