

## Syllabus of Microelectronic Device Fabrication Course Series

### Microelectronic Device Fabrication I

This course is the first in a full- year, three term sequence that treats both the science and practice of modern microelectronic device fabrication. The course starts with the principles of crystal growth and wafer preparation, ion implantation, doping and diffusion, and oxidation. Emphasis is placed on understanding the basic chemistry, physics, and material science of wafer processing. This includes crystal structure, defects, heterogeneous chemical reactions, thermodynamics and kinetics of basic processes such as diffusion. In addition, the practical implementation of these processes is discussed. This includes realistic process flows, physical metrology, device structure, electrical behavior and their trade-offs. This course is intended to serve both working process engineers and matriculated graduate students.

### Microelectronic Device Fabrication II

The second course of the series emphasizes metallization and dielectrics. Metallization issues discussed include silicides, barrier layers, interconnects, multi-level metallization, and low-k dielectrics. This is followed by discussion of deposition and properties of various dielectric films. Finally, science of epitaxial growth and properties of SOI and SiGe devices are covered. Class assignments include computer simulation of device fabrication (virtual fab).

### Microelectronic Fabrication III

This class starts with electron beam, x-ray, EUV, and photolithography, including discussion of the state of art resist technology (e.g., chemically amplified resists). This is followed by fundamentals and applications of plasmas for etching and deposition (e.g., high-density plasmas), including plasma damage. Other topics considered are process integration of several devices such as BiCMOS and memories. The limitations of fabrication and operation of nano-scale devices are discussed. Finally, yield and reliability statistics as related to microelectronic device fabrication are covered. Final project includes fabrication of a virtual device with specified electrical performance parameters.