The ICFAI University Dehradun, Faculty of Science and Technology

First Semester, 2015-16

Course Handout

Course No	Course Title	L	P	U
MEL 602	**Advanced VLSI Technology**	**3**	**0**	**3**

Scope and objective of the course: VLSI technology has become a major driving force in the development of all types of electronic systems. This course will introduce the fundamental concepts and techniques involved in the fabrication of VLSI (Very Large Scale Integration) circuits. These include the basic theory of Crystal Growth, Wafer Preparation, Epitaxy, Oxidation, Lithography, Etching, Diffusion and Ion-implantation, Metallization and Packaging.

Textbook(s)	*Sze, S.M., VLSI Technology, Tata McGraw Hill (2008).*
Reference book(s) R1	*Gandhi, S.K., VLSI Fabrication Principles, John Wiley (2003) 2nd ed.*
R2	*Chen, "VLSI Technology" Wiley, March 2003.*
R3	*Plummer, J.D., Deal M.D. and Griffin P.B., VLSI Technology: Fundamentals, Practice, and Modeling, Prentice Hall (2001).*

Lecture-wise plan:

Lecture Nos.	Learning Objective	Topics to be covered	Reference (Chapter/Sec./Page Nos. of Text/Ref. Books)
1	**Environment for VLSI Technology**	Clean room and safety requirements.	T1, T2
2-5	**Crystal Growth and Wafer Preparation**	Integrated Circuits, Scales of integration, Electronic Grade Silicon, Czochralski Crystal Growing, Silicon Shaping, Processing Considerations.	T1

6-11	**Epitaxy**	Vapour Phase Epitaxy - Basic Transport Processes and Reaction Kinetics, Doping and Auto-Doping, Equipments and Safety Considerations, Buried Layers, Epitaxial Defects, Molecular Beam Epitaxy -Equipment Used, Film Characteristics, SOI Structures.	T1
12-16	**Oxidation**	Growth Mechanism and Kinetics, Silicon Oxidation Model, Interface Considerations, Orientation Dependence of Oxidation Rates Thin Oxides. Oxidation Technique and Systems - Dry and Wet Oxidation, Plasma Oxidation, Masking Properties of SiO2.	T1
17-25	**Lithography**	Optical Lithography - Optical Resists, Contact and Proximity Printing, Projection Printing, Electron Lithography - Resists, Mask generation, Electron Optics - Roaster Scan and Vector Scan, variable beam shape, X-ray lithography - Resists and Printing, X-ray sources and masks, Ion-Lithography.	T1
26-34	**Etching**	Reactive plasma etching, AC and DC plasma excitation, plasma properties, chemistry and surface interactions, feature size control and an isotropic etching, ion enhanced and induced etching, properties of etch processes. Reactive - Ion - Beam – Etching, Specific etch processes: PolySi/Polycide, Trench etching, SiO2 and Si3N4.	T1
35-39	**Deposition, Diffusion and Ion-implantation**	Dielectric and polysilicon Deposition process and methods, Models of Diffusion in Solids, Fick's laws for Diffusion, Measurement Techniques, Fast Diffusion in Silicon, Diffusion in Polycrystalline Silicon and SiO2,	T1

		Ion-implantation and it's methods	
40-42	**Metallization and Packaging**	Metallization and its techniques, VLSI process integration, Analytical and assembly techniques, Packaging of VLSI devices,	T1