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