

Electronic Circuits

EEE 3308C, Section: All

Class Periods: MWF, Period 4, 10:30 am – 11:40 am

Location: MAE A 0303

Academic Term: Fall 2023

Instructor:

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NEB 533

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Office Hours: Wednesday, 12 noon – 1pm, NEB 533

Teaching Assistant/Peer Mentor/Supervised Teaching Student:

Please contact through the Canvas website

- STA: Troy B. Bryant, tbbryant@ufl.edu, office location: TBD, office hours: TBD
- UPI1: Liam E. Negron, liam.negron@ufl.edu, office location: TBD, office hours: TBD
- UPI2: Michael C. Bradbourne, mbradbourn@ufl.edu, office location: TBD, office hours: TBD
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Course Description

Electronic Circuits (EEE3308C) – 4 Credits Hours Fall 2022

Description: This course serves as a basic primer for the young circuit designer (undergraduates) and covers topics starting from KCL, KVL, basic electrical circuit analysis, Diodes, BJTs, MOSFETs and MOSFET based circuits (single-stage/multi-stage amplifiers, differential amplifiers, current mirrors, Op-Amps), along with some advanced concepts such as frequency response, feedback, and noise. A lot of emphasis is placed on building circuit intuition than just solving equations, and all the important concepts are accompanied with a hands-on lab section where students build circuits on breadboards and/or general-purpose PCBs and learn the basics of measurement techniques. Spice simulations and models are introduced to show different concepts in a design-oriented manner.

Course Organization: Each major topic will include homework assignments and labs, emphasizing practical applications. There will be two in-class tests, and one final exam.

Course Themes:

- Practical electronics: How do you create circuits to do useful things?
- Basic electronic elements
- Design-oriented analysis

Course Pre-Requisites / Co-Requisites

EEL 3111C Circuits 1

Course Objectives

- CO1: summarize different building blocks in basic electronic circuit design, and articulate their utility, both from intuition and mathematical derivations.
- CO2: analyze various electronic circuits including, but not limited to Diodes, BJTs, MOSFETs and MOSFET based circuits.
- CO3: analyze frequency response, feedback, and noise in electronic circuits (both for op-Amp-level and transistor-level designs)
- CO4: perform hands-on lab experiments where students build circuits on breadboards and/or general-purpose PCBs and learn the basics of measurement techniques

**EEE3308C Electronic Circuits
Syllabus Fall 2023 Rev. 1**

Day	Date	Lecture	Topic	Text	Lab
Aug	W	23	1	Logistics, Intro to Electronics	Ch. 1
Aug	F	25	2	Design-oriented analysis, KCL, KVL	Ch. 1
Aug	M	28	3	Voltage/current dividers, Cascaded Amps	Ch. 1
Aug	W	30	4	Op-Amps Intro, Application of Op-Amps	Ch. 8
Sep	F	1	5	Ideal vs. Non-Ideal Op-Amps	Ch. 8
Sep	M	4	Labor Day: No Class		
Sep	W	6	6	AC coupling, Biasing, Port Resistances	Ch. 8 1
Sep	F	8	7	Feedback	Ch. 12 1
Sep	M	11	8	GBW, Poles and Zeros	Ch. 11 1
Sep	W	13	9	Diodes: Ideal and Non-Ideal	Ch. 3 2
Sep	F	15	10	Wave Rectifiers	Ch. 3 2
Sep	M	18	11	AC-DC Converters, Other Diode App.	Ch. 3 2
Sep	W	20	12	Review for Test 1	
Sep	F	22	Test 1		
Sep	M	25	13	BJTs, small/large-signal concepts	Ch. 4-5 3
Sep	W	27	14	Biasing BJTs, BJT Ckts (Part 1)	Ch. 4-5 3
Sep	F	29	15	BJT Ckts (Part 2), Coupling/Bypass caps	Ch. 4-5 3
Oct	M	2	16	Transitioning to MOSFETs from BJTs	Ch. 6-7 4
Oct	W	4	17	N-MOSFET Physics and Regions	Ch. 6-7 4
Oct	F	6	Homecoming Weekend: No Class		
Oct	M	9	18	P-MOSFET Physics, MOSFET I-V	Ch. 6-7 4
Oct	W	11	19	Biasing, small/large-signal concepts	Ch. 6-7 4
Oct	F	13	20	MOSFET amplifiers (part 1): CS, CG, CD	Ch. 6-7 4
Oct	M	16	21	MOSFET amplifiers (part 2): CS, CG, CD	Ch. 6-7 5
Oct	W	18	22	Examples and Review of MOSFET amp.	Ch. 6-7 5
Oct	F	20	23	Degeneration, Cascoding, Folding	Ch. 6-7 5
Oct	M	23	24	Multi-stage amplifier design example	Ch. 6-7 Spice
Oct	W	25	Test 2		
Oct	F	27	25	Current mirrors and Active load	Ch. 9 Spice
Oct	M	30	26	Differential Amp (Part 1)	Ch. 10 6
Nov	W	1	27	Differential Amp (Part 2)	Ch. 10 6
Nov	F	3	28	CMRR and PSRR of Differential Amp	Ch. 10 6
Nov	M	6	29	Instrumentation Amplifier, Comparator	Ch. 10
Nov	W	8	30	Frequency Response of Amp. (part 1)	Ch. 11
Nov	F	10	Veteran's Day: No Class		
Nov	M	13	31	Frequency Response of Amp. (part 2)	Ch. 11 7
Nov	W-F	15-17	32-33	Op-Amps Revisted: Int. Circuitry (parts 1-2)	Ch. 7,10,17 7
Nov	M	20	34	Op-Amps Revisted: Int. Circuitry (part 3)	Ch. 7,10,17 7
Nov	W-F	22-24	Thanksgiving Week: No Classes		
Nov	M	27	35	Logic: Inverters	Ch. 16
Nov	W	29	36	Logic: NAND, NOR, delay	Ch. 16
Dec	F	1	37	Logic: Transmission gate	Ch. 16
Dec	M	4	Test 3		
Dec	W	6	38	Final Review	

Lab 1: Intro: Thevenin, Norton, etc.	Lab 5: Tone Control
Lab 2: Non-Ideal Op Amps	Spice Workshop
Lab 3: Diodes	Lab 6: BJT Amplifiers
Lab 4: MOSFET Common-Source Amp	Lab 7: CMOS Logic

Materials and Supply Fees

Digilent Analog Discovery (DAD) Board: Required. Versions 1/2 are also OK. Works with PC/Mac.

Parts Kit: You will need to order your own parts. See Parts List on the Canvas page.

Relation to Program Outcomes (ABET):

The table below is an example. Please consult with your department's ABET coordinator when filling this out.

Outcome	Coverage*
1. An ability to identify, formulate, and solve a broad range of electronic design problems by applying principles of basic electronic circuits as well as intuition.	High
2. An ability to apply engineering design to produce solutions for various electronic circuits including, but not limited to Diodes, BJTs, MOSFETs and MOSFET based circuits that meet specified needs with consideration of general electronic design for commercial sectors, public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.	High
3. An ability to communicate effectively with a range of audiences	Low
4. An ability to perform hands-on lab experiments to build circuits on breadboards and/or general-purpose PCBs and learn the basics of measurement techniques, to provide basic training to students to make them for Industry and/or further research to solve global societal, economic and environmental problems	Medium
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	Low
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	Low

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not covered or assessed in the course.

Required Textbooks and Software

- Behzad Razavi: Fundamentals of Microelectronics 3rd Edition (2021), ISBN-10: 1119695147, ISBN-13 : 978-1119695141 (You will need access to the textbook. Digital is fine.): [Amazon Link](#)

Recommended Materials

- Additional Reference Book: Sedra and K. Smith, Microelectronic Circuits, 8th Ed., ISBN-10: 0190853468, ISBN-13: 978-0190853464 (Good to have access to this book. Digital is fine.)
- Material will be provided on canvas for each lecture and lab

Attendance Policy, Class Expectations, and Make-Up Policy

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies. Click here to read the university attendance policies:

<https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/>

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade	Comments
Homework Sets (10)	100 each	18% (2% each for best 9)	Will drop the lowest grade
Labs (7)	100 each	28% (4% each)	
Exam 1	100	18%	
Exam 2	100	18%	
Exam 3	100	18%	
		100% (Total)	

Grading Policy

The following is given as an example only.

Percent	Grade	Grade Points
93.4 - 100	A	4.00
90.0 - 93.3	A-	3.67
86.7 - 89.9	B+	3.33
83.4 - 86.6	B	3.00
80.0 - 83.3	B-	2.67
76.7 - 79.9	C+	2.33
73.4 - 76.6	C	2.00
70.0 - 73.3	C-	1.67
66.7 - 69.9	D+	1.33
63.4 - 66.6	D	1.00
60.0 - 63.3	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Labs/ Times: MAE B, 226 (Please note the Venue)

Times and Sections are as per your Canvas Sections

Labs:

Labs in 3308C are run similarly to 3701.

1. Before starting your lab section you will be expected to:
 - a. Understand the lab manual
 - b. Analyze and build the circuits
 - c. Perform most measurements at home with your Analog Discovery board
 - d. Submit your pre-lab document on Canvas 15 min before your lab section
2. You must demonstrate your working circuit by the end of your lab section
3. A lab handout will be provided on Canvas for each lab. The lab handout is broken into pre-lab and in-lab sections. They will be graded separately.
4. The pre-lab steps and results are due before the lab starts.
5. You complete the in-lab steps while in contact with your UPI, and turn in
6. Failure to do any of these will negatively affect your lab score
7. Lab Manuals and Pre-Lab documents will be accessible before your lab date
8. There will be office hours to answer questions and help you get your lab working

Homework: ~ 1 per week (a max of total 10 homeworks over the semester)

- Usually assigned Friday; due by class start time on next Friday, where solutions will be discussed
- Goals are to illustrate and reinforce lecture topics and provide practice for quizzes
- Lowest score will be dropped
- It's OK to work in groups or to get tips from other students; but you must push your own calculator buttons and the work you turn in must be your own.
- You won't learn as much from the homework if you depend on somebody else to tell you how to do it. But feel free to discuss/ask questions to the instructor.
- Turn in homework online in Canvas as .pdf, .doc, .xls, or .asc.
- Late homework may be accepted at the instructor's discretion, typically for reduced credit (A typical penalty would be 5% per day).
- Turning in homework late based on my published solutions would be cheating.

Class Meetings:

Class Participation: The lectures will be in-person. However, previous year's recorded videos will also be made available through mediasite, whenever required. It is strongly encouraged to attend the in-person lectures so you can ask questions and participate in the class. For certain scenarios when the instructor is traveling, classes will be arranged through Zoom and will be notified ~1 week early.

Zoom Etiquette, whenever applicable:

I can teach more effectively if you keep your video on and audio off during lectures.

• Attendance at labs is required. Work out any conflicts with the lab UPI in advance if possible and/or arrange makeups.

Handouts: I put as much as possible in the notes, but the lectures usually cover more.

Textbook: Anything in an assigned chapter of the book is fair game unless I tell you otherwise.

Problems: Work as many as you can find, this is the best possible test preparation.

Supplementary problems: Sometimes we can help find more; try assigning yourself design problems and look at other books.

SPICE Assignments:

- LTSpice. Download from <http://www.linear.com/designtools/software/>
- To help debugging SPICE runs, we need print-outs of input and output files, a schematic with labeled node numbers, .OP (Bias Point Detail) information, .OPTIONS, .MODELS, etc.
- Have fun with this interactive online circuit simulator: <https://everycircuit.com/>

Academic Honesty Policy for this Class:

You are not allowed to cheat or to tolerate cheating. The University's honesty policy, which I follow, can be found at <https://sccr.dso.ufl.edu/wp-content/uploads/sites/4/2018/08/The-Orange-Book-Web.pdf>.

You may consult with other students on homeworks or projects. However, solutions or reports that you turn in must be your work alone. For example, you must create your own computer files and run your own simulations.

- You are expected to do your own work.
- You are expected to report any violations of the Honor Code that you become aware of.
- It is a violation of the Honor Code to turn in solutions to homeworks, labs or tests copied from other students or from published handouts or solutions.
- You are welcome to work with other students on homeworks and lab reports. However, once you understand the method of solution you should work through the calculations yourself.

How to study for this course:

The best way to learn how to analyze circuits and to prepare for tests is to practice. There are at least two sets of skills that you must master. One is figuring out how to approach an unfamiliar circuit or problem; the other is how to work through the solution to the problem or the analysis. If you always get help with setting up the problem, or just watch someone else solve the problem, you do not get any practice at all. To learn this material and to do well in the course, you must work problems and analyze circuits by yourself.

Software Use and Pledge:

All faculty, staff and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. "We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity."

Make-Up Opportunities:

It is very hard for me to make you a customized exam. However, with a University-approved excuse and arranged for in advance, or in an emergency, a make-up exam will of course be allowed and accommodated.

Students Requiring Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

In-Class Recording

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

University Honesty Policy

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (<https://sccr.dso.ufl.edu/process/student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values varied perspectives and lived experiences within our community and is committed to supporting the University’s core values, including the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of race, creed, color, religion, age, disability, sex, sexual orientation, gender identity and expression, marital status, national origin, political opinions or affiliations, genetic information, and veteran status.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- HWC OE Human Resources, 352-392-0904, student-support-hr@eng.ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as

appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

Campus Resources:

Health and Wellness

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: <https://counseling.ufl.edu>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.
<https://lss.at.ufl.edu/help.shtml>.

Career Connections Center, Reitz Union, 392-1601. Career assistance and counseling; <https://career.ufl.edu>.

Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.
<https://teachingcenter.ufl.edu/>.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.
<https://writing.ufl.edu/writing-studio/>.

Student Complaints Campus: <https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>; <https://care.dso.ufl.edu>.

On-Line Students Complaints: <https://distance.ufl.edu/getting-help/>; <https://distance.ufl.edu/state-authorization-status/#student-complaint>.