Title: VLSI CIRCUIT DESIGN

Course Number: EE 417

Credits: 3 (3 lectures - 0 lab.)

Coordinator: Shuja Ahmad Abbasi, Professor, Electrical Engineering

Goals: Provide students with an understanding of and experience with the design of VLSI circuits, particularly in MOS technology.

Objectives: To learn the techniques and the use of advanced EDA tools for the design of Combinational and sequential VLSI circuits including ASIC.

Textbooks:

1. Basic VLSI Design, 3rd Ed. By D. A. Pucknell & K. Eshraghian, Prentice Hall.

2. Introductory VHDL, By Yalamanchili, Prentice Hall, 2001.

Prerequisite: EE 315 - Analog and Digital Electronic Circuits

Topics:

- Basic fabrication sequence of ICs.
- Self aligned silicon gate, NMOS and CMOS technologies.
- Design rules and layout.
- Sub-system Design: Combinational Circuits.
- Sub-system Design: Sequential circuits.
- Memories and registers.
- Introduction to full custom and semi-custom ICs.
- Standard cells, gate arrays, FPGAs and PLDs etc.
- CAD tools for design of ICs.
- Introduction to high level design of ICs using VHDL.
- Introduction to low power IC design.

Course Structure:

The class meets for 3 lectures and 1 tutorial a week, each consisting of 50 minutes duration. There is regular home work and two mid term examinations. A final project is required by the end of the instruction period.

Week	Topics
1	Basic fabrication sequence of ICs: self aligned silicon gate, NMOS and CMOS technologies
2	Introduction to full custom and semi-custom ICs, standard cells, gate arrays
3	FPGAs and PLDs etc.
4	CAD tools for design of ICs and Introduction to high level design using VHDL
5	Circuit design using Switch logic and gate logic
6	Stick diagrams, Design rules and layout
7	Resistance and Capacitance of layers
8	Circuit delays; Scaling of MOS devices
9	Sub-system Design: Combinational Circuits
10	Sub-system Design: Sequential Circuits
11	Design of a 4-bit Arithmetic Processor, Design Partition, Design of Shifter
12	Design of Adder and Multiplier
13	Design of Memories and Registers
14	Introduction to low power IC design

Computer Resources:

Students use computer facilities for their home work and projects and carry out VLSI design of useful circuits/systems.

Laboratory Experiments:

A separate course EE418 takes care of experiments in this area.

Attendance Policy:

According to KSU policy, every student should attend atleast 75% of the course classes (including tutorials) held. Those who fail to fulfill this requirement will fail in the course.

Grading:

- 1st Mid-term examination 20%
- 2nd Mid-term examination 20%
- Home work and Quizzes 10%
- Term Project 10%
- Final examination 40%

Outcome Coverage:

a. Apply math, science and engineering

This course has extensive use of mathematical and scientific concepts in the design and simulation of VLSI circuits and systems.

b. An ability to design and conduct experiments as well as to analyze and interpret data.

None

c. An ability to design system, components or process to meet desired needs.

The students are required to learn and carry out the design of VLSI circuits and systems to meet the given requirements.

d. An ability to function on multi-disciplinary teams.

Students form teams of upto 3 persons for the term project. They have to take up design problems from various disciplines and work on them.

e. Identify, formulate and solve engineering problems.

The students learn the techniques and procedure to design various circuits/systems required in many areas of engineering which requires identifying, formulating and then solving the given problems.

g. An ability to communicate effectively.

The students are required to submit written report on their term projects. The reports are presented by the students in the class where they discuss and defend their work.

d. Broad education necessary to understand the impact of engineering solutions in a global and societal context.

The impact of advances in the field of Microelectronics on almost all spheres of life, resulting in revolutionary changes are discussed through out the course.

i. Recognition of the need and an ability to engage in life-long learning.

Tremendous advances are being made in the areas of VLSI technology and design resulting in rapid changes in tools and techniques. Every one working in this area is to keep on learning through out his life so that his knowledge remains upto date. This fact is clearly brought out during the teaching of the course.

j. Knowledge of contemporary issues.

Reasonable emphasis is laid on contemporary issues since the VLSI designer is to deal with real life problems in a wide range of applications.

k. Use of modern engineering tools.

The course deals with the use of latest design tools available. The students are required to use web services to keep them aware of latest development in the area.

Preparer: Shuja Ahmad Abbasi

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