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*
   Digital Integrated Circuits (2nd Edition) by Jan Rabaey et.al., Prentice Hall, 2003

   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