

EEE 433 Analog Integrated Circuits (4) [F,S]

Course (Catalog) Description:

Analysis, design, and applications of modern analog integrated circuits, Apply the methods learned in class to design and implement practical projects.
Lecture, lab. Technical Elective.

Prerequisite:

Engineering BS/BSE student and a grade of D or better in EEE 334, EEE335

Textbook:

Analog Integrated Circuit Design, Carusone, Johns, Martin, ISBN-978-0 047077010-8

Supplemental Materials:

Reading assignments are listed on the tentative schedule. You will be expected to have read the assignment before the day it is listed on the schedule and be ready to ask questions, work examples, etc. from this assignment. In some cases, the reading will be supplemented by lecture notes.

Coordinators:

S. Kiaei, Professor, David Allee, Professor

Course Objectives:

Design, analysis, simulations, and testing of analog circuits, analog electronics, with focus on integrated circuit design, included topics: DC biasing, op-amp

The labs will focus on designing operational amplifiers culminating in the design of a gamma or neutron radiation detector. The design, analysis, and simulations will be done using CADENCE, and Matlab. Students will simulate and layout the circuit.

Course Outcomes:

Design, analysis, simulations, and testing of analog circuits, analog electronics, with focus on integrated circuit design, included topics: DC biasing, op-amp

Cadence for Simulation Labs and Homework problems.

Course Topics:

- MOS device physics, DC, AC, Parasitics, High Freq. Model;
- Current Mirrors;
- Amp Models, Single-stage Amplifiers;
- Layout, Parasitics;
- Review of Freq. Response, BODE Plot;
- Frequency response of amps and analog circuits – Ch4
- Feedback Amp – Ch 5
- Folded Cascode Op-Amp – Ch 6
- Noise- Ch 9

Computer Usage:

The labs use Cadence software for simulations. All lab work will occur in GWC273 CAD lab. Students can login the system from any ASU computer, but you must be within the ASU domain computer to run CADENCE (no off campus access to CADENCE tools). Students can also login from your computer.

Laboratory Experiments:

There is a weekly project/Lab. The labs will be either using a CAD tool for simulations (PSPICE/CADENCE) and layout of Integrated Circuits (IC), or hardware lab. All hardware labs work will occur in GWC273 under an open lab system. You may do your work anytime the lab is open. For the students enrolled at 591 (graduate students), they will be performing projects and advance labs using the CAD tools.

Lab 1: CADENCE Tutorial, MOS IV Curves

Lab 2: CS with Passive, Active, Source Degeneration

Lab 3: Current Mirror, Cascode Mirror

Lab 4: Diff Amp

Lab 5: Frequency Response

Lab 6: Project

Grading

Bi-Weekly Quiz: 15%, 3 Exams: 15% Each, Labs 40%

Course Contribution to Engineering Science and Design:

EEE433 contributes to engineering science through circuit analysis, problem solving, computer solutions, and applications of mathematics, physics, and electronics. Design occurs through weekly design projects as well as a four-week final design project.

Course Relationship to Program Outcomes:

a: Students with Analog/Mixed signal background are highly sought after upon graduation. All the design and computer tool skills taught as applications of math, physics and engineering principles and are used in modern analog/mixed signal industries.

k: Students completing 433 have basic knowledge of analog/mixed signal design. Students have extensive exposure to Cadence circuit analysis in 433. Cadence tools and PSPICE used for layout, simulation and extraction as well as contemporary methods in electronic circuit analysis. Cadence tools will be used in five years; course material geared toward analog electronics expected over next five years. Students are taught problem solving through circuit design, circuit analysis, layout of circuits, extraction of layout parameters, and design analysis.

Furthermore, there exist some contributions to **b** (3 hours of hardware and Cadence simulation required per week, which require students to design and conduct experiments), **c** (students design a complete analog system with amplification, energy blocks, input/output stages to interface with external systems),

e (solving engineering problems related to electronic circuits), **g** (both written and oral reports are required), **i** (literature surveys and develop references outside class for their projects),

j (Industry speakers give presentations on applications of course knowledge).

Person preparing this description and date of preparation: Sayfe Kiaei, K. Tsakalis, Apr. 2009,
June 2015.