Design Issues of VLSI Programmable ASICs CSE670 (3-0-3)
Course Outline (032)

Instructor

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Office hours shall be announced in the class and posted on the door			

Course Description

ASIC design methodologies. Programmable ASICs. Field programmable gate Arrays: Architecture, Programming Technoloies, Design Parameters and Models. FPGA Technology Mapping Techniques, Routing Techniques, Placement Techniques and Testing.

Prerequisite: consent of instructor.

Text Book: **Field-Programmable Gate Arrays,** by S. Brown, R. Francis, J. Rose and Z. Varnesic. Kluwer Academic Publishers.

References:

1. **Programmable Logic Handbook: PLDs, CPLDs & FPGAs**, by Ashok K. Sharma, McGrow-Hill.
2. An on-line textbook can be used. The book is titled "Application-Specific Integrated Circuits" by Micheal J. Smith (Addison-Wesley) and is available from http://www.edatoolscafe.com/Book. Also a short version (notes) are available on my web site.

And any book on ASICs and FPGAs

Course Rationale

This course basically teaches ASICs design aspects using programmable Logic Devices. Different types of such devices will be studied, their architecture, interconnect structure, and programming techniques. Also application of such devices in re-configurable computing will be explored. The course mainly emphasizes research in the above areas.

Course Objectives

Insha'Allah by the end of this course students are expected to be able to:

- Understand the different types of programmable logic devices, their architecture, routing and programming techniques,
- Go through a complete ASIC design flow utilizing an FPGA and know the different CAD tools used at each level.

Learning Methodology

The course objective shall be met insha'Allah though lectures, hands-on in-class exercises, assignments and a course project.

Course Topics:

1. ***Introduction to Digital ASICs:*** **(3 weeks)**
   - Introduction to ASICs, Different design styles/options, Basic design flow, the design representations/abstraction (views)

- Review of Digital Circuits Design and specifications:
  - o Combinational Circuits, Sequential circuits (synchronous and asynchronous circuits)
  - o Specifications (propagation delay, Power dissipation, timing constraints, races, glitches, racethrough, slack …etc.).

2. ***Introduction to different types of programmable logic devices:*** **(3weeks)**
   a. **Simple PLDs**

   b. **Complex PLDS**
   - Fine-grain versus coarse grain FPGAs
   - Logic Block Architecture
   - Programming Techniques

3. **FPGA Technology Mapping   Techniques** **(3 weeks)**

4. **FPGA Placement and Routing Techniques** **(2 weeks)**

5. **FPGA Testing** **(1 weeks)**

6. **FPGA Applications:** Introduction to Reconfigurable Computing **(2 weeks)**

Course Projects: The course has two types of projects; a research project (literature review) and a design project. For the first project, the student would pick a topic related to reconfigurable ASICs and research that topic, summarizing the latest trends and findings. He is then to submit a report and deliver a presentation to the course instructor and his class mates. For the second project, the student would pick a design project, hopefully related to the topic he has researched in the first project, and implement a prototype. Again a report and oral presentations are to be delivered. The projects carry a significant portion of the total grade and should be taken seriously.

Grading Policy

Grading is meant only as a way of assessing the student's achievements in the course. Students should not feel too much pressured by this process. The adopted grading policy allows and indeed rewards improvements. A student failing to achieve a good grade in one component of the course should not feel that he has no chance to still get a good grade. The whole purpose of the adopted grading policy is to give the student a second and even a third chance if he needs it to achieve the best result he wants.

Assignments & Quizzes	10 points
Research Review	20 points
Design Project	20 points
Midterm Exam (Tentative Mar. 18th)	20 points
Final Exam	30 points
Total	100 points