

EE 311: Electronic Devices and Circuits 2 (Spring 2016)

**Time & Location:**

Spring 2016, M/W/F, 11:00 – 11:50 am, Hoch 114

**Instructor:**

Kwang W. Oh, Associate Professor, SMALL (Sensors & MicroActuators Learning Lab), Electrical Engineering, 113C Davis Hall, [kwangoh@buffalo.edu](mailto:kwangoh@buffalo.edu) (Please put "[EE 311]" in subject header)

**Description:**

**Office Hours: Wed. 10 – 11am and Fri. 12 – 1pm or by appointment (send an e-mail)**

**EE 311 Electronic Devices and Circuits 2, Lecture (3 hrs) and Lab (2 hrs), 3 Credits**

Biasing and active loads in bipolar junction transistor (BJT) and field-effect transistor (FET) integrated circuits; current sources; differential and multistage amplifiers; frequency response of single and multiple transistor amplifier circuits; digital circuits with an emphasis on complementary metal-oxide-semiconductor (CMOS) technology.

**Objectives:**

By the end of the course, students will:

1. Design and analyze single-stage all-transistor circuits
2. Simulate single and multiple stage transistor circuits to determine dc operating point and frequency response
3. Analyze differential pair/multistage amplifier circuits to determine operating point
4. Determine the frequency response of single-stage transistor circuits
5. Analyze basic CMOS digital logic and memory circuits

**Textbook:**

**Microelectronic Circuits, 7<sup>th</sup> Ed**, A. S. Sedra and K. C. Smith, Oxford University Press, 2014, ISBN #: 978-0199339136

**Prerequisite:**

EE 310 Electronic Devices and Circuits 1 (Ch 1 through Ch 7)

**Laboratory:**

**EE 311LLB L1 Lab Mon 12:00 – 01:50 pm Furnas 214 TA:**

**EE 311LLB L5 Lab Mon 05:00 – 06:50 pm Furnas 214 TA:**

**EE 311LLB L3 Lab Wed 12:00 – 01:50 pm Furnas 214 TA:**

**EE 311LLB L4 Lab Thur 02:00 – 03:50 pm Furnas 214 TA:**

**EE 311LLB L2 Lab Thur 06:30 – 08:20 pm Furnas 214 TA:**

**The first laboratory begins from 02/01/Mon. Students have to attend their own session in any circumstance. You should be able to use an NI Multisim for simulation. NI Multisim is installed in the computers in Furnas 214. Because it is not included in the 7th ed (2014) anymore, you need to download/install v.14.0 or higher if you want to do it on your own computer. To download: <http://www.ni.com/multisim/student-edition/> or**

**<http://www.studica.com/multisim-student-edition.html>. You have to pay ~\$40.00 to purchase the NI Multisim V.14.0 Student Edition. To get more info: refer Appendix B of textbook ([http://globaloup.com/us/companion.websites/fdscontent/uscompanion/us/static/companion.websites/9780199339136/Appendices/Appendix\\_B.pdf](http://globaloup.com/us/companion.websites/fdscontent/uscompanion/us/static/companion.websites/9780199339136/Appendices/Appendix_B.pdf)).**

NI Multisim and PSpice can both do the job, but NI Multisim is easier and more intuitive to use. **Instructor and TAs strongly recommend students to use NI Multisim rather than PSpice.** You may do your Multisim simulation on your own computer and/or on a computer in the Computer Lab. If you do the simulation in the Computer Lab, make sure to copy the simulation source files onto your USB memory after each session. During each lab session, you need to submit given lab assignments (e.g., **turn-in: paper assignment, upload to UBLearn: Multisim simulation files**). **You can do these in advance on your computer, however, you MUST show up and submit in-person to YOUR TA during each lab session.** The instructor and TAs will assume that all EE 311 students know how to use the NI Multisim. If you have not used this before, please contact YOUR TA immediately.

**TAs:**

## EE 311 Spring 2016 Syllabus

### Grading:

• **5 homework assignments** (5 x 4% = 20%): You need to submit these on due. When you submit homeworks, **print out the 1st page of the given homework pdf file**, fill out your information, and use it as a cover page when you submit your HW!!! **Without this printed cover page, your homeworks cannot be accepted. Please STAPLE your homeworks with this cover page. Otherwise, your homeworks cannot be accepted.** Pop-up quizzes will be (modified) from the homework assignments (even before homework due date, if related materials were covered during the class, similar/same questions will be shown on the quizzes right after (see mark "Lecture #" on each homework assignment) and the covered textbook Examples and Exercises. You will get at least 50% for each question that you provide any solution. If blank, you will get 0% of the point for the question.

• **13 lab assignments** (have to use NI Multisim simulator, open-book and open-note): Best 11 results will be used and worst 2 results will be discarded (**11 x 2% = 22%**). First, **YOU HAVE TO PRINT OUT** the assignment on a double-sided letter-size paper, then finish with your answers (of course, hand-written). **You MUST show up and submit in-person to YOUR TA during each lab session.** You need to submit each lab assignment at the end of the lab session. If you answer for each (sub)question, you will get at least 50% of the assigned maximum point for each (sub)question. If you leave blank for each (sub)question, you will get 0% of the point for each (sub)question.

• **8 pop-up quizzes** (various: 15-min through 50-min, open-book and closed-note): Best 6 quizzes will be used and worst 2 quizzes will be discarded (**6 x 5% = 30%**). Pop-up quizzes will be (modified) from the homework assignments (even before homework due date, if related materials were covered, similar/same questions will be shown on the quizzes) and the covered textbook Examples and Exercises. This pop-up quizzes will be offered **during any lecture** to increase your attention and attendance. If you answer for each (sub)question, you will get at least 50% of the assigned maximum point for each (sub)question. If you leave blank for each (sub)question, you will get 0% of the point for each (sub)question.

• **No mid terms**

• **1 Final exam** (28%, 2-hour-exam, **closed-book and closed-note**): **Don't forget to bring an ORIGINAL paper of your summary** (hand-written with required equations, schematics, circuits diagrams,...) to the final exam. **Any form of computer-aided electronic versions (e.g., scan, photo-copy, digital-camera, scale reduction, print-screen, etc,...) is not allowed. Only hand-written, of course your own hand-written, paper is allowed.**

As a part of HW #5, you need to submit a COPY of the original summary paper. See HW#5.10 for more details. Modified from the homeworks, lab assignments, pop-up quizzes. If you answer for each (sub)question, you will get at least 50% of the assigned maximum point for each (sub)question. If you leave blank for each (sub)question, you will get 0% of the point for each (sub)question.

#### Open-book/closed-note Policy

- ✓ Use your original textbook.
- ✓ Using an eTextbook is allowed during the quiz/exam. However, you need to sit on an assigned zone/chair (usually front lows). Otherwise, it is not allowed.
- ✓ Do not use class notes.

#### The cut-offs for each letter grade will not be negotiated:

- ✓ A (92.49%)
- ✓ A- (87.49%)
- ✓ B+ (82.49%)
- ✓ B (77.49%)
- ✓ B- (72.49%)
- ✓ C+ (67.49%)
- ✓ C (62.49%)
- ✓ C- (55.49%)
- ✓ D (49.49%)
- ✓ F (<49.49%)

### Course Webpages:

UBLeans → All course materials can be found there. Visit there often for announcements! Please do not expose lecture notes to public in any circumstance. You can use them for your personal purpose to study.

### Late Work:

- Missed homeworks/assignments/quizzes/exam cannot be made up.
- Missed homeworks/assignments/quizzes/exam will result in a grade of zero (illness only with a physician's note).

### Academic

#### Dishonesty:

You are encouraged to help each other with the homeworks/lab assignments. However, when this help extends to the point of doing the other person's assignments, it is considered cheating. Anyone proven to be turning in duplicate assignments will fail this course. Moreover, anyone who does this is not caught will probably also fail this course because the assignments are the best method of preparing for the quizzes/exams. More info: <http://www.student-affairs.buffalo.edu/judicial/rulereg.php>

## EE 311 Spring 2016 Syllabus

### Schedule:

See the next page. Depending on the class background and the level of difficulty encountered in discussing each topic, the number of lectures devoted to any specific topic could be revised upwards/downwards as deemed appropriate by the instructor. If the instructor cannot teach specific lectures due to his planned/emergency schedule and/or meetings, TA will teach the lectures, instead of the instructor.

**As of 01/26/2015/Monday. Check UBLearns for more updated schedule and info.**

EE 311 Spring 2016 Syllabus

EE 311 Spring 2016										
the number of lectures devoted to any specific topic could be revised upwards or downwards as										
Lec	Date	Chapters	Series	L1(M12)	L3(W12)	L4(Th2)	L2(Th630)	Quiz	HW	HW Due
1	01/25/16	M	Review EE310	1					H1	
2	01/27/16	W		2					E6.4, E6.5	
3	01/29/16	F		3					P7.125	
4	02/01/16	M		4					E5.3, E5.5, E5.6, E5.7, ExD5.14	
5	02/03/16	W		5					E5.4, P5.59, P5.60, AG-EG.1, AG-EG.2	
	02/05/16	F						#1		H1 (Due)
6	02/08/16	M	Chapter 8	1				#2	P8.3	
7	02/10/16	W		2				#2	P8.6	
8	02/12/16	F		3				#2	P8.14, P8.25	
9	02/15/16	M		4				#2	P8.40, P8.49	
10	02/17/16	W		5				#2	P8.53, P8.54, P8.60	
11	02/19/16	F		6				#2	P8.71	
12	02/22/16	M		7				#2	P8.79	
13	02/24/16	W		8				#2	P8.83, P8.92	
	02/26/16	F						#3		H2 (Due)
14	02/29/16	M	Chapter 9	1				#4	P9.1, P9.2	
15	03/02/16	W		2				#4	P9.6	
16	03/04/16	F		3				#4	P9.20	
17	03/07/16	M		4				#4	P9.29, P9.47	
18	03/09/16	W		5				#4	P9.57, P9.58	
19	03/11/16	F		6				#4	P9.87	
	03/14/16	M	Spring Recess							
	03/16/16	W	Spring Recess							
	03/18/16	F	Spring Recess							
20	03/21/16	M		7				#4	P9.114, P9.127ab, P9.128abc	H3 (Due)
21	03/23/16	W		8				#4		
22	03/25/16	F	Chapter 10	1				#5	P10.4, P10.6	
23	03/28/16	M		2				#5	P10.7, P10.8	
24	03/30/16	W		3				#5	P10.13, P10.14	
25	04/01/16	F		4				#5	P10.30, P10.39	
26	04/04/16	M		5				#5	P10.27	
27	04/06/16	W	Chapter 11	1				#5	P11.2, P11.33	
28	04/08/16	F		2				#6		
29	04/11/16	M	Chapter 12	1				#6	P12.8	
30	04/13/16	W		2				#6	P12.12	
31	04/15/16	F	Chapter 13	1				#6	Table 13.1	H4 (Due)
32	04/18/16	M	Chapter 14	1				#7	P14.17	
33	04/20/16	W		2				#7	P14.26	
34	04/22/16	F		3				#7	P14.31	
35	04/25/16	M		4				#7	P14.64	
36	04/27/16	W		5				#7	P14.5, P14.6, P14.7, P14.8	
37	04/29/16	F	Chapter 16	1				#7	P15.32, P16.3	
38	05/02/16	M		2				#8	P16.25	
39	05/04/16	W		3				#8	1T DRAM	
40	05/06/16	F	Wrap-Up					#8		H5 (Due)
Final		Final Exam, Room: TBA								