ESE 517
Integrated Electronic Devices and Circuits II

Spring 2016

Stony Brook University
Department of Electrical and Computer Engineering

Course Description
This is an advance, project oriented, integrated circuit design class. Topics considered will include design of switched-capacitor circuits, digital-to-analog and analog-to-digital data converters, delta-sigma modulation, filters, imagers, bioinstrumentation and adaptive neural computation. The various practical aspects of analog and mixed-signal circuit design, like structured design, scalability, parallelism, low-power consumption, and robustness to process variations, will be covered.

Classes: Th 11:30am-2:30pm in Chemistry 126
Office hours: by appointment

Instructor : Shaorui Li
Email : shaoruili@bnl.gov

Text Book:
Class Handouts and Technical Papers.

References :
D.A. Johns and K. Martin, "Analog Integrated Circuit Design", 1st edition, Wiley 1996.
B. Razavi, "Design of Analog CMOS Integrated Circuits"
P.R. Gray, P.J. Hurst, S.H. Lewis, and R.G. Meyer, "Analysis and Design of Analog Integrated Circuits"
J.E. Franca and Y. Tsividis, Eds. "Design of Analog-Digital VLSI Circuits for Telecommunications and Signal Processing"

Suggested Reading: (or browsing, for project ideas)
1. IEEE Journal of Solid-State Circuits
2. IEEE Transactions on Circuits and Systems I

Grading
A. Research Paper Presentation
Each student will make a presentation based on an assigned research paper. These presentations will be scheduled during the lectures, in the second part of the semester, and they will be 30 minute long each. The presentation will count with 20% in the final grade.

B. Class Project

The students would organize themselves into groups, each comprising of 2 or 3 members. The group will schedule meeting hour (1 hour per week) with the instructor to discuss project issues.

The group can choose a design of pipeline ADC converter with the defined specifications (the project will consist of 4 tasks) or a specific project from the following areas: biomedical signal processing and acquisition, smart imagers, speech processors and sensory systems.

Group formation and definition of the project is due by the end of Week 2.

Course Schedule

Week 1	Discrete-time systems.
Week 2	Switched capacitor circuits.
Week 3	Switched capacitor circuits.
Week 4	Sample-and-hold circuit and comparators.
Week 5	Data converter fundamentals.
Week 6	Digital-to-analog Nyquist-rate converters.
Week 7	Analog-to-digital Nyquist-rate converters (integrating, SAC, algorithmic).
Week 8	Analog-to-digital Nyquist-rate converters (flash, two-step, interpolating, folding, pipelined).
Week 9	Delta-sigma modulation.
Week 10	Low-voltage and low-current analog design. Biasing and voltage references.
Week 11	Technical paper study.
Week 12	Analog computation blocks.
Week 13	Microelectronics for radiation detectors.

Goals:
The course is designed to provide students with in-depth analysis and design of complex analog integrated circuits and systems.

Objectives:
Understand the difference between the continuous-time and the discrete-time systems, spectra of continuous and discrete signals, Laplace and Z transform.
Understand the function of anti-aliasing filtering and sample and hold circuit.
Analyze and design switched-capacitor circuits.
Analyze and design discrete filters based on switched-capacitor circuits.
Analyze and design different architectures for comparators.
Understand the fundamentals of the data converters.
Understand the basic principles of different types of Nyquist rate analog-to-digital and digital-to-analog converters.
Analyze and design different types of Nyquist rate analog-to-digital and digital-to-analog converters.
Understand the basic principles of delta-sigma converters.
Analyze and design delta-sigma converters.
Understand the basic principles of analog computation.
Be proficient at using a circuit simulator to study the circuit response.

Access to our class's on-line Blackboard site:

You can access class information on-line at: http://blackboard.sunysb.edu
If you have used Stony Brook's Blackboard system previously, your login information (Username and Password) has not changed. If you have never used Stony Brook's Blackboard system, your initial password is your SOLAR ID# and your username is the same as your Stony Brook (sparky) username, which is generally your first initial and the first 7 letters of your last name.

For help or more information see:
http://www.sinc.sunysb.edu/helpdesk/docs/blackboard/bbstudent.php

For problems logging in, go to the helpdesk in the Main Library SINC Site or the Union SINC Site, you can also call: 631-632-9602 or e-mail: helpme@ic.sunysb.edu

Electronic Communication Statement:

Email and especially email sent via Blackboard (http://blackboard.stonybrook.edu) is one of the ways the faculty officially communicates with you for this course. It is your responsibility to make sure that you read your email in your official University email account. For most students that is Google Apps for Education (http://www.stonybrook.edu/mycloud), but you may verify your official Electronic Post Office (EPO) address at http://it.stonybrook.edu/help/kb/checking-or-changing-your-mail-forwarding-address-in-the-epo.

If you choose to forward your official University email to another off-campus account, faculty are not responsible for any undeliverable messages to your alternative personal accounts. You can set up Google Mail forwarding using these DoIT-provided instructions found at http://it.stonybrook.edu/help/kb/setting-up-mail-forwarding-in-google-mail.

If you need technical assistance, please contact Client Support at (631) 632-9800 or supportteam@stonybrook.edu.

Americans with Disabilities Act:

If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Disability Support Services, ECC (Educational Communications Center) Building, room128, (631) 632-6748. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential.

Academic Integrity:

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty are required to report any suspected instances of academic dishonesty to the

Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at http://www.stonybrook.edu/uaa/academicjudiciary/

Critical Incident Management:

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures.