Department of Electrical and Computer Engineering

EEO311 Electronic Circuits II

Syllabus

Last updated January 22, 2024

Important Note: Every effort will be made to avoid changing the course schedule, but the possibility exists that unforeseen events will make syllabus changes necessary. It is your responsibility to check Brightspace for corrections or updates to the syllabus. Any changes will be clearly noted in course announcements or through Stony Brook email.

Part 1: Course Information

Course title: Electronic Circuits II

Course catalog # and section: EEO311, Sec 30

Credit hours: 3

Semester: Spring 2024

General education designation(s) (SBC): N/A

Prerequisites: EEO315 or equivalent (Electronic Circuits I)

Instructor name: Dmitri Donetski

Instructor's Stony Brook email, phone number, and time zone: dmitri.donetski@stonybrook.edu, 631-632-8411 (office), EST (New York)

Office hours: Tuesday, Thursday, 3-5 PM, or by appointment in zoom accessed with the link

https://stonybrook.zoom.us/j/93433786494?pwd=QnZVQUFqSktsZnpiTWQyWkFUM2J5dz09

Meeting ID: 934 3378 6494, Passcode: 892092

Course Description: The course covers single-stage amplifiers biased and loaded with current sources, frequency response, two stage operational amplifiers designed by conventional and computer aided techniques, negative feedback and stability, frequency compensation of feedback amplifiers to avoid oscillations.

Goals and outcomes: Development of abilities to identify transistor configurations and functional blocks in integrated circuits, to estimate voltage gain, input and output impedances of open loop amplifiers and amplifiers with negative feedback. Familiarization with design methodologies of analog circuits. Development of abilities to design amplifiers with Computer Aided Design (CAD) tools.

Required Course Materials: A laptop or desktop with a webcam for videoposts in Voicethread. The posts will be graded. The computer is required to operate under Windows for running the PSPICE/ORCAD circuit simulator. A free student license is available with registration.

Recommended Reading:

1. B. Razavi, Design of Analog CMOS Integrated Circuits, 2nd ed., 2016, McGraw Hill, ISBN-13: 978-0072524932 (the best reference textbook however it assumes background knowledge from B. Razavi, Fundamentals of Microelectronics, 2nd ed., 2014, Wiley, ISBN 978-1118156322)

2. A. Sedra, Microelectronic Circuits, 8th ed., 2019, Oxford, ISBN 9780190853464 (the textbook covers both background and now material)

Course Delivery Mode and Structure:

This is an online version of the course on design of analog integrated circuits offered on campus. All materials (lectures, assignments, instructions) will be posted on Brightspace. The schedule of the online course version will be kept synchronous with that for ESE411 offered on the campus. The lecture materials will be posted twice a week in Mondays and Wednesdays by the end of the day. Each lecture material is broken into 2-3 units presented in the format of learning modules. The main forms of interaction are video posts in the VoiceThread or office hours in Zoom. Upon review of module materials for two lectures students will be asked to take a quiz by responding to quiz questions. Quizzes will be posted separately once a week. Quiz responses are due in Thursdays by the end of the day EST. Student responses to quiz questions will be graded. The quiz score makes the major contribution to the total score and the final grade, respectively. The instructor can be reached by e-mail. The instructor office hours in Zoom are scheduled twice a week in Tuesdays and Thursdays from 3 to 5 PM EST or by appointment.

Most of homework (HW) assignments will be completed on Brightspace. The HW assignments with numerical calculations are graded in Brightspace automatically with instant scores. Up to 10 attempts will be offered. In each attempt input data for questions will be randomly generated. The last attempt score will contribute to the final grade. In other assignments students will be requested to upload copies of handwritten sketches of plots using provided templates. These assignments will be graded manually. Papers should be scanned/photographed, consolidated into a single file (for example, in MSWord), saved in PDF format and uploaded to Brightspace for grading.

Homework assignments are due in Fridays by the end of the day EST. The late penalty is 50 % of the HW score. No credit will be given for late HW after posting solutions.

Simulation assignments ending with a project are scheduled after the Spring recess. Simulations will be done in PSPICE/ORCAD. The simulation reports are due in Mondays by the end of the day EST.

Students must be mindful of all course expectations, deliverables and due dates, especially because the online format of the course requires significant time management. All assignments and course interactions will utilize internet technologies. See “Technical Requirements” section for more information.

How We Will Communicate:

Course-related questions should be posted in the General Questions Forum in the course Discussion board. For personal/private issues, email me directly. If you use **e-mail tool** from the course site, it will automatically include your full name, course name and section when you send me an email.

Please allow between 24-48 hours for an email reply. Typically, email messages are answered much faster. Your Stony Brook University email must be used for all University-related communications. You must have an active Stony Brook University email account and access to the Internet. All instructor correspondence will be sent to your SBU email account.

Plan on checking your SBU email account regularly for course-related messages. To log in to Stony Brook Google Mail, go to http://www.stonybrook.edu/mycloud and sign in with your NetID and password.

Regular announcements will be posted on Brightspace and automatically sent by email.

Regular communication is essential in online classes. Logging in once a day, checking the discussion board and participating with your peers ensures that you are able to remain an active member of the class and earn full points.

Technical Requirements:

This course uses Brightspace and Voicethread for the facilitation of communications between faculty and students, submission of assignments and taking tests.

If you are unsure of your NetID, visit https://it.stonybrook.edu/help/kb/findingyournetidandpassword for more information. You are responsible for having a reliable computer and Internet connection throughout the term.

Caution! You will be at a disadvantage if you attempt to complete all coursework on a smart phone or tablet. It may not be possible to submit the files required for your homework assignments.

Students should be able to use email, a word processor, spreadsheet program, and presentation software to complete this course successfully.

The following list details a minimum recommended computer setup and the software packages you will need to have access to, and be able to use:

- PC with Windows 10 (recommended)
- Macintosh with 8 GB RAM or higher will be required to run Windows under VM or Parallels for compatibility with PSPICE/ORCAD as there is no suitable Mac version of SPICE/ORCAD
- Intel Core i5 or higher
- 250 GB Hard Drive
- Latest version of Chrome or Firefox; Mac users may use Chrome or Firefox. A complete list of supported browsers and operating systems can be found on the My Institution page when you log in to Blackboard
- High speed internet connection
- Word processing software (Microsoft Word is available to SBU students)
- Headphones/earbuds and a microphone (recommended)
- Webcam with a microphone (required)
- Printer (optional)
- Ability to download and install free software applications (SPICE/ORCAD) and plug-ins (you must have administrator access to install applications and plug-ins).

Technical Assistance:

If you need technical assistance at any time during the course or to report a problem with Blackboard you can:

- Phone: 631-632-9800 (client support, Wi-Fi, software and hardware)
- Submit a help request ticket: https://it.stonybrook.edu/services/itsm
- If you are on campus, visit the Walk-Up Tech Support Station in the Educational Communications Center (ECC) building.

Part 2: Course Learning Objectives and Assessments

Upon completion of the course, students will be able to:

1. Understand fundamentals of analysis and design of analog circuits constructed with MOSFET and BJT devices and building blocks: standard differential gain stages, current sources.

2. Read schematic and understand analog circuit functionality: estimate voltage gain of amplifier stages, input and output circuit impedances, frequency response

3. Design analog integrated circuits with conventional methods (on paper) and with CAD tool: the design process involves selection of the device dimensions (gate length and width for MOSFETs) bias currents of standard gain stages to meet specifications on voltage gain and frequency response of voltage amplifier stages.

How to Succeed in this Course:

- Create your study schedule ahead of deadlines and do your best effort to follow it.

  Communicate with the instructor, ask questions.
- Allocate more time than you expect you will need for course activities. How much time should students devote to an online course? Time on task information, see NY State Education Department:

  http://www.nysed.gov/collegeuniversityevaluation/distanceeducation-program-policies

Part 3: Tentative schedule

Mondays Simulations	Wednesdays Homeworks	Topics
Lecture 1 1/22	Lect. 2 1/24	MOSFET and BJT characteristics.
Lect.3 1/29	Lect. 4 1/31	Gain of the basic gain stage. Current sources and sinks. Biasing with voltage and current sources. Loading with current sources/sinks.
Lect. 5 2/5	Lect. 6 1/7, HW1	Current Mirrors. Common-source (CS) stage with source degeneration. Common-Gate (CG) stage. Cascode amplifier.
Lect. 7 2/12	Lect. 8 2/14, HW2	MOSFET Cascode current source. Differential pairs with resistive, current source and current mirror loads.
Lect. 9 2/19	Lect. 10 2/21, HW3	Large signal range. DC gain: differential, common mode, CMRR. Analysis and design of CS and CG stages.
Lect. 11 2/26	Lect. 12 2/28, HW4	Analysis and design of cascode amplifiers. Common-drain stage. Common-emitter, common-base and common-collector stages. BJT current sources
Lect. 13 3/4	Lect. 14 3/6, HW5	Wide-swing cascode current source. Current steering. CS differential stage loaded with current mirror. Low-pass filter. MOSFET capacitances. Transition frequency.
		Spring Recess (March 11 - March 17)
Lect. 15 3/18	Lect. 16 3/20	Frequency response of CS, CG and cascode amplifiers. Poles and zeros. Effect of bias current on gain and bandwidth. Unity gain frequency. Miller's theorem.
Lect. 17 3/25, Sim1	Lect. 18 3/27, HW6	Design with charts. Frequency response of CS stages with current mirror load: differential gain, common-mode gain and CMRR. 2-stage CMOS OpAmp.
Lect. 19 4/1, Sim2	Lect. 20 4/3, HW7	Frequency response of the differential gain and frequency compensation. Phase Margin. Transient response, slew rate. Folded cascode OpAmp.
Lect. 21 4/8, Sim 3	Lect. 22 4/10, HW8	Four negative feedback topologies. Input and output impedances of feedback circuits. Voltage amplifiers. Transimpedance amplifiers.
Lect. 23 4/15, Sim4	Lect. 24 4/17, HW9	Transconductance amplifiers. Current amplifiers. Loop gain, pole location and stability.
Lect. 25 4/22	Lect. 26 4/24, HW10	Regulated cascode amplifiers.
Lect. 27 4/29, Project	Lect. 28 5/1	Review.
No Final Exam		

Part 4: Grading, Attendance, and Late Work Policies

Viewing Grades on Brightspace: Total course scores provided by BSpace can be misleading due to missing manually entered scores and appropriate weights of different activities. Scores for HW1 - HW5 with numerical answers are generated instantly. HW6 - HW10 and simulation reports with manual grading will be evaluated within 1 week of being uploaded to BSpace. In order to meet the course requirements additional effort for improvement of simulation results and reports can be requested. Video answers to quiz questions should be recorded and posted on Voicethread (no duplicated posts on Brightspace are needed). Quiz answers will be commented when necessary. Scores for Quizzes will be entered into BSpace manually. In this course, you will be assessed on the following:

Activity/Assignment	**Points**	**Due Date**
Activity in Voicethread - discussions, questions posted in Lecture units over the semester	4	Mondays, the following week after topic presentations, end of the day, EST.
12 Quizzes	48	Thursdays, the following week after topic presentations, end of the day, EST. Quizzes start from the week of Feb 5
10 Homeworks	20	Wednesdays, see the schedule, end of the day, EST
4 Simulations	16	Mondays, see the schedule, end of the day, EST
Project	12	April 29, end of the day, EST
Total	100	

Letter Grades: Final grades assigned for the course will be based on the percentage of total points earned and are assigned as follows:

Letter Grade	Points or Percentage
A	>90
A-	89-85
B+	84-80
B	79-75
B-	74-70

C+	69-65
C	65-60
C-	59-55
D+	54-50
D	49-45
F	< 44

Attendance Policy: *Attendance is not graded. When requested by the school, the last day of student attendance is determined from the records of student access.*

Late Work Policy: *Late work is accepted with a 50 % penalty. No credit will be given after posting solutions.*

Grading of Quizzes and Voicethread post frequency

Interpretation Points	Quality of posts	Frequency
Exemplary 4 points	The comment is accurate, relevant and properly attributed. Adds substantial learner presence to the course and stimulates additional thought about the issue under discussion. Collegial and friendly tone.	Participates steadily throughout the semester and responds on or before deadline.
Accomplished 3 points	The comment lacks at least one of the above qualities, but is above average in quality. Makes a significant contribution to our understanding of the issue being discussed.	
Developing 2 points	The comment lacks two or three of the required qualities. Comments which are based solely upon personal opinion or personal experience often fall within this category.	Few posts.
Needs work 1 point	The comment presents little information. However, may provide social presence and contribute to a collegial atmosphere.	Few posts. Deadlines are not met.

Part 5: University and Course Policies

Student Accessibility Support Center Statement:

If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact the Student Accessibility Support Center, 128 ECC Building, (631) 632-6748, or at sasc@stonybrook.edu. They will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential.

Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and the Student Accessibility Support Center. For procedures and information go to the following website:
https://ehs.stonybrook.edu/programs/firesafety/emergencyevacuation/evacuation-guide-peoplephysicaldisabilities and search Fire Safety and Evacuation and Disabilities.

Academic Integrity Statement:

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty is required to report any suspected instances of academic dishonesty to the Academic Judiciary. For more comprehensive information on academic integrity, including categories of academic dishonesty please refer to the academic judiciary website at http://www.stonybrook.edu/commcms/academic_integrity/index.html

Important Note: Any form of academic dishonesty, including cheating and plagiarism, will be reported to the Academic Judiciary.

Critical Incident Management:

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of University Community Standards any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures. Further information about most academic matters can be found in the Undergraduate Bulletin, the Undergraduate Class Schedule, and the Faculty-Employee Handbook.

Course Policies:

Understand When You May Drop This Course:

It is the student's responsibility to understand when they need to consider withdrawing from a course. Refer to the Stony Brook Academic Schedule for dates and deadlines for registration: http://www.stonybrook.edu/commcms/registrar/calendars/academic_calendars.

- Undergraduate Course Load and Course Withdrawal Policy
- Graduate Course Changes Policy

Incomplete Policy:

Under emergency/special circumstances, students may petition for an incomplete grade. Circumstances must be documented and significant enough to merit an incomplete. If you need to request an incomplete for this course, contact me for approval as far in advance as possible.

Course Materials and Copyright Statement:

Course material accessed from Blackboard, SB Connect, SB Capture or a Stony Brook Course website is for the exclusive use of students who are currently enrolled in the course. Content from these systems cannot be reused or distributed without written permission of the instructor and/or the copyright holder. Duplication of materials protected by copyright, without permission of the copyright holder is a violation of the Federal copyright law, as well as a violation of Stony Brook's Academic Integrity.

Online Communication Guidelines and Learning Resources:

Maintain professional conduct both in the classroom and online. The classroom is a professional environment where academic debate and learning take place. I will make every effort to make this environment safe for you to share your opinions, ideas, and beliefs. In return, you are expected to respect the opinions, ideas, and beliefs of other students—both in the face-to-face classroom and online communication. Students have the right and privilege to learn in the class, free from harassment and disruption. The course follows the standards set in the Student Code of Conduct, and students are subject to disciplinary action for violation of that code. If your behavior does not follow the course etiquette standards stated below, the grade you receive for a posting may suffer. I reserve the right to remove any discussion messages that display inappropriate language or content.

Online Etiquette:

- Offensive language or rudeness will not be tolerated. Discuss ideas, not the person.
- Avoid cluttering your messages with excessive emphasis (stars, arrows, exclamations).
- If you are responding to a message, include the relevant part of the original message in your reply, or refer to the original post to avoid confusion;
- Be specific and clear, especially when asking questions.
- Use standard punctuation and capitalization. Using all UPPERCASE characters gives the appearance of shouting and makes the message less legible;
- Remember that not all readers have English as their native language, so make allowances for possible misunderstandings and unintended discourtesies.

Online Classes Require Better Communication:

It is important to remember that we will not have the non-verbal cues that occur in a face-to-face classroom. I cannot see the confused, frustrated, or unhappy expressions on your face if you encounter problems. You MUST communicate with me so that I can help. To make the experience go smoothly, remember that you're responsible for initiating more contact, and being direct, persistent, and vocal when you don't understand something.

Instructor roles:

The instructor will serve as a "guide" in online classroom. I will read what is posted in Lecture units on VoiceThread, and reply when necessary. Expect instructor posts in the following situations:

- To assist each of you when it comes to making connections between discussion, lectures, and textbook material.
- To fill in important things that may have been missed.
- To redirect discussion when it gets "out of hand."
- To point out key points or to identify valuable posts.

Part 6: Student Resources

Academic and Major Advising (*undergraduate only*): Have questions about choosing the right course? Contact an advisor today. Phone and emails vary-please see website for additional contact information; website:

https://www.stonybrook.edu/for-students/academic-advising/

Academic Success and Tutoring Center *(undergraduate only)*: https://www.stonybrook.edu/tutoring/

Amazon @ Stony Brook: Order your books before classes begin. Phone: 631-632-9828; email: Bookstore_Liaison@stonybrook.edu; website: http://www.stonybrook.edu/ bookstore/

Bursar: For help with billing and payment. Phone: 631-632-9316; email: bursar@stonybrook.edu; website: http://www.stonybrook.edu/bursar/

Career Center: The Career Center's mission is to support the academic mission of Stony Brook University by educating students about the career decision-making process, helping them plan and attain their career goals, and assisting with their smooth transition to the workplace or further education. Phone: 631-632-6810; email: sbucareercenter@stonybrook.edu;

website: http://www.stonybrook.edu/careercenter/

Counseling and Psychological Services: CAPS staff are available by phone, day or night. http://studentaffairs.stonybrook.edu/caps/

Ombuds Office: The Stony Brook University Ombuds Office provides an alternative channel for confidential, impartial, independent and informal dispute resolution services for the entire University community. We provide a safe place to voice your concerns and explore options for productive conflict management and resolution. The Ombuds Office is a source of confidential advice and information about University policies and procedures and helps individuals and groups address university-related conflicts and concerns. http://www.stonybrook.edu/ombuds/

Registrar: Having a registration issue? Let them know. Phone: 631-632-6175; email: registrar_office@stonybrook.edu; http://www.stonybrook.edu/registrar/

SBU Libraries: access to and help in using databases, e-books, and other sources for your research.

- Research Guides and Tutorials: http://guides.library.stonybrook.edu/
- Getting Help: https://library.stonybrook.edu/research/ask-a-librarian/

Student Accessibility Support Center: Students in need of special accommodations should contact SASC. Phone: 631-632-6748; email: sasc@stonybrook.edu; https://www.stonybrook.edu/sasc/

Support for Online Learning: https://www.stonybrook.edu/online/

Writing Center: Students are able to schedule face-to-face and online appointments. https://www.stonybrook.edu/writingcenter/