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.**  
      Course addresses ABET Student Outcome(s): a, b, c, e, g, k.
• 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.

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.