Boston University

# EC 578 FABRICATION TECHNOLOGY OF INTEGRATED CIRCUITS

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| Prerequisite: | EC 410 |
| Professor: | Kleptsyn |
| Class hours: | TR 2-4 |
| Office hours: | |
| Credits: | 4 |
| Lab hours: | |
| Maximum number of students | 10 |

In this course the book "VLSI Fabrication principles" by S.K.Ghandhi (Wiley – Interscience Publication, ISBN 0-471-58005-8), and materials collected from various other sources will be used.
Also recommended: Richard C. Jaeger. Introduction to Microelectronic Fabrication. 2002
James D. Plummer, Michael D. Deal, Peter B Griffin. Silicon VLSI Technology. 2000

## COURSE CONTENTS

1. Crystal structures, unit cells, crystallographic planes, Miller indices, single crystals, silicon properties, silicon wafers.
2. Defects in crystals, vacancies, interstitials, impurities.
3. Bands, band structure, doping, p- and n-types of semiconductors, band gap levels.
4. Diffusion, Fick's laws, diffusion from a constant source and with a constant amount, phase diagrams, solid solubility; interstitial and substitutional diffusion, diffusion coefficient, activation energy. Design of the diffusion process.
5. Oxidation, kinetics of oxidation, wet and dry oxidation, color chart.
6. Photolithography and masks, cleaning wafers, photoresist deposition, baking, aligning, developing, BOE etching, photoresist removal.
7. BJT, field effect, field effect transistor.
8. Wet etching and reactive ion etching of silicon.

In a separate lab section students will use their theoretical background to fabricate semiconductor devices and acquire the skills needed to do research on solid state devices.

## PROJECT

In this course the practical aspects of the fabrication process are the main focus of attention. Theoretical aspects such as modeling of the physical processes and calculations will be given inasmuch as the time permits.

The first and the main goal of this course is to guide students through the practical steps of making an integrated circuit of their own design. As a rule, those steps including measurements and inspection will be supposed to perform manually for more profound understanding of the physical and chemical processes.

The project consists of three main parts:

1. Design. Students will have to design a circuit (e.g. amplifier), transistors, masks and the technological process of the fabrication.
2. Fabrication. Students will perform all necessary technological steps beginning from the plain wafer; the wafer with a few hundred of chips will be the result.
3. Inspection will have to be done after each operation. Final wafer inspection will include checking IC parameters on a probe station.

Grading: Homework 20%, Labwork 50%, Final 30%.