Course Syllabus

ECE 624 - Digital Systems Design Automation and VHDL Modeling

Department: Electrical and Computer Engineering
Course Number: ECE 624
Course Title: Design Automation
Credit Units: 3

Course Description:
Issues related to CAD tools used in the physical design of VLSI systems. A discussion of the mathematical tools used in this field, such as graph theory, optimization and search techniques such as mathematical programming, defining the constraints and objectives associated with each problem, as well as several classical algorithms used in their solution. These problems include: floorplanning, partitioning, placement and routing. Discussion of static timing analysis and signal integrity, leading to development of new CAD tools for Deep Sub-micron technology.

Prerequisites:
Students taking this course should be familiar with combinational and sequential logic design process and topics covered in ECE 623.

Texts: Instructor’s lecture notes and Journal papers on individual topics.

Term Project: Depending upon the selected topic students, individually or in groups of 2, will either write a term paper or implement some of the algorithms discussed in class using VHDL or C++.

Course Objectives: After completing this course the students should be able to:

1. Understand concept of design optimization algorithms and their application to physical design automation.
2. Use the appropriate Heuristic methods for various phases of design lay out such as routing, partitioning and placement.
3. Understand the latest design techniques as practiced in the industry for design lay out optimization.
4. Understand the trade offs among various design styles given a set of design constraints in physical design automation. Understand performance/area tradeoffs in a chip design process.
6. Understand the impacts of Nano-technology on physical design automation.
7. Understand implementation issues for digital design automation including optimization techniques.
8. Understand the relationship between good design practices and the testability of digital systems.
Topics Covered/Course Outline:

Chapter 1: An Overview of VLSI Physical Design Automation
Chapter 2: Introduction
Chapter 3: Review of Algorithms and Complexity
Chapter 4: Assignment Problem
Chapter 5: Partitioning
Chapter 6: Placement
Chapter 7: Routing
Chapter 8: Clock, Power and Ground routing
Chapter 9: VLSI Layout Design System Applications

Relationships to Program Outcomes:
This course supports the achievement of the following outcomes:

a) Ability to apply knowledge of advanced principles to the analysis of electrical and computer engineering problems.
b) Ability to apply knowledge of advanced techniques to testing of design systems.
c) Ability to apply the appropriate design practices, emerging technologies, state-of-the-art design techniques, software tools, and research methods for design and design for testability of digital systems.
d) Ability to use the appropriate state-of-the-art engineering references and resources, including IEEE test journals and industry publications, needed to find the best solutions to system design.
e) Ability to communicate clearly and use the appropriate medium, including written, oral, and electronic methods.
f) Ability to maintain life-long learning and continue to be motivated to learn new subjects.
g) Ability to learn new subjects that are required to solve problems in industry without being dependent on a classroom environment.
h) Ability to be competitive in the engineering job market and/or be admitted to an excellent Ph.D. program.

Prepared by:
Ramin Roosta
3/26/2010