1. *Course number and name*

**ENGR 453: Digital IC Design**

1. *Credits and contact hours*

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

1. *Instructor’s or course coordinator’s name*

Instructor: Hamid Mahmoodi, Assistant Professor of Computer Engineering

Course coordinator: Hamid Mahmoodi, Assistant Professor of Computer Engineering

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

[Digital Integrated Circuits (2nd Edition) by Jan Rabaey et.al.](http://bwrc.eecs.berkeley.edu/IcBook/), Prentice Hall, 2003

1. *other supplemental materials*

(none)

1. *Specific course information*
2. *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.

1. *prerequisites or co-requisites*

Grades of C- or better in ENGR 301, 353, and 356

1. *indicate whether a required, elective, or selected elective course in the program*

Elective.

1. *Specific goals for the course*
2. *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.

1. *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): 1, 2, 6.

1. *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