Course Title: EE599 Integrated Memory Device and Technology

Course Meeting Times

Lectures: 3:30pm-4:50pm MW

Office Hours: 1 session / week, 1.5 hour / session

Course Objectives and Outcomes

Course Objectives

This graduate course introduces students to the fundamental device physics, advanced integration technology and cutting-edge innovations in memory device innovations. Upon completion of this course, students will be able to do the following:

1. Understand the basic device physics of semiconductor memory devices.
2. Demonstrate a familiarity with major memory device structures and integration technology.
3. Apply device models to analyze various types of memory devices.
4. Establish a good knowledge base about the emerging advance memory technologies.

Grading Scale

5% participation
10% homework
10% project presentation
30% mid-term
45% final

Course Outcomes

Students who complete the course will have demonstrated the ability to do the following:

Week 1: Understand the basic operation of transistor devices
Week 2: Understand the basic properties of magnetic materials
Week 3: Explain the basic operations of magnetic memory devices.
Week 4-Week 5: Analyze transistor based memory devices (Week 1-Week 3)
Week 6: Explain the basic operations of NAND Flash memory technology
Week 7: Explain the basic operations of NOR Flash memory technology
Mid-Term Exam
Week 8: Analyze multi-level cells of flash memory devices.
Week 9: Understand the fundamental properties of various types of phase change materials.
Week 10: Explain the operating principles of phase change memory devices.
Week 11: Understand the operations of resistive memory (memristor) devices
Week 12: Understand the cross-bar architecture
Week 13: Gain the understanding of the 3D memory device technology
Week 14: Introduction to advanced applications of memory or memory-like devices in the emerging field of neuromorphic computing.
Week 15: Class presentation by students and final review

Prerequisites

Understanding of basic semiconductor device physics and fabrication technology will be useful, but is not required.

Lectures

Lectures will be held twice a week for 1.5 hours each. The students are responsible for material presented in lectures, including oral comments made by the lecturer.

<div align="center">

Statement on Academic Conduct and Support Systems

</div>

Academic Conduct

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Section 11, *Behavior Violating University Standards*https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions/. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, http://policy.usc.edu/scientific-misconduct/.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the *Office of Equity and Diversity* http://equity.usc.edu/ or to the *Department of Public Safety* http://capsnet.usc.edu/department/department-public-safety/online-forms/contact-us. This is important for the safety whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. *The Center for Women and Men* http://www.usc.edu/student-affairs/cwm/ provides 24/7 confidential support, and the sexual assault resource center webpage sarc@usc.edu describes reporting options and other resources.

Support Systems
A number of USC's schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the *American Language Institute* http://dornsife.usc.edu/ali, which sponsors courses and workshops specifically for international graduate students. *The Office of Disability Services and Programs* http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.htmlprovides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, *USC Emergency Information* http://emergency.usc.edu/will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.