GUJARAT TECHNOLOGICAL UNIVERSITY

M.E. Chemical Engineering

Semester: I

Subject Name: **Nano-Devices Fabrication Technology (Inter Disciplinary – I)**

Sr.No	Course content
1.	**Crystal Growth and Wafer Preparation:** Introduction, Electron-Grade Silicon, Czochralski Crystal Growing, Silicon Shaping, Processing Considerations, Future Trends
2.	**Epitaxy:** Introduction, Vapor-Phase Epitaxy, Molecular Beam Epitaxy, Silicon on Isulators, Epitaxial Evaluations, Future Trends
3.	**Oxidation:** Introduction, Growth Mechanism, Thin Oxides, Oxidation Techniques and Systems, Oxide Properties, Redistribution of Dopants at Interface, Oxidation of Polysilicon, Oxidation-Induced Defects, Summary
4.	**Lithography:** Introduction, Optical Lithography, Electron Lithography, X-ray Lithography, Ion Lithography, Summary
5.	**Reactive Plasma Etching:** Introduction, Plasma Properties, Feature-Size Control and Anisotropic Etch Mechanisms, Other Properties of Etch Processes, Reactive Plasma-Etching Techniques and Equipments, Specific Etch Processes, Summary
6.	**Dielectric and Polysilicon Film Deposition:** Introduction, Deposition Processes, Polysilicon, Silicon Dioxide, Silicon Nitride, Plasma-Assisted Depositions, Other Materials, Summary
7.	**Diffusion:** Introduction, Models of Diffusion in Solids, Fick's One-Dimensional Diffusion Equations, Atomic Diffusion Mechanisms, Diffusitivities of B, P, As, and Sb, Measurement Techniques, Fast Diffusants in Silicon, Diffusion in Polycrystalline Silicon, Diffusion in SiO2, Diffusion Enhancements and Retardations, Summary
8.	**Ion Implementation:** Introduction, Range Theory, Implantation Equipment, Annealing, Shallow Junctions, High-Energy Implantations, Summary

9.	**METALLIZATION:** Introduction, Metallization Applications, Metallization Choices, Physical Vapor Deposition, Patterning, Metallization Problems, New Role of Metallization, Summary
10.	**Process Simulation:** Introduction, Ion Implantation, Diffusion and Oxidation, Epitaxy, Lithography, Etching and Deposition, Future Trends
11.	**Assembly Techniques and Packaging of Vlsi Devices:** Introduction, Package Types, Packaging Design Considerations, VLSI Assembly Technologies, Package Fabrication Technologies, Summary
12.	**Yield and Reliability:** Introduction, Mechanism of Yield Loss in VLSI, Modeling of Yield-Loss Mechanisms, Reliability Requirements for VLSI, Mathematics of Failure Distributions, Reliability, and Failure Rates, Common Distribution Functions, Accelerated Testing, Failure Mechanisms, Summary

Reference Books:

1. C. Y. Chang and S.M.Sze (Ed), ULSI Technology, McGraw Hill Companies Inc, 1996.
2. S. K. Ghandhi, VLSI Fabrication Principles, Wiley India, 2nd Edition.
3. S. M. Sze (Ed), VLSI Technology, 2nd Edition, McGraw Hill, 1988.