

Syllabus for ECSE/MTLE 6300 - Integrated Circuit Fabrication Laboratory

Course Instructor and Coordinator:

James J.-Q. Lu, Professor, Office Rm: CII-6229, luj@rpi.edu Phone: x2909

WebEx Space link: [webex:teams://im?space=9928c730-8e14-11ed-b11e-bd3aef60bc79](https://webex.teams.com/join?space=9928c730-8e14-11ed-b11e-bd3aef60bc79)

Catalog Description:

Theory and practice of IC fabrication in a research laboratory environment. Test chips are fabricated and the resulting devices and circuits evaluated. Processes and fabrication equipment studied and used include oxidation/diffusion, CVD reactors, photolithography, plasma etching, vacuum evaporator, ion implantation, etc. Instruments used in process monitoring and final testing include thin film profilometer, ellipsometer, resistivity probe, scanning electron microscope, capacitance-voltage system, etc. The fundamentals of hazardous material handling and clean room procedures are studied.

Prerequisite: ECSE 4250 or equivalent.

When Offered: Spring term annually.

Cross Listed: Cross listed as MTLE 6300.

Credit Hours: 3

Textbook: Optional (not required)

Sze, Simon M., VLSI Technology, 2nd Ed., McGraw-Hill, 1988.

Sze, Simon M., Physics of Semiconductor Devices, 2nd Ed., John Wiley & Sons. Inc., 1981.

Computing

Students need access to a UNIX system. They will use telnet or other means to access the unix system operated by the ECSE Department to perform process numerical simulations. Course notes, homework, and other materials are available via FabLab homepage:

<http://www.ecse.rpi.edu/courses/S23/ECSE-6300/index.html>, LMS and WebEx.

Grading

Unit Quizzes.....	32%
Lab Participation.....	20%
Final Project Report.....	32%
Homework.....	16%
Best Poster Competition.....	Award

Note in response to COVID-19 Contingency Planning:

- If required, we will switch to a hybrid modality, i.e., lectures may be offered and streamed online and recorded through WebEx; all lab works will be conducted in-person in RPI Microscale and Nanoscale Cleanroom (MNCR).
- Further Fabrication and Device Testing sessions may be cancelled or conducted by cleanroom staff. Necessary achieved test data may be provided. Students will analyze the data collected by themselves, TA and cleanroom staff, and the achieved data.
- Homework assignments and Quizzes will be released online. Students will submit their work online, including the final project report.
- Poster presentations may be conducted hybrid.

Class/Lab Schedule:

Week	Lecture	Action/Process Steps	Lab	HWs	Quiz
1 9-Jan	1. Introduction / Safety	No Lab Course Organization	-	-	-
2 16-Jan	MLK Day, no lecture	No Lab Course Organization			
19-Jan	2. Diffusion in Si				
3 23-Jan	3. Thermal Oxidation / SUPREM	Field Oxidation	1	1	1
4 30-Jan	4. Photolithography	M1 Active Area: Photolithography & Oxide Wet Etch Gate Oxidation, Poly-Si Deposition and Doping;	2		2
5 6-Feb	5. Dielectrics and Poly-Si Deposition	M2 Poly-Si Gate: Poly-Si/Oxide Etch, S/D Ion Implantation (@ Vendor)	3		3
6 13-Feb	6. Ion Implantation	ILD Deposition and Densification & Implant Activation	4	2	4
7 21-Feb	7. Plasma-Assisted Etching (Tuesday)	"M5" Contacts: ILD RIE Etch for Contacts	5		5
8 27-Feb	8. Metallization	Al/Si Contact - Sputtering Deposition	6		6
9 (3/6)	Spring Break				
10 13-Mar	9. MOSFET	"M6" Metallization: Al/Si Wet Etch	7	3	7
11 20-Mar	10. Device Characterization	Etch Backside Deposit Al/Si on Back, Sinter	8		
12 (3/27)	None	Device Testing	9	4	8
13 (4/3)	None	Device Testing			
14 (4/10)	None	Device Testing			
15 (4/17)	None	Device Testing			
16 (4/24)	Poster Competition	Final Report Due			

Academic Integrity and Policy: we follow the “Student Handbook (Rights & Responsibilities) & Graduate Student Supplement to Handbook (Rights & Responsibilities):

<https://info.rpi.edu/sites/default/files/Handbook-of-Student-Rights-and-Responsibilities-Rev-August-29-2019.pdf> &

<https://www.rpi.edu/dept/doso/resources/judicial/docs/GraduateStudentSupplementtoHandbookRevised10-52015FINAL.pdf>.