

Electronic Circuits I

EEE3308C

Class Periods: MWF 3rd period (9:35 – 10:25 AM)

Location: NEB 202

Academic Term: Spring 2020

Instructor:

Soumyajit Mandal

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NEB 527, (352) 392-0622

Office Hours: Available almost every day. Email to make sure of availability.

Teaching Assistant/Peer Mentor/Supervised Teaching Student:

Undergraduate peer instructors (UPIs):

- Yiyang Tan tanyyang@ufl.edu
- Andres Inchausti andresinchausti@ufl.edu
- Nicholas Fata nicholas.fata@ufl.edu

Supervised teaching PhD student:

- Shubhra Deb Paul shubhra.paul@ufl.edu

Course Description

Fundamentals of electronic circuits and systems. Laboratory. 4 Credits.

Course Pre-Requisites / Co-Requisites

Pre-requisites: EEL3008 (Physics of EE); EEL3112 (Circuits 2)

Course Objectives

Each major topic will include homework assignments emphasizing analysis and design and in-class demonstrations emphasizing practical applications. Three tests plus a final exam.

Course themes:

- Practical electronics: How do you create circuits to do useful things?
- Basic electronic elements: Op Amps, MOSFETs, BJTs, diodes
- Design-oriented analysis

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.

Materials and Supply Fees

Required for labs:

- 5 sections; NEB 211
- 8 labs (about 2 weeks/lab)
- Supply fee is \$71.12

Lab schedule:

Day	Time	UPI
Tuesday	4-5 (10:40 - 12:35)	Andres
Wednesday	4-5 (10:40 - 12:35)	Andres

Wednesday	11-E1 (6:15 - 8:10)	Yiyang
Wednesday	E2-E3 (8:20 - 10:10)	Yiyang
Friday	7-8 (1:55 - 3:50)	Nicholas

- You must attend all of the labs. Be sure to work out any conflicts with the TA, in advance if possible.
- Lab handouts will be available well before the lab meeting time.
- It is required that you be prepared for labs. Generally, you will need to have your lab circuit built and working and all pre-labs done before you come to lab. If you are unprepared, you will receive a score of zero.
- The TAs will be available in the week before the lab meets to help you get things working and to answer questions about the labs.
- Since most of the work will be done before lab, you should be done with the actual lab in less than two hours.

Diligent boards:

- The labs require the Diligent/National Instruments Analog Discovery boards (DAD/NAD, respectively). Both versions 1 and 2 are acceptable.
- NAD-2 available for \$179 at <http://tinyurl.com/NAD-UF-f17>.
- DAD-2 available for \$179 (at extra effort) at <http://tinyurl.com/NAD-UF-f17>. Select “Get Academic Pricing”.
- The UF Bookstore carries some NAD-1 (\$199) and NAD-2 (\$311.25) for those who want to use financial aid or want it right away.
- The Analog Parts Kit is also recommended.

Professional Component (ABET):

This course consists of 3 credits of Engineering Science and 1 credits of Engineering Design.

Relation to Program Outcomes (ABET):

Outcome	Coverage*
1. An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics.	Medium
2. An ability to apply both analysis and synthesis in the engineering design process, resulting in designs that meet desired needs.	High
3. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.	Medium
4. An ability to communicate effectively with a range of audiences	
5. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.	
6. An ability to recognize the ongoing need for additional knowledge and locate, evaluate, integrate, and apply this knowledge appropriately.	Medium
7. An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty	

*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

- “Microelectronic Circuits” by A. Sedra and K. Smith, Oxford University Press, 6th or 7th edition, ISBN number: 978-0195323030 (6th edition), 978-0199339136 (7th edition)

- **Hardware:** Digilent/National Instruments Analog Discovery Board. Both versions 1 and 2 are acceptable; works with PC or Mac. See <http://tinyurl.com/NAD-UF-f17>.
- **Software:** LTspice. Download from <https://tinyurl.com/LTspice-UF>.

Recommended Materials

- To be provided by the instructor during the course.

Course Schedule

			Lecture		Homework, etc.	7 th Edition
Jan	M	6	1	Introduction		Ch. 1
	W	8	2	Amplifiers intro, design-oriented analysis		Ch. 1
	F	10	3	Voltage/current dividers, cascade amps	Lab 1	Ch. 1
	M	13	4	LTspice		Append B
	W	15	5	Ideal op amps		Ch. 2
	F	17	6	Op amp non-idealities		Ch. 2
	M	20		Martin Luther King Day (No class)		
	W	22	7	Frequency Response		Ch. 2
	F	24	8	AC coupling	Lab 2	Ch. 2
	M	27	9	Choosing capacitors, port resistances		Append E, F
	W	29	10	Difference/instrumentation amps		Ch. 2
	F	31	11	Review		
Feb	M	3		Test 1		
	W	5	12	Port resistances	Lab 3	
	F	7	13	NMOS FET regions of operation		Ch. 5
	M	10	14	Resistor biasing		Ch. 5
	W	12	15	MOSFET amplifiers		Ch. 7
	F	14	16	More MOSFET amplifiers		Ch. 7
	M	17	17	Other FET types, PMOS	Lab 4	Ch. 5
	W	19	18	Coupling, bypass cap design		
	F	21	19	Degeneration, source followers		Ch. 7
	M	24	20	NMOS/PMOS amps		Ch. 8
	W	26	21	Current mirrors; active loads		Ch. 8
	F	28		Test 2		
Mar	M	9	22	Test 2 review, multi-stage amps	Lab 5	Ch. 9
	W	11	23	Diff pairs with active loads		Ch. 9
	F	13	24	Diff pairs, comparators		Ch. 9
	M	16	25	Logic: NAND, NOR		Ch. 14
	W	18	26	Logic: Transmission gates		Ch. 14
	F	20	27	Memory: Latches and Flip Flops	Lab 6	Ch. 16
	M	23	28	Memory: SRAM and DRAM		Ch. 16
	W	25	29	Comparators, Schmitt triggers		Ch. 18
	F	27	30	Relaxation oscillators		Ch. 18
	M	30	31	Test 3		
Apr	W	1		Test 3 review, op amps plus transistors	Lab 7	
	F	3	32	Diodes		Ch. 4
	M	6	33	BJT large-signal analysis		Ch. 6
	W	8	34	BJT small-signal analysis		Ch. 6
	F	10	35	High-frequency response		Ch. 10
	M	13	36	Time-constant analysis	Lab 8	Ch. 10
	W	15	37	Passive and active filters		Ch. 17
	F	17	38	Tuned amplifiers		Ch. 17
	M	20	39	History of electronics, vacuum tubes		
	W	22	40	Review		
	Tu	28		Final Exam		

- **Tests:** Closed-book, no notes. Formulas will be provided; held in-class during regular class periods.
- **Final exam:** Tuesday April 28, 7:30 AM – 9:30 AM
- **Review sessions:** Maybe held on Thursday before each of the tests
- **Homework:** ~ 1 or 2 per week
 - Usually due at start of 2nd following class day, where solutions will be discussed
 - Goals are to illustrate and reinforce lecture topics and to provide practice for quizzes
 - Lowest score will be dropped
 - It's OK to work in groups or to get tips from other students; 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.
 - Homework is usually assigned at the end of a lecture and is usually due at the start of the class meeting after the next one.
 - Instructor will go over the homework solutions at the start of class, while it is fresh in your mind.
 - Homework should be turned electronically in Canvas as .pdf, .doc, .xls, or .asc files.
 - Late homework may be accepted at the instructor's discretion, typically for reduced credit.
 - Turning in homework late based on published solutions would be cheating.
- **SPICE assignments:**
 - Requires LTspice; download from <https://tinyurl.com/LTspice-UF>.
 - To help debugging SPICE runs, please provide print-outs of input and output files, a schematic with labeled node numbers, .OP (Bias Point Detail) information, .OPTIONS, .MODELS, etc.
 - If you turn in .asc files, make sure all needed files are included.

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. Excused absences must be consistent with university policies in the undergraduate catalog (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>) and require appropriate documentation.

- Attendance at lectures will be tracked using the multi-platform clicker software PollEverywhere. The course staff will help you get signed up using your ufl email address. Please do not create an account using a different email address, since this makes it difficult to track you.
- At the beginning of most class meetings, the instructor will provide a few warm-up questions to answer using your phone or computer.
- You are responsible for everything in the lecture unless the instructor tells you otherwise.
- If you need to miss class, be sure to see the instructor or a TA to find out what you missed.
- Handouts: As much as possible will be included in the notes, but the lectures usually cover more.
- Textbook: Supplements lecture; follow by topic; syllabus may include some pointers to topics.
- Problems: Work as many as you can find: the best possible quiz preparation.
- Supplementary problems: Sometimes the course staff can help find more; try assigning yourself design problems and look at other books.

Make-up opportunities: It is very hard for the instructor to make you a customized exam. A make-up exam will be allowed only if: i) you have a University-approved excuse and arrange for it in advance, or ii) in an emergency.

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Homework sets (14)	100 each	15%
Labs (8)	100 each	20%
Tests (3 @15% each)	100 each	45%
Final exam	100	20%
		100%

Grading Policy

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>

Students Requiring Accommodations

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://www.dso.ufl.edu/drc>) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure 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/>.

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/policies/student-honor-code-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.

- 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 homework, labs or tests copied from other students or from published handouts or solutions.
- You are welcome to work with other students on homework and lab reports. However, once you understand the method of solution you should work through the calculations yourself.
- Sending someone “secret” information from a lecture so they can pretend to be present when they’re not would be blatant cheating, and both parties would risk failing the course.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

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
- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@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: <http://www.counseling.ufl.edu/cwc>, 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 Resource Center, Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.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://care.dso.ufl.edu>

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>.