EE 311 Spring 2018 Syllabus

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Department of Electrical Engineering, University at Buffalo

EE 311: Electronic Devices and Circuits 2 (Spring 2018)

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Time & Location: Spring 2018, M/W/F, 11:00 – 11:50 am, Davis 101

Instructor: **Kwang W. Oh**, Associate Professor, SMALL (Sensors & MicroActuators Learning Lab), Electrical Eng. & Biomedical Eng., 113C Davis Hall, kwangoh@buffalo.edu (Please put "**[EE 311]**" in subject header, otherwise your emails will not be read at all!)
Office Hour: Wed. 9:30 – 11am and Fri. 12 – 1pm or by appointment (send an e-mail)

Description: **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, 7th 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: Anthony Clabeau
EE 311LLB L5 Lab Tue   05:00 – 06:50 pm Furnas 214 TA: Dongyin Ren
EE 311LLB L3 Lab Wed   12:00 – 01:50 pm Furnas 214 TA: Anthony Clabeau
EE 311LLB L4 Lab Thur   02:00 – 03:50 pm Furnas 214 TA: Keke He
EE 311LLB L2 Lab Thur   06:30 – 08:20 pm Furnas 214 TA: Keke He

The first laboratory session (#1) begins from 02/05/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 213/214. **Because it is not included in the 7th Ed (2014) anymore, you need to download/install v.13 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 ~$41.95 to purchase the NI Multisim V.14.1 Student Edition. To get more info: refer Appendix B of textbook
(http://global.oup.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., (1) turn-in: paper assignment, (2) upload to UBLearns: 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. If you have not used this before, please contact YOUR TA immediately.

TAs:

Anthony Clabeau (aclabeau@buffalo.edu): L1, L3; Office Hr: T 3:30-5, W 3:30-5; Davis 117
Keke He (kekehe@buffalo.edu): L2, L4; Office Hr: M 3:30-5, F 2-3:30; Davis 115B
Dongyin Ren (dongyinr@buffalo.edu): L5; Office Hr: Th 9:30-11; Davis 230V

Grading:

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 (94.49%)
- ✓ A- (89.49%)
- ✓ B+ (84.49%)
- ✓ B (79.49%)
- ✓ B- (74.49%)
- ✓ C+ (69.49%)
- ✓ C (64.49%)
- ✓ C- (59.49%)
- ✓ D (49.49%)
- ✓ F (<49.49%)

• 6 homework assignments (6 **x 3% = 18%**): Homework is lengthy but a must. You need to submit these on due. When you submit homework, **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 HOMEWORK CANNOT BE ACCEPTED. PLEASE STAPLE YOUR HOMEWORK WITH THIS COVER PAGE. OTHERWISE, YOUR HOMEWORK CANNOT BE ACCEPTED. Also, PLEASE SCAN IT and MAKE a .pdf (EE311_StudentID#_HW_1.pdf) each time before submission, and HAVE to UPLOAD it on UBLearns. You will get at least 50% for each (sub)question if you answer reasonably. If blank, you will get 0% for the (sub)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 1.5% = 16.5%**). 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 show your effort 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% for each (sub)question.

• n pop-up quizzes (**various: 15-min through 50-min, open-book and closed-note**): Best ($n-3$) quizzes will be used and worst 3 quizzes will be discarded: $(\boldsymbol{n-3}) \times \frac{\boldsymbol{48}}{(\boldsymbol{n-3})}\% = \boldsymbol{48}\%,$ where $8 \le n \le 12$. Pop-up quizzes will be (modified) from the homework assignments (**even before homework due date, if related materials have been covered during the class already, you should expect to see similar/same questions on the quizzes. See mark "Lecture #" on each homework assignment**.) 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 show your effort 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%.

• No mid terms

• 1 Final exam (17.5%, 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 and/or high-tech 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 #6, you need to submit a COPY of the original summary paper. See HW#6.10 for more details. Modified from the homeworks, lab assignments, pop-up quizzes.

• Bonus (2% maximum): You will get 1%, whenever you visit Prof. Oh's office during office hours or by appointment. You will get 0.5%, whenever you visit TAs' office during office hours or by appointment. Professor and TAs have time limitations and other students waiting to see them, so the more prepared you are when you go to an office hour, the more you will get done.

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Course Webpages: UBLearns → 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 it in duplicate assignments from/to others/online-resources (coursehero.com, chegg.com,…; even the final exam summary paper) will fail this course.** More info: http://www.student-affairs.buffalo.edu/judicial/rulereg.php

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/meetings, TA will teach the lectures, instead of the instructor.

As of 01/29/2018. Check UBLearns for more updated schedule and info.

EE 311 Spr 18	Monday	Tuesday	Wednesday	Thursday	Friday
9:00 AM					
9:30 AM			Office Hour	Office Hour	
10:00 AM			(Davis 113C)	(Davis 230V)	
10:30 AM			Prof. Kwang Oh	Dongyin Ren	
11:00 AM	Lecture (Davis 101)		Lecture (Davis 101)		Lecture (Davis 101)
11:30 AM	Prof. Kwang Oh		Prof. Kwang Oh		Prof. Kwang Oh
12:00 PM	L1		L3		Office Hour (Davis 113C)
12:30 PM	(Furnas 214)		(Furnas 214)		Prof. Kwang Oh
1:00 PM	Anthony Clabeau		Anthony Clabeau		
1:30 PM					
2:00 PM				L4	Office Hour
2:30 PM				(Furnas 214)	(Davis 115B)
3:00 PM				Keke He	Keke He
3:30 PM	Office Hour	Office Hour	Office Hour		
4:00 PM	(Davis 115B)	(Davis 117)	(Davis 117)		
4:30 PM	Keke He	Anthony Clabeau	Anthony Clabeau		
5:00 PM		L5			
5:30 PM		(Furnas 214)			
6:00 PM		Dongyin Ren			
6:30 PM				L2	
7:00 PM				(Furnas 214)	
7:30 PM				Keke He	
8:00 PM					

Anthony Clabeau (aclabeau@buffalo.edu): L1, L3; Office Hr: T 3:30-5, W 3:30-5; Davis 117

Keke He (kekehe@buffalo.edu): L2, L4; Office Hr: M 3:30-5, F 2-3:30; Davis 115B

Dongyin Ren (dongyinr@buffalo.edu): L5; Office Hr: Th 9:30-11; Davis 230V

Prof. Kwang W. Oh (kwangoh@buffalo.edu): Lecture, Office Hr: W 9:30-11, F 12-1; Davis 113C

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Lec	Date		Chapters	Series	L1(M12) L5(M5) L3(W12) L4(Th2) L2(Th630)	Quiz	HW	HW Due
					EE 311 Spring 2018			
					the number of lectures devoted to any specific topic could be revised upwards or downwards as			
1	01/29/18	M	Review EE310	1	No Lab		H1	
2	01/31/18	W		2			E6.4, E6.5	
3	02/02/18	F		3			P7.125	
4	02/05/18	M		4	Lab #1		E5.3, E5.5, E5.6, E5.7,ExD5.14	
5	02/07/18	W		5			E5.4, P5.59, P5.60, AG-EG.1,AG-EG.2	
	02/09/18	F				#1		H1 (02/08/Th)
6	02/12/18	M	Chapter 8	1	Lab #2		P8.3	
7	02/14/18	W		2			P8.6	
8	02/16/18	F		3			P8.14	
9	02/19/18	M		4	Lab #3		P8.40, P8.49	
10	02/21/18	W		5			P8.53, P8.54, P8.60	
11	02/23/18	F		6			P8.71	
12	02/26/18	M		7	Lab #4		P8.79	
13	02/28/18	W		8			P8.83, P8.92	
13	03/02/18	F		9				H2 (03/01/Th)
14	03/05/18	M	Chapter 9	1	Lab #5		P9.1,P9.2	
15	03/07/18	W		2			P9.6	
16	03/09/18	F		3			P9.20	
17	03/12/18	M		4	Lab #6		P9.57,P9.87	
18	03/14/18	W		5			P9.114,P9.127ab,P9.128abc	
19	03/16/18	F		6				H3 (03/15/Th)
	03/19/18	M	Spring Recess					
	03/21/18	W	Spring Recess					
	03/23/18	F	Spring Recess					
20	03/26/18	M	Chapter 10	1	Lab #7		P10.4,P10.6	
21	03/28/18	W		2			P10.7,P10.8	
22	03/30/18	F		3			P10.13,P10.14	
23	04/02/18	M		4	Lab #8		P10.30,P10.39	
24	04/04/18	W		5			P10.27	
24	04/06/18	F		6				H4 (04/05/Th)
25	04/09/18	M	Chapter 11	1	Lab #9		P11.2,P11.33	
26	04/11/18	W		2				
27	04/13/18	F	Chapter 12	1			P12.8	
28	04/16/18	M		2	Lab #10		P12.12	
28	04/18/18	W		3				
29	04/20/18	F	Chapter 14	1			P14.17	
30	04/23/18	M		2	Lab #11		P14.26	
31	04/25/18	W		3			P14.31	
32	04/27/18	F		4			P14.64	H5 (04/27/F)
33	04/30/18	M		5	Lab #12		P14.5,P14.6	
33	05/02/18	W		6			P14.7,P14.8	
34	05/04/18	F	Chapter 16	1			P15.32,P16.3	
35	05/07/18	M		2	Lab #13		P16.25	
36	05/09/18	W		3			1T DRAM	
	05/11/18	F	Wrap-Up					H6 (05/10/Th)
	Final				05/14/Monday 11:45 AM - 2:45 PM (Hoch 114)			