1. Course number and name  
ENGR 353: Electronics

2. Credits and contact hours  
3 credit hours

3. Instructor’s or course coordinator’s name  
Instructor: Nick Langhoff  
Course coordinator: Hao Jiang, Associate Prof. in EE

4. Text book, title, author, and year  

5. Specific course information  
   a. brief description of the content of the course (catalog description)  
      PN Diodes, BJTs, and MOSFETs. Semiconductor device basics, characteristics and models. Diode applications. Transistor biasing, basic amplifier configurations, and basic logic circuits. PSpice simulation.
   b. prerequisites or co-requisites  
      Grades of C- or better in ENGR 205 (Electric Circuits) and 206 (Electric Circuits Lab)
   c. indicate whether a required, elective, or selected elective course in the program  
      Required for Electrical Engineering and Computer 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 op amp circuits and instrumentation applications; to investigate the effect of practical op amp limitations  
      - To study pn junction diodes and basic applications  
      - To study transistors (BJTs and FETs), as well as their applications as single-stage amplifiers and logic inverters  
      - To expose students to SPICE simulation of basic op–amp, diode, and transistor circuits
   b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.  
      Course addresses ABET Student Outcome(s): a, c, e, k.  
      - Students will demonstrate an ability to analyze popular op–amp circuits, including instrumentation blocks.
• Students will demonstrate an ability to assess the effect of practical op-amp limitations upon circuit performance.

• Students will become conversant with the transient and frequency behavior of basic op-amp circuits, and the use of Bode Plots.

• Students will become conversant with pn junction behavior and characteristics.

• Students will demonstrate an ability to analyze diode circuits using graphical and iterative techniques as well as large-signal and small-signal modeling concepts.

• Students will demonstrate a knowledge of popular diode applications such as rectification, regulation, limiting, and clamping.

• Students will become conversant with SPICE diode models.

• Students will become conversant with the physical structures of BJTs, MOSFETs, and JFETs, as well as their electrical characteristics.

• Students will demonstrate an ability to use large-signal models for the DC analysis and design of simple transistor circuits.

• Students will demonstrate an ability to use small-signal models for the analysis and design of basic single-stage amplifiers.

• Students will demonstrate an ability to analyze simple logic inverters using transistors.

• Students will become conversant with SPICE transistor models.

• Students will demonstrate a skill in running successful computer simulations of simple electronic circuits and compare with hand calculations.

7. Brief list of topics to be covered

• Review and introduction to electronics concepts: Signals; amplifiers; logic inverters, modeling; transient and frequency responses

• Operational amplifiers: Basic configurations; applications; nonidealities; SPICE simulation.

• Diodes: Characteristics; physical operation of pn junctions; circuit analysis; models; basic applications; SPICE simulation.

• Bipolar junction transistors: Physical operation; characteristics; models; biasing; single-stage amplifier configurations; switch and logic applications; SPICE simulation.

• Field-effect transistors: Physical operation; characteristics; models; biasing; single-stage amplifier configurations; CMOS inverters and switches; SPICE simulation.