

GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRONICS & COMMUNICATION (VLSI SYSTEM DESIGN) (42)

IC FABRICATION TECHNOLOGY

SUBJECT CODE: 2734202

M.E. 3rd SEMESTER

Type of course: CMOS Physical Design.

Prerequisite: Basics knowledge of CMOS Device.

Rationale: IC fabrication technology is at the core of the subject of VLSI. For, practical implementation of the design and principles of VLSI is possible only through an in depth understanding of the fabrication processes and procedures.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
			ESE (E)	PA (M)	ESE (V)		PA (I)			
ESE	OEP	PA			RP					
3	2#	2	5	70	30	20	10	10	10	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Introduction	4	10
2	Material Properties, Crystal Growth or Wafer Preparation, Wet Cleaning and Dry Cleaning Technology : Related Facility Systems, Wafer Specification, Electrostatic Discharge Damage, RCA Cleaning, Protection Network, IMEC Cleaning, Soft Errors, Clean Room	7	15
3	Oxidation: Thermal Oxidation, CVD Oxidation, Plasma Oxidation, Growth Kinetics, Oxidation Technology for low Contamination levels, Segregation Co-efficient, Oxidation Induced Effects, Isolation in active device.	8	20
4	Photolithography: Optical Lithography, E-Beam Lithography, Ion Beam Lithography	7	15
5	Diffusion: Conventional Furnace Technique, Ion-Implantation Technique, Solid solubility, Role of Oxygen in diffusion, Ion Implantation: Low Current, High Current , Effects, Applications	6	15
6	Metallization: Single Level, Multi Level , Electromigration, PVD, Evaporation, Sputtering, Junction Spiking, Electromigration, CVD: Epitaxial Growth , Non Epitaxial Growth	6	15
7	Etching : Intorduction, Wet Chemical, Dry Physical, Plasma, Eutectic Temperature, Measurement: Thickness, resistivity	4	10

Reference Books:

1. S. M. Sze, *VLSI Technology*, Second Edition, MH, 1988.
2. S. K. Gandhi, *VLSI Fabrication Principles*, Second Edition, Wiley, 1994.
3. D. Nagchoudhari, *Principles of Microelectronics Technology*, Wheeler, 1998
4. S. A. Campell, *The Science and Engineering of Microelectronics Fabrication*, OUP, 1996
5. P. Van Zant, *Microchip Fabrication: A Practical Guide to Semiconductor Processing*, Third Edition, MH, 1997.

Course Outcome:

After learning the course the students should be able to:

1. Understand the different properties of material.
2. Understand the growth of silicon.
3. Understand the importance of clean room.
4. Understand the various steps of fabrication in detail.
5. Understand the detail fabrication process (from Silica to Silicon) of IC (Integrated Circuit).

List of Experiments:

1. To study different types of wafers.
2. To study different types of clean rooms used in IC fabrication industry.
3. To study the different clean room facilities.
4. To study the oxidation process in IC fabrication.
5. To study the photolithography techniques.
6. To study the diffusion process in IC fabrication.
7. To study the metallization process in IC fabrication.
8. To study the etching process in IC fabrication.
9. To prepare the list of commercial foundries and recent models files.
10. Case Study.

Design based Problems (DP)/Open Ended Problem:

1. To study and compare various foundries' models file.

Major Equipment: N. A.**List of Open Source Software/learning website:**

Ng-spice
www.nptel.com
www.nptel.ac.in

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.