ELEG-448: Microelectronic Fabrication

Semester: Fall 2009
Class Time: Tuesday, Thursday, 2:30pm-3:45pm.
Classroom: Dana 109.
Instructor: Xingguo Xiong (Assistant Professor)
Office: Tech 140.
Office Hours: Mon. Wed. 10:00am-11:00am, Tue. 4:00pm-5:00pm..
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Description: This class covers basic microfabrication processes for semiconductor and VLSI fabrication, including photolithography, plasma and reactive ion etching, ion implantation, diffusion, oxidation, evaporation, vapor phase epitaxial growth, sputtering, and CVD. Advanced processing topics such as next generation lithography, MBE, and metal organic CVD are also introduced. The physics and chemistry of each process are introduced along with descriptions of the equipment used for the manufacture of integrated circuits. The integration of microfabrication process into CMOS, bipolar, MEMS and nanotechnologies are also discussed.

Textbook: Richard C. Jaeger, *Introduction to microelectronic fabrication: Volume 5 of Modular Series on Solid State Devices* (2nd Edition), Oct. 27, 2001, Prentice Hall, ISBN: 0201444941.

Reference: Stephen A. Campbell, *The science and engineering of microelectronic fabrication*, 2nd edition, Oxford University Press, ISBN: 0195136055.
Gary S. May, and Simon M. Sze, *Fundamentals of semiconductor fabrication*, 2004, John Wiley & Sons, ISBN: 0471232793.
Peter V. Zant, *Microchip fabrication*, 5th edition, 2004, McGraw Hill, ISBN: 0071432418.
Marc J. Madou, *Fundamentals of microfabrication*, 1st edition, 1997, CRC-Press, ISBN: 0849394511.
Sorab K. Ghandhi, *VLSI fabrication principles: silicon and gallium arsenide*, 2nd Edition, Wiley-Interscience, ISBN: 0471580058.
Nadim Maluf, Kirt Williams, *An introduction to microelectromechanical systems engineering*, 2nd Edition, Artech House, 2004, ISBN: 1580535909.
Mark A. Ratner, Daniel Ratner and Mark Ratner, *Nanotechnology: A gentle introduction to the next big idea*, Prentice Hall PTR, 1st edition, Nov. 8, 2002, ISBN-10: 0131014005, ISBN-13: 978-0131014008.

Goals: The purpose of this course is to provide students with technical background and knowledge in silicon microelectronic fabrication process. Fabrication processes on Microelectromechanical System (MEMS) and nanotechnology will also be introduced. Upon finishing this course, students will be familiar

with the basic semiconductor and VLSI microfabrication processes. They will be able to explain the physical and chemical mechanism for the fabrication process, and understand the basic procedures of the process.

Prerequisites: Undergraduate and graduate students with engineering or physics background.

Topics:

1. An overview of microelectronic fabrication.
2. Lithography.
3. Thermal oxidation of silicon.
4. Diffusion.
5. Ion implantation.
6. Film deposition.
7. Interconnections and contacts.
8. Packaging and yield.
9. MOS process integration.
10. Bipolar process integration.
11. Process for MicroElectroMechanical Systems (MEMS).
12. Process for Nanotechnology.

Grading: The final grade will be 30% on homework, 15% on final presentation, 25% on mid-term exam, 26% on final exam, and 4% for attendance. There are four times of random attendance during the whole semester. Each attendance will be counted 1 point toward your final grade.

Exams There will be two exams: the mid-term exam and the final exam.

Computer Usage: PC.

Lab Project: The student may need computer software (such as Matlab) for the mathematical calculation in solving the homework problems.

Cheating Policy: It is the student's responsibility to familiarize himself or herself with and adhere to the standards set forth in the policies on cheating and plagiarism as defined in Chapters 2 and 5 of the Key to UB (http://www.bridgeport.edu/pages/2623.asp) or the appropriate graduate program handbook.