ECE 425 Syllabus\textsuperscript{1}  
Fall 2014

**Instructor:** Prof. Spyros Tragoudas  
**Office:** EGR E-0202b  
**Email:** spyros@engr.siu.edu,  
**Office Phone:** 453-7027

**Office Hours:** Tuesday & Thursday, 11:00am - 2:00pm or by appointment  
**Lecture:** T&TR 8:00-9:15am, EGR A-222

**Teaching Assistant (TA):** Wisam Aljubouri, wisam@siu.edu  
**Lab hours & TA hours:** Tuesday 9:15-10:30am Room: E-132 (Sun workstation Lab) or Neckers 240  
Thursday 9:15-10:30am Room: E-132 (Sun workstation Lab).  
Friday 8-8:50am Room: E-132 (Sun workstation Lab) or EGRA 320

**Grading/Evaluation:**  
- Three exams: Each 18\% of the total grade.  
- Laboratory assignments: 36\% of the total grade  
- 2 projects: with a total of 10\% of the grade

\begin{align*} 
A: & 90-100; 
B: & 80-89; 
C: & 70-79; 
D: & 60-69; 
F: & 0-59
\end{align*}

**Classroom Policies:**
A. Students are responsible for all announcements made in class and/or posted to D2L.
B. Late Laboratory assignments are not accepted.
C. No make-up exams.
D. Third exam will be given on the finals week.
E. Cell phone usage is not allowed during lecture.

1. **Course number and name:** ECE 425 VLSI Design and Test Automation.  
2. **Credits and contact hours:** 4 credits, Two 75-minute sessions per week, Two 75-minute sessions per week in the Unix lab.  
3. **Course Committee:** S. Tragoudas, D. Kagaris, H. Wang.  
The course material will be supplemented using notes that will be given in class.  
   **Other supplementary textbooks:**  

5. **Specific course information**
   a. The course covers all the phases of Electronic Design Automation. Laboratory experiments on existing tools will supplement the lectures. Projects will supplement the laboratory assignments.
   b. Prerequisites

\textsuperscript{1} Pages 2 and 3 are for ABET
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ECE 329, ECE 345

c. This course is a Technical Elective for EE and CpE majors.
d. Professional Component {Credit Hours}
   Mathematics 0 Sciences 0 General Ed. 0
   Eng. Science  2  Eng. Design  2

6. Instructional Objectives
   The student is expected to have a clear understanding of:
   1. VHDL principles for VLSI CAD.
   2. Algorithmic and graph theoretic concepts necessary for design automation.
   3. Principles of CMOS VLSI design.
   4. During the lab sessions they will become familiar with the VHDL simulator of the
      Cadence (or equivalent) design automation tools.
   5. In addition, through a programming project in C, such as a three valued algebra
      combinational circuit simulator at the logic level, they will gain programming skills for
      VLSI CAD.
   6. Techniques for automated synthesis and verification of digital combinational and
      sequential systems.
   7. Techniques for tool development in timing analysis, testing, and concepts in high level
      synthesis.
   8. During the lab sessions they will become familiar with the:
      i) Ambit tools (for synthesis).
      ii) SIS package (for synthesis).
      iii) Atalanta tools of Cadence (for testing).
      iv) Equivalent design automation tools for the above design automation areas.
      v) In addition they will gain experience in programming using existing tools in VLSI
         CAD. This will be accomplished through a more advanced programming project such
         as a program for logic or timing verification that is built on top of existing packages.
  10. Methods for physical design automation.
  11. During the lab sessions they will become familiar with Cadence physical design
      automation tools with installed libraries to experiment with the generation of automated
      layouts in sub micron technology that meet certain specifications associated to area,
      performance, crosstalk, power consumption and SIS tools will also be used for
      technology mapping.

7. Brief list of topics (class, lab and project) to be covered
   a. Classroom Topics
      • Principles of CMOS technology. (Approximately 2 classes)
      • Graphs and graph algorithms. (Approximately 3 classes)
      • An overview of VHDL. (at the lab sessions)
      • Logic Synthesis.(Approximately 4 classes)
      • System and High Level Synthesis. (Approximately 4 classes)
      • Simulation. (Approximately 2 classes)
      • Fault modeling and design for testability. (Approximately 3 classes)
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- Fault simulation Automatic Test Pattern Generation. (Approximately 3 classes)
- Timing analysis. (Approximately 2 classes)
- Floorplanning. (Approximately 2 classes)
- Placement and Partition. (Approximately 2 classes)
- Routing. (Approximately 1 class)

b. Laboratory Topics
- Introduction to Unix, cadence and synopsys tools. (2% - 3 sessions)
- Logic Simulation. (5% - 3 sessions)
- Testbench on Datapath Portion. (3% - 4 sessions)
- High Level Synthesis. (5% - 4 sessions)
- Logic Synthesis for Area and Delay Optimization. (6% - 4 sessions)
- Static Timing analysis. (5% - 4 sessions)
- Testing. (4% - 3 sessions)
- Physical Design - Floorplanning, Placement & Routing. (6% - 3 sessions)

c. Projects
- Logic and Fault Simulation Project 1. (6 hours)
- Logic and Fault Simulation Project 2. (6 hours)

8. CAD and Computer Tools Used: Cadence, Synopsys, Binary Decision Diagrams.

9. Assessment of the Contribution to Student Outcomes

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<tr>
<th>Outcome</th>
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<td>Assessed</td>
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Student Outcomes (ABET criteria a-k) are quoted here:

(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.
University Policies

A. **Incomplete Grades:** An *INC* is assigned when, for reasons beyond their control, students *engaged in passing work* are unable to complete all class assignments. An *INC* must be changed to a completed grade within a time period designated by the instructor but not to exceed one year from the close of the term in which the course was taken, *or graduation*, whichever occurs first. Should the student fail to complete the course within the time period designated, not to exceed one year, or graduation, whichever comes first, the incomplete will be converted to a grade of *F* and the grade will be computed in the student’s grade point average. Students should not reregister for courses in which an *INC* has been assigned with the intent of changing the *INC* grade. Re-registration will not prevent the *INC* from being changed to an *F*.

B. **Academic Integrity:** You are expected to submit your original work and adhere to the academic policies as stated in the SIU Student Conduct Code: [http://srr.siu.edu](http://srr.siu.edu) (listed under Additional Links). Any act of academic dishonesty, cheating, or plagiarism in any form, including anonymous internet sources used in student papers, will be reported. These acts are taken seriously and the consequences may range from failing an assignment to expulsion from the university.

C. **SIU Email:** Your SIU email account is an official form of University communication. Your instructor will use SIU email as a primary means of electronic communication with students. Please make sure that you maintain a valid password and acquire the habit of regularly checking your SIU email account for important instructor and University announcements. You may view the official SIU Student Email Policy at: [http://policies.siu.edu/policies/email.html](http://policies.siu.edu/policies/email.html).

D. **Emergency Procedures:** SIU is committed to providing a safe and healthy environment for study and work. Because some health and safety circumstances are beyond our control, we ask that you become familiar with SIU Emergency response Plan and building Emergency Response Team (BERT) program. Emergency response information is available on posters in buildings on campus, available on BERT’s website at [http://www.bert.siu.edu/](http://www.bert.siu.edu/), the SIU Department of Public Safety’s website [www.dps.siu.edu](http://www.dps.siu.edu) (disaster dropdown and video, “Shots Fired”), and in the Emergency Response Guideline pamphlet. Know how to respond to each type of emergency. Instructors will provide guidance and direction to students in the classroom in the event of an emergency affecting your location. **It is important that you follow these instructions and stay with your instructor during an evacuation or sheltering emergency.** The Building Emergency Response Team will provide assistance to your instructor in evacuating the building or
sheltering within the facility.

E. **Supplementary Assistance**: SIU is committed to assisting students with disabilities. With the cooperation of SIU’s Disability Support Services (DSS), each student who qualifies for reasonable supplementary assistance has the right to receive it. Students requesting supplementary assistance must first register with DSS in Woody Hall, B-150, 618-453-5738 or 618-453-2293 (TTY), by email DSS@siu.edu, or http://disabilityservices.siu.edu/. Notice: If you have any type of special need(s) or disability for which you require accommodations to promote your learning in class, please contact me as soon as possible. The Office of Disability Support Services (DSS) offers various support services and can help you with special accommodations. You may wish to contact DSS to verify your eligibility and options for accommodations related to your special need(s) or disability.

**Student Services**

A. **Learning Support Services**: The Center for Learning Support Services (CLSS) assists students of all cultures, abilities, backgrounds and identities with enhancing their self-management and interdependent learning skills. Programs offered by CLSS include: group study sessions; math tutoring; academic coaching; early intervention program; and study skills seminars. For additional information please contact CLSS in Woody Hall, Room A-313, 618-453-2925, or www.tutoring.siu.edu.

B. **Writing Center**: The Writing Center offers free tutoring services and assistance with improving writing skills to all SIU undergraduate students and faculty. For center locations and hours, to schedule an appointment online, and to view information regarding the Online Writing Lab (OWL) contact the Writing Center at 618-453-1231 (Morris Library location); 618-453-2927 (Trueblood location), or www.write.siu.edu.

C. **Saluki Cares**: The purpose of Saluki Cares is to develop, facilitate and coordinate a university-wide program of care and support for students in any type of distress-physical, emotional, financial or personal. By working closely with faculty, staff, students and their families, SIU will continue to display a culture of care and demonstrate to our students and their families that they are an important part of the community. To make a referral to Saluki Cares click, call or send: http://salukicares.siu.edu/index.html; 618-453-5714, or siucares@siu.edu.