EE6306 DIGITAL INTEGRATED CIRCUIT DESIGN

Acad Unit: 3
Prerequisite: Nil
Effective: AY2014-15
Last update: October 2013

LEARNING OBJECTIVE

The objective of this course is to provide students with a basic understanding of the integrated-circuit (IC) devices, namely the bipolar transistor and MOSFET. Some second order transistors' effects will be discussed. The basic silicon devices processes, the working principle of CMOS logic circuits (both static and dynamic) as well as the consideration for power will all be covered. Following the basic devices, the BiCMOS devices that is used in niche areas of digital IC design, will be discussed. The issues of low voltage and low power, as well as the sensitivity analyses of BiCMOS digital circuits will all be presented. The layout design rules is also covered in the course before introducing the Sub-System Design in Digital Circuits

In the Design Methodologies topic, the concepts on design flow, design analysis, verification, different implementation approaches, design synthesis and test methods are discussed. The objective is to provide the students with clear concepts on these topics.

All of these topics serves as important background to our present day devices and help to form a strong foundation for the learning of future newly developed semiconductor devices and their applications. Finally, this course together with the Analog IC Design course provide a comprehensive study of integrated circuit design for graduate students.

CONTENT

Review of Integrated Circuit Fundamentals. Layout and Design Issues. CMOS Digital Circuits. BiCMOS Digital Circuits. Sub-System Design in Digital Circuits. Design Methodologies.

LEARNING OUTCOME

Students are expected to achieve a basic understanding of transistor device physics, as well as the secondary effects of these devices. They should be able to draw the layout for a block of CMOS circuit at the end of the course. The working mechanism of CMOS circuits (both static and dynamic) as well as the consideration for low power design should be better appreciated. Finally, they should be able to analyze and design digital CMOS circuits with high speed and more importantly, low power considerations. Finally, digital sub-system

design is covered to enable students to scale up from devices and circuits to digital functional modules and more complex digital integrated systems with low power consumption.

OTHER RELEVANT INFORMATION

This course is intended for graduate students. The prerequisites for understanding the course are: a bachelor degree in Physics or in Electrical and/or Electronic engineering.

ASSESSMENT SCHEME

Continuous Assessment	20%
Final Examination	80%

TEXTBOOKS

1. Neil HE Weste and David M Harris, CMOS VLSI Design, Addison Wesley, 4th edition, 2011
2. Ming-Bo Lin, Introduction to VLSI Systems: A Logic, Circuit and System Perspective, CRC Press, 2012

REFERENCES

1. Jan M. Rabaey, A Chandrakasan, and B Nikolic “Digital Integrated Circuits”, 2nd edition Prentice Hall, 2003.
2. S.S. Rofail and K.S. Yeo, "Low-Voltage Low-Power Digital BiCMOS Circuits: Circuit Design, Comparative Study, and Sensitivity Analysis", Prentice Hall, 1999