1. **Course number and name**
   COE 428 – VLSI Design

2. **Credits and contact hours**
   3 credit hours, 3 contact hours

3. **Instructor's or course coordinator's name**
   Dr. Assim Sagahyroon

4. **Textbook, title, author, and year**
   D. Harris and N. Weste, *CMOS VLSI Design: A Circuits and Systems Perspective*, 4th edition, Addison Wesley, 2011.

   Other supplemental materials
   None

5. **Specific course information**
   a. **Brief description of content of the course (catalog description)**
      Covers CMOS technology; layout rules and techniques; CMOS logic and circuit design; circuit characterization and performance estimation; design methodologies and tools.

   b. **Prerequisites or co-requisites**
      Prerequisites: COE 221/CMP 210 (Digital Systems) and ELE 241 (Electronics I)

   c. **Indicate whether a required, elective, or selected elective course in the program**
      Selected Elective

6. **Specific goals for the course**
   a. **Specific outcomes of instruction**
      This course requires the student to demonstrate the following:
      1. Understanding of CMOS circuit design techniques
      2. Describe integrated circuits design flow
      3. Describe the characteristics of circuit families (Static CMOS, Pseudo-NMOS, Dynamic, etc)
      4. Design Combinational Circuits using CMOS
      5. Design sequencing elements (flip-flops and latches) using CMOS
      6. Calculate delays using RC Models
      7. Compare design options using Logical Effort technique
      8. Estimate Power Consumption in CMOS circuits
      9. Use CAD tools (such as Electric) to perform the design and layout of simple CMOS circuits.

b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course

This course contributes in a significant way to the accomplishment of the following program outcomes:

Program outcome	Emphasis in this course
(a) an ability to apply knowledge of mathematics, science, and engineering	◑
(b) an ability to design and conduct experiments, as well as to analyze and interpret data	
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	
(d) an ability to function on multidisciplinary teams	
(e) an ability to identify, formulate, and solve engineering problems	◑
(f) an understanding of professional and ethical responsibility	
(g) an ability to communicate effectively	
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	
(i) a recognition of the need for, and an ability to engage in life-long learning	○
(j) a knowledge of contemporary issues	
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.	●

Emphasis: ● High; ◑ Medium; ○ Low; Blank – Nothing Specific Expected

7. Brief list of topics to be covered

    i.   Introduction to CMOS logic, fabrication and layout
    ii.   MOS C-V characteristics
    iii.   DC transfer characteristics
    iv.   Delay estimation
    v.   Power dissipation
    vi.   Interconnects
    vii.   CMOS Circuits characterization
    viii.   CMOS Circuit families
    ix.   Combinational and sequential circuit design
    x.   Design methodology and tools