

**University of Bridgeport**  
**Department of Electrical Engineering**  
**CpE/EE 458**  
**Analog VLSI Circuit Design**

**CPEG/EE 458 Analog VLSI Circuit Design**

**Syllabus**

**Spring 2008**

**Class Time** : Saturday 01:00pm-3:30pm.  
**Classroom** : MAN 310  
**Instructor** : Prakash S. Thapa  
**Office** : N/A  
**Office Hours** : Saturday: 0900 to 1000  
Saturday: 1530 to 1600  
Others: by Appointment.  
**Phone** : N/A.  
**Email** : [thapa@bridgeport.edu](mailto:thapa@bridgeport.edu)  
**GA** : Aushall Franklin [afrankli@bridgeport.edu](mailto:afrankli@bridgeport.edu)  
**Web Page** : <http://www.bridgeport.edu/~thapa>

**Required Texts:**

1. Title : *Analog Integrated Circuit Design*  
Authors : David Johns, Ken Martin  
Publishers : John Wiley & Sons, Inc.  
Print Date : November 1996  
ISBN : 04711-4448-7.

**References:**

1. Title : *CMOS: Circuit Design, Layout, and Simulation, 2nd Edition*  
Authors : R. Jacob Baker  
Publishers : Wiley-IEEE Press  
Print Date : 11/2004  
ISBN : 0-471-70055-X.
2. Title : *CMOS VLSI Design: A Circuit and Systems Perspective 3<sup>rd</sup> Edition*  
Authors : Neil H. E. Weste, David Harris  
Publishers : Addison Wesley Publishing Company  
Print Date : 2005  
ISBN : 0-321-14901-7
3. Title : *Microelectronics Circuits, fifth edition*  
Authors : Adel S. Sedra, and Kenneth C. Smith  
Publishers : Oxford University Press  
Print Date : 2004  
ISBN : 0-19-514251-9
4. Title : *CMOS Analog Circuit Design*  
Authors : Phillip E. Allen and Douglas R. Holberg  
Publishers : Oxford University Press  
Print Date : 2002  
ISBN : 0-19-511644-5
5. Title : *Design of Analog CMOS Integrated Circuit*  
Authors : Behzad Razavi  
Publishers : MC Graw Hill  
Print Date : 2001  
ISBN : 0-07-238032-2

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**Course Objectives:**

- Be able to design and analyze basic analog and mixed-signal CMOS VLSI circuits.
- Be familiar with analog/mixed-signal VLSI circuits (like current sources and sinks, amplifiers, and ADC/DAC etc.)
- Design analog VLSI layouts.
- Decide on transistor sizing.
- Simulate the designed VLSI circuits.
- Learn and use EDA tools such as PSPICE, Mentor Graphics tools, etc.

**Prerequisite** : Basic knowledge in microelectronics.

**Description:**

Analog circuits are very important for the front and back ends to interface to the outside world. The system-on-chip (SoC) technology requires the implementation of both digital and analog modules on a single chip. The VLSI industry remains strong need for analog VLSI design engineers each year. The goal of this course is to introduce the modeling, design and analysis of analog CMOS VLSI. The students will design analog VLSI layouts, extract the netlists and simulate the circuit behavior. The transistor sizing in analog VLSI layouts will also be discussed.

**Syllabus**

**Topics:**

1. Integrated-circuit devices and modeling
  - MOS transistors
  - Resistors, capacitors, MOSFET working principles and characteristics.
  - MOS device modeling
2. Processing and layout
  - CMOS processing
  - CMOS layout and design rules
3. Basic current mirrors and single-stage amplifiers.
  - Simple CMOS current mirror
  - Amplifiers.
  - Differential amplifiers.
  - Transistor sizing in analog VLSI.
4. Basic OPAMP design and compensation.
  - Two-stage CMOS OPAMP
  - Feedback and OPAMP compensation
5. Comparators
6. Sample and holds, voltage references, and translinear circuits.
7. Discrete-time signals.
8. Switched-capacitor circuits.
9. Data converter fundamentals (DAC/ADC architectures).
10. Nyquist-rate D/A and A/D converters.
11. Continuous-time filters

**Lab and Project:** Several lab projects on VLSI design and simulation will be assigned. The goal of the projects is to help student accumulate skills and experience in analog VLSI design and simulation. Students will use EDA tools (PSPICE, Mentor Graphics Tools, etc.) to design the VLSI circuits, and simulate its response. Software tutorials will be given before the project. Through the projects, students will get familiar with analog/mixed-signal VLSI design and simulation.

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**Grading:**

There will be 3 Exams.

I will take best of 2. Only 2 Exams will be counted for your grade.

If you take all 3 exams I will drop the lowest.

If you take all 2 exams then I will count all.

If you take only 1 exam then I will put "0" in remaining exam.

First Exam	:	February	23, 2008
Second Exam	:	April	19, 2008
Final Exam	:	May	10, 2008

There will be Problem Sets.

Problem Sets will NOT BE GRADED.

If you submit them you will get BONUS POINTS.

Projects are integral Part of this Course.

Projects will be part of Exams. Each Project will be at least 30% in each exam.

All Projects of Final Exam will be due by May 10, 2008 1600.

**Computer Usage:** PSPICE, Mentor Graphics Tools, etc.

Here is a schedule break down of Classes.

January 19, 2008	Class
January 26, 2008	Class
February 02, 2008	Class
February 09, 2008	LAB : Work on Project
February 16, 2008	LAB : Work on Project
February 23, 2008	No Class : Preparation of Exam
March 01, 2008	<b>EXAM-I</b>
March 08, 2008	Class : Return EXAM-I
March 15, 2008	<b>Spring Break: No Class</b>
March 22, 2008	Class
April 05, 2008	Class
April 12, 2008	LAB: Work on Project
April 19, 2008	<b>Exam-II</b>
April 26, 2008	Class : Return EXAM-II
May 03, 2008	No Class : Preparation for Final Exam
May 10, 2008	<b>FINAL EXAM</b>

**CPEG/EE 458 Analog VLSI Circuit Design      Syllabus      Spring 2008**