

EE 112 Analog Integrated Circuits I

Fall, 2016

Instructor: Haoyu Wang

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Class Hours: Tuesdays and Thursdays 10:15am-11:55am; Rm. 1D-108, Bldg. SIST

Recitations: Fridays 3:00pm-4:00pm; Rm. 1D-108, Bldg. SIST

Office Hours: Fridays 1:00pm-3:00pm; the other times are fine, but by appointment only

Course Websites: <http://pearl.shanghaitech.edu.cn/ee112/>

Piazza: <https://piazza.com/shanghaitech.edu.cn/fall2016/ee112>

Recitation TA: Zhiqing Li, lizhq@shanghaitech.edu.cn; (021)2068-5097

Lab TAs: Liang Yu, yuliang@shanghaitech.edu.cn; Ming Shang, shangming@shanghaitech.edu.cn

Course Description: This course provides a basic understanding of semiconductor devices and analog integrated circuits. Topics include: Ideal and nonideal Op Amplifiers; Basic device concepts of pn junction diode, bipolar junction transistors (BJT), and field effect transistors (FET) and their SPICE models; Single transistor amplifiers; Biasing circuits for amplifiers; Input/output impedances of various amplifiers; Multistage amplifiers; Frequency response and bandwidth of amplifiers.

Prerequisite(s): Circuits Theory; Advanced Mathematics

Credit Hours: 4

Required Text:

A. S. Sedra, and K. C. Smith, *Microelectronic circuits*, 7th Edition, Oxford University Press, 2014. ISBN: 978-0199339136

Recommended Texts:

The following recommended texts will provide background for the course.

R. Jaeger, and T. Blalock, *Microelectronic Circuit Design*, 5th Edition, McGraw-Hill Education, 2015. ISBN: 978-0073529608

B. Razavi, *Fundamentals of Microelectronics*, 2nd Edition, Wiley, 2013. ISBN: 978-1118156322

Lecture Contents:

1. Introduction and overview
2. Ideal Op Amps and non-ideal op amps
3. Semiconductors basis
4. PN junction diodes
5. MOSFET
6. Bipolar junction transistor
7. DC analysis of BJT
8. Transistor amplifiers and small signal models
9. Single transistor amplifier configurations
10. Discrete circuit amplifiers

11. Basic IC gain cells
12. Cascode amplifiers
13. Differential pair
14. Multi-stage amplifiers
15. Frequency response
16. High frequency response of amplifiers

Labs:

1. Non-ideal op amp circuits
2. Characterization of Diode, Bipolar Junction Transistor, and MOSFET
3. Single-Stage Common-Emitter (CE) and Common-Source (CS) Amplifiers
4. PMOS characterization and CMOS Inverter
5. Multi-Stage Amplifiers
6. Differential Amplifies

Course Material: Most of the course material will be delivered within the lecture. Supplementary material, such as slides, homework and course announcement, will be updated on the website and/or via direct email to students in the class. In case of email notification, I will send it to your @shanghaitech.edu.cn email by default. All class announcements will be mirrored onto the class website as an alternative means of retrieving updated information.

Labs: Students should attend the Lab section they are enrolled in. All of the lab assignments will be posted online. Each pre-lab assignment is due at the beginning of the corresponding lab session. Post-lab assignments are due at the beginning of the following lab session. Although students will be allowed to work in pairs during the lab sessions, each student must individually turn in his/her own pre-lab and post-lab assignments.

Homework: Homework will be given roughly every 1.5 weeks. They will be distributed from the webpage. Homework will typically be due in class one week after it is posted and will be collected right before the lecture.

Late Policy: Late homework or lab report is allowed five days maximum after its due date, but its weight will be discounted by 20% per day.

Exams: Your exam score in the class will be based on two midterm exams and one final exam. Those two midterm exams are equally-weighted. The exact dates of the exams will be posted on the course website. Exam questions will be based on the course material and homework.

Grading: Grading will be based on: homework (10%), midterm exam (15% each), Lab (25%, you must complete all labs to pass the course!), final exam (30%), attendance (quizzes) (5%).

Academic Dishonesty: Although I sincerely wish that I will not have to cope with this issue, I would like to make it very clear that academic dishonesty will not be tolerated. The following acts of

academic dishonesty are absolutely prohibited: cheating, fabrication, facilitating academic dishonesty, and plagiarism. Academic dishonesty in this course includes copying of homework/lab report or deliberately taking unfair advantage of the other students in the course. Once found, it can lead one to a fail grade in this class and will be referred to the academic committee in the School of Information Science and Technology.