1. **Course number and name**
   
   ENGR 453: Digital IC Design

2. **Credits and contact hours**
   
   4 credit hours; two 75-minute lecture sessions/week and one 2-hour-45-minute lab session/week

3. **Instructor’s or course coordinator’s name**
   
   Instructor: Hamid Mahmoodi, Professor of Electrical and Computer Engineering
   
   Course coordinator: Hamid Mahmoodi, Professor of Electrical and Computer Engineering

4. **Text book, title, author, and year**
   
   
   a. **other supplemental materials**
      
      (none)

5. **Specific course information**
   
   a. **brief description of the content of the course (catalog description)**
      
      Integrated circuit technology, transistor characteristics and models. MOS and bipolar logic families, noise margins, speed, power, fanout, interfacing, PSpice simulation. Regenerative circuits and memories. Class work, 3 units; laboratory, 1 unit. Extra fee required.
   
   b. **prerequisites or co-requisites**
      
      Grades of C- or better in ENGR 301, 353, and 356
   
   c. **indicate whether a required, elective, or selected elective course in the program**
      
      Elective for Electrical 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.**
      
      • The student will be able to describe fundamental metrics used for quantitative evaluation of a digital circuit.
      
      • The student will be able to explain basics of MOS transistors and CMOS technology.
      
      • The student will be able to describe silicon technology scaling and trends.
      
      • The student will be able to design logic circuits using different logic styles such as complementary CMOS logic, pass-transistor logic, and dynamic logic styles.
• The student will gain the skill of transistor-level analysis and design of simple and complex logic gates such as inverter, NOR and NAND gates in CMOS.
• The student will be able to explain different designs for memory elements and design sequential logic circuits such as latches and flip-flops in CMOS.
• The student will demonstrate a skill in using modern EDA tools for full-custom IC design, including circuit simulation and layout tools.
• The student will measure and verify the performance of digital circuits in the laboratory.

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, k.

7. Brief list of topics to be covered
• Introduction to digital integrated circuits
• Design metrics
• MOS transistor
• CMOS technology
• CMOS inverter
• Interconnects
• Combinational logic gates in CMOS
• Design of sequential logic circuits