

# ***ECE 559/659 VLSI Design (Project)***

## **Spring 2018**

### Syllabus

**Course Meetings:** Monday, Wednesday 2:30 - 3:45 pm, ELAB 323

**Instructor:** Maciej Ciesielski, Electrical and Computer Engineering  
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Office Hours: Tu, Th 1:30 – 2:30 PM.

**Catalog Description:** Lab. The design of very-large-scale integrated circuits. Experience in VLSI design through team projects emphasizing issues involved in the design of an entire custom chip. CAD tools used in the design process, resulting in specification of circuitry suitable for fabrication. Prerequisite: ECE 558/658 or equivalent.

#### **Course Description and Organization:**

This is a hands-on project course in VLSI design intended for students with sufficient background in theory of VLSI Design. Students, working in groups of two to three will work together, partitioning tasks, and presenting their work in the form of formal design reviews. The project will consist of a complete specification, design on appropriate level (RTL, circuit, layout), and verification or simulation of a substantial component of a VLSI system. Students will be presented with some ideas of the systems or circuits from which they can choose their project, or they can come up with their own design.

Occasional lectures will cover theoretical analysis techniques as well as standard design practices of industry. All other lectures will be devoted to discussions of student projects, presentations and scheduled design reviews. There will be one midterm exam covering the theoretical aspects of VLSI Design.

**Pre-requisites:** Introductory course in VLSI design (ECE 558/658).

#### **Lectures:**

1. Introduction, course organization
2. VLSI design flow, VLSI technologies
3. Case studies
4. Computer arithmetic, datapath design
5. Testing, self-test, and verification
6. Reverse engineering (guest lecture)
7. Memory and IO design
8. Memristors (guest lectures)

**Text:** *CMOS VLSI Design: A Circuits and Systems Perspective*, Weste and Harris, 4th edition, 2011, the same text as used in ECE 558/658.

#### **Computer Requirements:**

Web access and familiarity with Windows and Linux OS. Students will be provided with access to CAD tools running on UMass servers.

**Grading:**

- Midterm Exam 20%
- Design Proposal (PDR) 20%
- Comprehensive Design Review (MDR) 30%
- Final Design Review (FDR) 30%

**Tentative Schedule**

	Topic	Type
Week 1 – Jan. 24, 26	Course intro, VLSI Design flow	Lecture
Week 2 – Jan. 29, 31	Circuit technologies; Case studies	Lecture
Week 3 – Feb. 05, 07	Arithmetic circuits: multipliers, dividers	Lecture
Week 4 – Feb. 12, 14	<b>Proposals / PDR; Seminar</b>	Students, guest
Week 5 – Feb. 21	Arithmetic circuits: Adders	Lecture
Week 6 – Feb. 26, 28	Testing, BIST	Lecture
Week 7 – March 05, 07	Verification, Reverse engineering	Lecture + guest
Week 8 – March 12, 14	<b>Spring Break - No class</b>	
Week 9 – March 19, 21	Work on projects CDR preparation	
Week 10 – March 26, 28	<b>Comprehensive Design Review (CDR)</b>	Students
Week 11 – April 02, 04	Material review, <b>Midterm Exam</b>	Lecture + students
Week 12 – April 09, 11	Memories, Memristor	Lecture + guest
Week 13 – April 16, 18	Formal verification; IO design	Lecture
Week 14 – April 23, 25	<b>Final Design Review (FDR)</b>	Students