

1. Course number and name

COE 424 - Advanced Digital System Design

2. Credits and contact hours

3 credit hours, 5 contact hours

3. Instructor's or course coordinator's name

Dr. Assim Sagahyroom

4. Textbook, title, author, and year

M.D. Ciletti, *Advanced Digital Design with the Verilog HDL*. 2nd edition, Prentice Hall Publishers, 2011.

Other supplemental materials

None

5. Specific course information

a. Brief description of content of the course (catalog description)

Covers advanced digital design techniques, structured design methods for advanced digital design, case studies of complex digital circuits, hardware description languages (HDL) and PLD implementations, reliable design and testing techniques.

b. Prerequisites or co-requisites

Prerequisite: COE 341 (Computer Architecture & Organization)

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

Required

6. Specific goals for the course

a. Specific outcomes of instruction

This course requires the student to demonstrate the following:

1. Describe and design hardware at the *Structural*, *RTL* and *Behavioral* level using an HDL (Hardware Description Language)
2. Design combinational circuits using an HDL
3. Design synchronous Finite State Machines using an HDL
4. Use industry-standard CAD simulation environment to build and test the functionality of a circuit
5. Apply synthesis techniques to generate optimized hardware
6. Design using Programmable Logic devices
7. Demonstrate a basic understanding of VLSI testing.

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: H – High; M – Moderate; L – Low; Blank – Nothing specific expected

7. Brief list of topics to be covered

- i. Review of combinational and synchronous sequential circuits
- ii. Introduction to digital design methodology
- iii. Use of Hardware description languages (HDLs) in the design cycle of ASICs
- iv. Structural, RTL and behavioral level design using an HDL
- v. Combinational circuits design using an HDL
- vi. Design of synchronous Finite State Machines (FSM) using an HDL
- vii. Test benches generation
- viii. Synthesis techniques of combinational logic circuits
- ix. Synthesis techniques of sequential logic circuits
- x. Design and implementation of digital circuits using Programmable Logic devices
- xi. Introduction to VLSI testing.