

ECE 404/504, Semiconductor Memory Circuits

Spring 2008 Syllabus

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Meets Tuesday and Thursday; 11:00 – 12:15; JEB25

Text *CMOS Circuit Design, Simulation, and Layout*, R. Jacob Baker, 2nd Edition

Web Site Homework assignments, student grades, instructor announcements, and discussion groups will be available on Blackboard (www.blackboard.uidaho.edu)

Prerequisites ECE 310, *Fundamentals of Electronics*.
Knowledge of basic transistor operation and logic circuits.

Course Objectives This course will provide an understanding of the general operating principles of semiconductor mass memory circuits. Students will learn the function and behavior of the major memory building blocks, such as address decoders and sense amplifiers. The characteristics of simple masked-ROM, static RAM, and dynamic RAM will be investigated in detail. The course will also present the underlying phenomena used in floating-gate, magnetic-tunnelling, and phase-change non-volatile memories. We will discuss the scalability and reliability issues related to memory circuits, as well as some of the less common memory architectures.

Topics

1. Review of MOSFETs and CMOS gates
2. Organization and structure of semiconductor mass memory
3. Function, behavior, and design trade-offs of major functional blocks such as sense amplifiers and address decoders
4. Operating principles of mask-programmed ROM
5. Operation and behavior of bit cells for static and dynamic RAM
6. Operating principles of non-volatile memories, including floating-gate, magnetic tunneling, and phase-change
7. Scalability and reliability issues in advanced MOS technology
8. Atypical memory architectures such as content-addressable memory, FIFO, and multiple-port RAM

Computer Usage Circuit simulations will often be assigned as part of the homework. Students will be expected to use *LTspice*, a circuit simulator available at no cost (see <http://cmosedu.com/cmos1/LTspice/LTspice.htm>).

Grading Homework: 30%
2 Exams: 45%
Final Exam: 25%

Additional homework and exam problems will be required for graduate credit.