1. **Course number and name**

   ENGR 445: Analog Integrated Circuit Design

2. **Credits and contact hours**

   4 credit hours

3. **Instructor’s or course coordinator’s name**

   Instructor: Hao Jiang,
   Course coordinator: Hao Jiang, Associate Prof. in EE

4. **Text book, title, author, and year**


   a. other supplemental materials

5. **Specific course information**

   a. **brief description of the content of the course (catalog description)**

      Integrated circuit technology, transistor characteristics and models. Analysis and design of monolithic op amps. Frequency response, negative feedback, stability, circuit simulation.

   b. **prerequisites or co-requisites**

      Grades of C- or better in Engr 353 and Engr301

   c. **indicate whether a required, elective, or selected elective course in the program**

      Elective for Electrical Engineering.

6. **Specific goals for the course**

   a. **Specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.**

      - To study basic semiconductor principles and analog IC technology.
      - To study analog IC building blocks up to the complete op amp.
      - To investigate the frequency response of analog ICs.
      - To study negative feedback, stability, and frequency compensation.
To design and simulate the performance of analog ICs in the laboratory.

b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

- Students will demonstrate an understanding of *pn* junction properties and *i-v* characteristics.
- Students will demonstrate an understanding of CMOS transistor properties, characteristics, and models.
- Students will become conversant with analog IC technology and fabrication techniques.
- Students will demonstrate an understanding of classical single-transistor and two-transistor configurations.
- Students will demonstrate an understanding of basic analog IC building blocks (current sources, active loads, and output stages).
- Students will demonstrate an ability to perform the DC and small-signal analysis of a complete op amp.
- Students will demonstrate an ability to investigate the frequency response of basic analog IC building blocks.
- Students will demonstrate an ability to investigate the small- and large-signal transient response of an IC op amp.
- Students will demonstrate an ability to identify and analyze classic negative-feedback topologies.
- Students will demonstrate an ability to assess the stability of a negative-feedback circuit.
- Students will become conversant with the most common frequency-compensation techniques.
- Students will demonstrate an ability to characterize electronic devices using circuit simulation tools.
- Students will demonstrate an ability to characterize analog building blocks using circuit simulation tools.

7. **Brief list of topics to be covered**

- Models for integrated-circuit active devices
- CMOS integrated-circuit technology
- Single-transistor and two-transistor amplifiers
- Current sources, active loads, and output stages
- Large-signal and small-signal analysis of an op amp
- Frequency and time responses of integrated circuits
- Negative feedback
• Frequency response, stability, and frequency compensation of negative-feedback amplifiers