1. *Course number and name*

   ENGR 301: Electrical Measurement

2. *Credits and contact hours*

   1 credit hours

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

   Instructor: Ian Santos

   Course coordinator: Hao Jiang, Associate Prof. in EE

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

   Franco, Sergio, and Klingenberg, Larry J. *Lab Manual for ENGR 301*

5. *Specific course information*

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

   Measurement techniques, device characterization, experimental verification, and PSpice simulation. 2nd-order transient and frequency responses. Characterization of diodes, BJTs and FETs. Diode circuits, transistor amplifiers, simple logic gates.

   b. prerequisites or co-requisites

   ENGR 353 (Electronics) (can be taken concurrently)

   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 measure the characteristics of common electronic devices such as diodes, BJTs, FETs, and to compare with theoretical prediction.
   - To observe experimentally the behavior of the aforementioned devices in a variety of common applications, such as rectification, regulation, amplification, and digital logic, and to compare with theoretical prediction.
   - To simulate the aforementioned circuits via PSpice, and to compare with experimental observations.
   - To plot, analyze, and interpret data, and to prepare technical reports of appropriate quality.

   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 characterize junction diodes.
- Students will demonstrate an ability to characterize bipolar transistors.
- Students will demonstrate an ability to characterize field-effect transistors.
- Students will be able to verify experimentally popular diode applications such as rectification and regulation, and compare with theoretical prediction.
- Students will be able to verify experimentally popular BJT applications such as amplification and digital logic, and compare with theoretical predictions.
- Students will be able to verify experimentally popular FET applications such as amplification and digital logic, and compare with theoretical predictions.
- Students will demonstrate a skill to use PSpice to simulate the transient and frequency responses of a second-order circuit, and compare with experimental observations.
- Students will demonstrate a skill to use PSpice to simulate the diode circuits investigated in the lab, and compare with measured data.
- Students will demonstrate a skill to use PSpice to simulate the BJT and MOSFET amplifiers investigated in the lab, and compare with measured data.
- Students will demonstrate a skill to use PSpice to simulate the BJT and MOSFET logic circuits investigated in the lab, and compare with measured data.
- Students will demonstrate an ability in collecting, plotting, and interpreting experimental data, comparing with theoretical predictions, and accounting for discrepancies.
- Students will demonstrate a skill in the presentation of experimental results via effective graphic means, such as *i-v* characteristics, Bode Plots, voltage transfer curves, and waveforms.
- Students will demonstrate a skill in technical report preparation emphasizing both technical merit and effective writing.

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, b, c, e, g, k.

7. Brief list of topics to be covered

- Second-order step responses under various damping conditions; frequency responses, Bode Plots.
- Diode characteristics, and basic diode applications as rectifiers and regulators.
- Transistor (BJT and MOSFET) characteristics, and basic transistor applications as amplifiers and logic circuits.
- Computer simulation of diodes and transistor circuits using PSpice; comparison with experimental observations.