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*
   Behzad Razavi *Fundamentals of Microelectronics* Wiley, 2008

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.*

- 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*
    - Reviewand introduction to electronics concepts: Signals; amplifiers; logic inverters, modeling; transient and frequency responses

- Operationalamplifiers: Basic configurations; applications; nonidealities; SPICE simulation.
- Diodes:Characteristics; physical operation of pn junctions; circuit analysis; models; basic applications; SPICE simulation.
- Bipolarjunction transistors: Physical operation; characteristics; models; biasing; single-stage amplifier configurations; switch and logic applications; SPICE simulation.
- Field-effecttransistors: Physical operation; characteristics; models; biasing; single-stage amplifier configurations; CMOS inverters and switches; SPICE simulation.