

ECE 449/ ECE 560 (Technology of Integrated Circuits)

Instructor: Professor Shaikh S. Ahmed
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Office Hours: TTH 12:30 – 2:30 p.m., W 1:30 – 2:30 p.m. (or by appointment)

Lecture: TTH 3:35 p.m. – 4:50 p.m., ENGR A-322

Total Credit Hours: 3

Prerequisite: ECE 345 (or instructor consent)

Text Book:

Semiconductor Material and Device Characterization by Dieter Schroder, Wiley-IEEE Press, 3rd edition (January 30, 2006), ISBN-10: 0471739065, ISBN-13: 978-0471739067

The subject matter for this course will be heavily drawn from the literature and extensive references will be provided in the class notes. Another useful book:

Semiconductor Devices: Physics and Technology by S. M. Sze and M. K. Lee, John Wiley and Sons, Inc., 3rd edition (2012), ISBN 978-0470-53794-7

Topical Outline:

IC industry:

Market driver: Moore's law and More-than-Moore; IC production flow and types

Materials for state-of-the-art integrated circuits:

Semiconductor crystals, tubular and monolayer materials, organic materials, heterostructures, wafers and notations

Micro- and nano- fabrication technologies:

Wafer technology, Basic processing steps in IC fabrication, Selective doping techniques including diffusion and ion implantation, Nanolithography, Etching, Contacts and interconnects, Spontaneous formation and ordering of nanostructures, Methods of nanotube and thin-film growth, Chemical and biological methods for fabrication, Fabrication of electromechanical (MEMS) systems, IC assembly and packaging.

IC characterization:

Electrical Characterization: Wafer mapping, Doping profiling, Contact resistance, Threshold voltage, Channel length and width, Oxide charges and traps measurements using CV profiling, Defects characterization using DLTS, Carrier lifetime using photoconductance decay; Optical characterization: Microscopy and Spectroscopy, Ellipsometry, Raman spectroscopy, Electron Beam Microscopy; Particle Beam Analysis: Secondary ion mass spectrometry (SIMS), Rutherford backscattering spectrometry (RBS); X-ray Techniques

IC Reliability:

ICs in harsh environments, hot carriers, NBTI, electromigration, electrostatic discharge, IC power and hot-spot cooling using thermoelectrics

Future directions:

Emerging IC technologies: biochips, energy harvesting, sensors, organic ICs

Date and Time of Final Examination: Thursday, December 17, 2015, from 2:45–4:45 p.m.

Grading: HW (30%), Mid-Term Exam (25%), Final examination (35%), Final paper (10%)

Classroom Policies:

- A. Syllabus is subject to change at the instructor's discretion. Students are responsible for all announcements made in class and/or posted to D2L.
- B. **Attendance Policy:** Attendance will be taken at random throughout the semester, and it may be counted toward the final grade.
- C. **Late Homework/Missed Exams:** Late homework is not accepted. If an exam is missed for a *legitimate* reason, a grade will be assigned based on the remaining homework/exams.

Mobile Technology Policy: N/A

IMPORTANT DATES *

Semester Class Begins.....	08/24/2015
Last day to add a class (without instructor permission):.....	08/30/2015
Last day to withdraw completely and receive a 100% refund:.....	09/06/2015
Last day to drop a course using SalukiNet:.....	11/01/2015
Last day to file diploma application (for name to appear in Commencement program):.....	09/18/2015
Final examinations:.....	12/14–12/18/2015

Note: For outreach, internet, and short course drop/add dates, visit Registrar's Academic webpage <http://registrar.siu.edu/>

FALL SEMESTER HOLIDAYS

Labor Day Holiday 09/07/2015

Fall Break 10/10–10/13/2015

Veterans Day Holiday 11/11/2015

Thanksgiving Vacation 11/25–11/29/2015

WITHDRAWAL POLICY ~ Undergraduate only

Students who officially register for a session may not withdraw merely by the stopping of attendance. An official withdrawal form needs to be initiated by the student and processed by the University. For the proper procedures to follow when dropping courses and when withdrawing from the University, please visit <http://registrar.siu.edu/pdf/ugradcatalog1314.pdf>

INCOMPLETE POLICY~ Undergraduate only

An INC is assigned when, for reasons beyond their control, students engaged in passing work are unable to complete all class assignments. An INC must be changed to a completed grade within one semester following the term in which the course was taken, or *graduation*, whichever occurs first. Should the student fail to complete the course within the time period designated, that is, by no later than the end of the semester following the term in which the course was taken, or graduation, whichever occurs first, the incomplete will be converted to a grade of *F* and the grade will be computed in the student's grade point average. For more information please visit: <http://registrar.siu.edu/grades/incomplete.html>

REPEAT POLICY

An undergraduate student may, for the purpose of raising a grade, enroll in a course for credit no more than two times (two total enrollments) unless otherwise noted in the course description. For students receiving a letter grade of A,B,C,D, or F, the course repetition must occur at Southern Illinois University Carbondale. Only the most recent (last) grade will be calculated in the overall GPA and count toward hours earned. See full policy at

<http://registrar.siu.edu/pdf/ugradcatalog1314.pdf>

GRADUATE POLICIES

Graduate policies often vary from Undergraduate policies. To view the applicable policies for graduate students, please visit

<http://gradschool.siu.edu/about-us/grad-catalog/index.html>

DISABILITY POLICY

Disability Support Services provides the required academic and programmatic support services to students with permanent and temporary disabilities. DSS provides centralized coordination and referral services. To utilize DSS services, students must come to the DSS to open cases. The process involves interviews, reviews of student-supplied documentation, and completion of Disability Accommodation Agreements.

<http://disabilityservices.siu.edu/>

PLAGIARISM CODE

http://pvcaa.siu.edu/_common/documents/Plagiarism/Guide%20to%20Preventing%20Plagiarism.pdf

MORRIS LIBRARY HOURS

<http://www.lib.siu.edu/about>

SAFETY AWARENESS FACTS AND EDUCATION

Title IX makes it clear that violence and harassment based on sex and gender is a Civil Rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, etc. If you or someone you know has been harassed or assaulted, you can find the appropriate resources here: <http://safe.siu.edu>

SALUKI CARES

The purpose of Saluki Cares is to develop, facilitate and coordinate a university-wide program of care and support for students in any type of distress—physical, emotional, financial, or personal. By working closely with faculty, staff, students and their families, SIU will continue to display a culture of care and demonstrate to our students and their families that they are an important part of the community. For Information on Saluki Cares: (618) 453-5714, or siucares@siu.edu,

<http://salukicare.siu.edu/index.html>

EMERGENCY PROCEDURES

Southern Illinois University Carbondale is committed to providing a safe and healthy environment for study and work. We ask that you become familiar with the SIU **Emergency Response Plan** and **Building Emergency Response Team (BERT)** programs. Please reference the **Building Emergency Response Protocols for Syllabus** attachments on the following pages. *It is important that you follow these instructions and stay with your instructor during an evacuation or sheltering emergency.*

INCLUSIVE EXCELLENCE

SIU contains people from all walks of life, from many different cultures and sub-cultures, and representing all strata of society, nationalities, ethnicities, lifestyles, and affiliations. Learning from and working with people who differ is an important part of education as well as an essential preparation for any career. For more information please visit: <http://www.inclusiveexcellence.siu.edu/>

LEARNING AND SUPPORT SERVICES

Help is within reach. Learning support services offers free tutoring on campus and math labs. To find more information please visit the Center for Learning and Support Services website:

Tutoring : <http://tutoring.siu.edu/>

Math Labs http://tutoring.siu.edu/math_tutoring/index.html

WRITING CENTER

The Writing Center offers free tutoring services to all SIU students and faculty. To find a Center or Schedule an appointment please visit <http://write.siu.edu/>

AFFIRMATIVE ACTION & EQUAL OPPORTUNITY

Our office's main focus is to ensure that the university complies with federal and state equity policies and handles reporting and investigating of discrimination cases. For more information visit:

<http://diversity.siu.edu/#>

Additional Resources Available:

SALUKINET: <https://salukinet.siu.edu/cp/home/displaylogin>

ADVISEMENT: <http://advisement.siu.edu/>

SIU ONLINE: <http://online.siu.edu/>