[ECE6135] Syllabus

**[Digital System in Nanometer Nodes, 3 Credits (2-2-3)]**

**[Days: TBD, Times: TBD, Location: TBD]**

**Instructor Information**

|  |  |  |
| --- | --- | --- |
| Instructor | Email | Office Hours & Location |
| Saibal Mukhopadhyay | Saibal@ece.gatech.edu | KACB2356, TBD |
| **Teaching Assistant(s)** | **Email** | **Office Hours & Location** |
| [TA Name] | [Email address] | [Location, Hours, Days] |

**General Information**

**Description**

An advanced treatment of design challenges, such as, power, variability, and reliability, associated with digital integrated circuits and systems in nanometer nodes.

## Pre- &/or Co-Requisites

## Suggested pre-requisite is Graduate standing and backgrounds in MOS VLSI Design, VLSI CAD tools, Basic knowledge on solid-state physics. Specifically, ECE4130/6130 or ECE4420 or ECE6430 or permission of the instructor

**Course Educational Objectives:**

As part of this course, students …

1. Apply knowledge of mathematics and physics to analyze advanced integrated circuits

2. Demonstrate an ability to understand and solve system design problems

3. Learn to formulate, define, and excute an engineering design problem

4. Learn to work in a design team

5. Demonstrate an ability to understand state-of-the-art practices in an engineering field

6. engage in formal and informal oral and written communication of project [g]

## Course Educational Outcomes

Upon successful completion of this course, you should be able to.

1. Understand challenges of designing VLSI systems

2. Develop methods to design low power and robust VLSI systems

3. Learn state-of-the-art practices in VLSI system design

4. Learn to formulate, define, excute, and present an VLSI design project

5. Learn to work in a design team

6. Understand operations of nanoneter scale MOSFETs

**Course Requirements & Grading**

|  |  |  |
| --- | --- | --- |
| Assignment | Date | Weight (Percentage, points, etc) |
| Exam - Midterm | TBD | 35% |
| Exam - Final | TBD | 10% |
| Homework(s) | TBD | 15% |
| Project |  | 40% |
| Proposal | 01/31/2017 | 5% |
| Midterm | 03/07/2017 | 5% |
| Final | 04/25/2017 | 30% |

**THERE WILL BE NO Extra Credit Opportunities**

**Description of Graded Components**

**Midterm and Final Exam** - The analytical questions on a set of topics covered. The final exam can be replaced by oral presentation.

**Homework(s)** – Analytical and simulation-based homework to test the concepts on power dissipation, variation, and reliability learned in the course.

**Project** - Students pick the project topic they want to work on and discuss with the the instructor to finalize the project. After the literature survey, choose a paper or papers that you would like to evaluate yourself. You can also propose a new circuit/system design. The project has to be on digital VLSI circuit or system. Your contribution must be clearly shown at the end. The example contributions include:

* + Show the work’s claim using your own simulations
  + Comparison of different solutions to a problem
  + Improve previous design
  + New circuit and system
  + Show limitation of previous techniques

Project will include presentation and report

* + - Project Proposal
    - Mid-semester report
    - Final Report + Presentation

**Grading Scale**

The letter grade will be based on the curve on the cumulative points considering exams, homework, and projects with their corresponding weights. To receive grades B and higher, all parts of the course (two exams, all homework, and project) must be completed and submitted.

**Course Materials**

**Course Text**

**S. Bhunia and S. Mukhopadhyay, “Low-power Variation Tolerant Design in Nanometer Silicon”, Springer, 2011 (ISBN#** 1441974172)

## Additional Materials/Resources

## Selected papers from Journals/Conferences (uploaded to T-square)

* **Lecture slides will be posted in T-square**

## Course Website and Other Classroom Management Tools

T-square site

Piazza

**Course Expectations & Guidelines**

## Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. For information on Georgia Tech's Academic Honor Code, please visit http://www.catalog.gatech.edu/policies/honor-code/ or <http://www.catalog.gatech.edu/rules/18/>.

Any student suspected of cheating or plagiarizing on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

## Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services at (404)894-2563 or <http://disabilityservices.gatech.edu/>, as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

## Attendance and/or Participation

As the course will follow a discussion format the class attendance is highly recommended. The lectures and discussions in the class is the primary study material. In case of a missed class, the student is required to cover the materials discussed in class on their own.

## Collaboration & Group Work

The exams require individual work and no collaboration is allowed. The homeworks require individual work and no collaboration is allowed. The collaboration policy for projects will be defined as a part of the project description. The students are allowed to (and expected to) consult published materials for their projects, but cannot directly use published materials in reports and/or presentations.

## Extensions, Late Assignments, & Re-Scheduled/Missed Exams

There will no re-scheduled and missed exams. The extension of the deadlines for projects/homeworks, if any, will be announced in class. No late assignments will be accepted. Exceptions will be made for “approved Institute activities” (e.g. field trips and athletic events). See <http://www.catalog.gatech.edu/rules/4/> for more information.]

## Student-Faculty Expectations Agreement

At Georgia Tech we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. See <http://www.catalog.gatech.edu/rules/22/> for an articulation of some basic expectation that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

## Student Use of Mobile Devices in the Classroom

The students are not allowed to use mobile devices in the classroom, unless directed by the instructor.

**Tentative Lecture Topics**

1. Introduction

2. Device operations in nanometer nodes:

3. Power dissipation and low-power design

4. Variation tolerant design methodologies

5. Reliability-aware design methodologies

6. Power distribution

7. Thermal challenges

8. Alternate computing models

9. Review of an example state-of-the-art industrial VLSI design

**Course Schedule (Tentative)**

|  |  |  |
| --- | --- | --- |
| Date | Topic | Reading, Notes, due dates, and more |
| Week 1 | Introduction |  |
| Week 2 | Device operations in nanometer nodes |  |
| Week 3 | Power dissipation |  |
| Week 4 | Power dissipation |  |
| Week 5 | Power dissipation |  |
| Week 6 | Variation |  |
| Week 7 | Variation |  |
| Week 8 | Reliability |  |
| Week 9 | Power distribution |  |
| Week 10 | Power distribution |  |
| Week 11 | Spring Break |  |
| Week 12 | Thermal |  |
| Week 13 | Recent VLSI Chips |  |
| Week 13 | Recent VLSI Chips |  |
| Week 14 | Alternative Computing Models |  |
| Week 15 | Other topics |  |