

# **ESE 516**

## **Integrated Electronic Devices and Circuits I**

Fall 2016

Instructor : Milutin Stanacevic  
Office : 263 Light Engineering  
Email : milutin.stanacevic@stonybrook.edu

**Classes** : MW 2:30pm-3:50pm, in Fray Hall 112

**Office hours** : MW 10am-12pm, or by appointment

### ***Recommended Textbooks:***

D.A. Johns and K. Martin, "Analog Integrated Circuit Design", 2nd edition, Wiley 2011.

B. Razavi, "Design of Analog CMOS Integrated Circuits"

### ***References:***

P.R. Gray, P.J. Hurst, S.H. Lewis, and R.G. Meyer, "Analysis and Design of Analog Integrated Circuits"

### **Course Description**

This is an advance circuit design course that will discuss the principles, concepts and techniques required to produce successful designs of analog integrated circuits. Fundamentals of devices, circuits and basic topologies will be reviewed. Topics considered will include design of high-performance operational amplifiers, comparators, continuous-time filters and switched-capacitor circuits.

### **Course Schedule**

- Week 1** Introduction to VLSI technology, fundamentals of diode and MOS transistor, modeling.
- Week 2** Single-stage amplifiers.
- Week 3** Basic analog building blocks: differential pair and current mirrors.
- Week 4** Advance current mirrors.
- Week 5** High-gain amplifiers: "classic" two-stage amplifier.
- Week 6** High-gain amplifiers: "current-mirror" amplifier, "telescopic" and "folded cascode" architectures.
- Week 7** High-gain buffered amplifiers (op-amps)
- Week 8** "Small-signal/moderate frequency" transistor models. Frequency response of single-stage amplifiers.
- Week 9** Frequency response of amplifiers: feedback and compensation.
- Week 10** Deviations from idealities of practical op-amps and designs that minimize some of them.

- Week 11**      Noise analysis.  
**Week 12**      Biasing of the amplifiers.  
**Week 13**      Project presentations.

**Goals:**

The purpose of this course is to introduce students to principles of analysis and design of analog integrated circuits, starting from single transistor circuits to the multi-stage operational amplifier design.

**Objectives:**

Students should be able to:

- 1) analyze and design single-stage amplifier
- 2) analyze and design multi-stage differential amplifiers
- 3) analyze the frequency response of a single-stage and multi-stage amplifier
- 4) design a high-gain amplifier based on defined set of performance parameters.

**Homework:**

To help prepare for the midterm and final exams, some homework exercises will be assigned. They will not be graded. Solutions will be given a week after they are assigned.

**Project:**

The project will include a set of three Cadence homework problems: MOS transistor parameter extraction from simulations, single-stage amplifier simulation and two-stage operational amplifier simulation. The final part of the project is the design problem: design of a high-gain amplifier based on defined set of performance parameters.

**Credit Distribution**

1. Midterm (30%)
2. Final (40%)
3. Project (30%)

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

You can access class information on-line at: <http://blackboard.stonybrook.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](mailto: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](tel:631-632-9800) or [supportteam@stonybrook.edu](mailto: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.