Boston University
College of Engineering

Course Number: ME 579, cross-listed as EC 579, usually taught each spring

Course Title: Microelectronic Device Manufacturing

Instructor: Dan Cole
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The classes will be on Tuesday and Thursday from 6-8 pm.

My **office hours** will be: 9-11am on Wednesday and Thursday in room 135, 15 Saint Mary's. Please feel free to contact me by email or phone to arrange to meet with me at other times, or, just stop by and see if I am free.

Course Description/Catalog Data:

Physical processes and manufacturing strategies for the fabrication and manufacture of microelectronic devices. Processing and device aspects instrumental in silicon, including the fabrication of doping distributions, etching, photolithography, interconnect construction, and packaging. Future directions and connections to novel devices, MEMS, photonics, and nanoscale structures will be discussed. Emphasis will be on "designing for manufacturability." The overall integration with methods and tools employed by device and circuit designers will be covered.

Prerequisite Course(s): Senior or graduate standing in engineering, or consent of instructor.

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Textbooks:

(1) “Introduction to Micro Fabrication,” by Sami Franssila, Wiley, 2004, ISBN 0-470-85106-6.

(2) “Advanced Semiconductor Fundamentals,” 2nd ed., by Robert Pierret, Prentice-Hall, 2002, ISBN 013061792X.

(3) Recent microelectronic business case studies, including:

(1) “Reversal of Fortune? The Recovery of the U.S. Semiconductor Industry,” by Jeffrey T. Macher, D. Mowery and D. Hodges, 1998, 29 pages, HBSP, Case CMR138.

(2) Ramon Casadesus-Masanell et al., "Intel Corp.--1968-2003," Harvard Business School Publishing (HBSP), 2002, case # 703427.

(3) Clayton M. Christensen et al., "Whither Moore's Law: The Future of Semiconductors," HBSP, 2004, case # 1751BC.

(4) “A Silicon Island of the East: Creating a Semiconductor Industry in Singapore,” by John Mathews, 1999, 23 pages, HBSP, Case CMR142.

Two cases that may be briefly reviewed / discussed in lecture, but not assigned, are:

“The Processes of Strategy Development and Implementation at Intel Corp.,” by Clayton Christensen and R. Burgelman, 1999, 22 pages, HBSP, Case 300010,

and

“Taiwan Semiconductor Manufacturing Co.: The Semiconductor Services Company,” Hau Lee, Seungjin Whang, and Shiri Shneorson, 2006, case # GS40.

(4) Current news articles on microelectronic technology developments, such as new devices and new business directions. These news articles will be covered as they happen, to help foster interest and awareness of the rapidly changing microelectronics industry.

Goals:

The intent of this course is to provide an overall view of the microelectronics industry, emphasizing semiconductor processing, device design, device operation, and circuit integration, all from the perspective of obtaining an improved manufacturable product. Most semiconductor related courses focus on one of these aspects, without aiming for a full integration of the technology development to enable high yield, fast devices, and low priced products to be obtained. A key emphasis now being recognized in the microelectronics industry

is the need to “design for manufacturability” right from the very beginning of the development of a new technology generation, rather than designing first, and later worrying about this important aspect later. A number of examples will be discussed that emphasize the change in business practices now taking place in the microelectronics industry to incorporate this new attitude. Connections will be made throughout the course on how the microelectronics industry is evolving, with directions and connections to new innovative technologies, including novel semiconductor devices, MEMS, photonics, and nanoscale devices. Embracing solid manufacturing practices will be essential for these new and exciting technologies to reach their full potential in the rapidly changing technology business market.

Grading:

Two quizzes, one ¼ way in and the other about ¾ way into course. Dates will be announced. The intent is to provide a feel for midterm and final	10%
Midterm	30%
Final	30%
Project	30%

Lectures and class activities will require 4 hours per week.

Topics

(1) Initial overview of key components in microelectronics industry (1 week)
(2) Silicon processing (3 weeks)
(3) Device operation (3 weeks)
(3) Photolithography processing (1 & 1/2 weeks)
(4) Interconnect processing (1 week)
(5) Connections to device and circuit design (1 week)
(6) Packaging (1 week)
(7) Testing and reliability (1/2 week)
(8) Future technologies to be incorporated into manufacturable schemes, including nanoelectronics, optoelectronics, and MEMS (2 weeks)
(9) Presentations by students on special topics agreed upon with instructor by middle of semester (1 week)