EC-572 MOS Device Physics

Autumn 2014

M 10-11, W 10-11, Th 11-12 in ECE S-308

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Course Description: This course covers basics of semiconductor physics, diodes and primarily, metal oxide semiconductor (MOS) transistor device physics. This is useful for understanding the basics of circuit design as well as semiconductor fabrication.

Prerequisite: Undergraduate device physics. **Credit Hours:** 3

Text: *The MOS Transistor*, 3rd Edition by **Yannis Tsividis**, OUP, ISBN: 978-0-19-809737-2

Course Topics:

1. Semiconductor Basics: Carrier statistics, transport models
2. PN junction: Current and capacitance models
3. MOS capacitor: Potential profile; depletion, accumulation and inversion
4. Basics of MOS transistor: Regions of operation, pinchoff voltage, effective mobility
5. Small-channel and thin oxide effects: Short channel, narrow channel, hot carrier effects
6. CMOS device design: MOSFET scaling, CMOS performance factors
7. MOSFET modeling: Small signal modeling, BSIM modeling
8. Advanced MOS devices: High-k, strained Si

Marks Distribution:

End Term Exam	40%
Mid Term Exam	30%
Quizzes & Homeworks	25%
Class Participation	5%

Course Policies:

- **General**
  - **No makeup quizzes or exams will be given.** Surprise quizzes can also not be made up, but the lowest score amongst all quizzes will be dropped.
  - Attendance rules of the institute will be strictly followed. 75% attendance requirement is including all sickness/emergencies etc.
  - Computers/cell phones are not to be used in class even on silent mode. If anyone is found using them, he will be asked to leave the class and lose attendance for that day.

- **Assignments**
  - Students are expected to work independently. **Offering** and **accepting** solutions from others is an act of **plagiarism**, which is a serious offense and **all involved parties will be penalized according to the Academic Honesty Policy**. Discussion amongst students is encouraged, but copying is completely unacceptable.
  - **No late assignments will be accepted under any circumstances**.

Academic Honesty Policy Summary:

Introduction

In addition to skills and knowledge, IIT Roorkee aims to teach students appropriate Ethical and Professional Standards of Conduct. The Academic Honesty Policy exists to inform students and Faculty of their obligations in upholding the highest standards of professional and ethical integrity. All student work is subject to the Academic Honesty Policy. Professional and Academic practice provides guidance about how to properly cite, reference, and attribute the intellectual property of others. Any attempt to deceive a faculty member or to help another student to do so will be considered a violation of this standard.

Unauthorized/Excessive Assistance

The student may not give or get any unauthorized or excessive assistance in the preparation of any work.

Authorship

The student must clearly establish authorship of a work. Referenced work must be clearly documented, cited, and attributed, regardless of media or distribution. Even in the case of work licensed as public domain or Copyleft, (See: http://creativecommons.org/) the student must provide attribution of that work in order to uphold the standards of intent and authorship.

Consequences

An instructor may impose a sanction on the student that varies depending upon the instructor's evaluation of the nature and gravity of the offense. Possible sanctions include but are not limited to, the following: (1) Require the student to redo the assignment; (2) Require the student to complete another assignment; (3) Assign a grade of zero to the assignment; (4) Assign a final grade of "F" for the course.