

Semiconductor Manufacturing - Advanced Production & Process Flow

COURSE OUTLINE

Category	Semiconductors
Duration	16 hours
Prerequisites	Semiconductor Manufacturing Curriculum: Semester 1

Lesson 1: Process Overview and Lifecycle

- Semiconductor FAB structure and cleanrooms
- Core manufacturing process families
- FEOL MOL and BEOL phases
- Step by step semiconductor flow
- Silicon wafer journey and transport
- Continuous process control and testing

Lesson 2: Wafer Preparation

- Making single crystal silicon ingots
- Slicing and orienting silicon wafers
- N type and P type doping
- Wafer cleaning methods and challenges
- Growing protective silicon dioxide layers
- The critical silicon oxide interface

Lesson 3: Doping Ion Implantation and Annealing

- Principles of doping pure silicon
- Boron phosphorus and arsenic dopants
- Step by step ion implantation
- Controlling dopant concentration and depth
- Thermal annealing for lattice repair
- Activating dopants and atomic diffusion

Lesson 4: Lithography

- Defining device geometry with lithography
- Coating wafers with sensitive photoresist
- Photoresist chemistry and spin coating
- Aligning masks and exposing patterns
- Pattern replication across the wafer
- Managing resolution limits and defects

Lesson 5: Etching

- Transforming blueprints into physical structures
- High vacuum dry plasma etching
- Liquid chemical bath wet etching
- Anisotropic versus isotropic etch profiles
- Etch selectivity and profile control
- Safety protocols and equipment interlocks

Lesson 6: Thin Film Deposition

- Importance of ultra thin layers
- Epitaxial alignment and crystal growth
- Chemical vapor deposition mechanisms
- Sputtering and physical vapor deposition
- Atomic layer deposition cyclical process
- Measuring and controlling film thickness

Lesson 7: Process Integration and Yield

- Building layer stacks sequentially
- Process step dependencies and integration
- Defining manufacturing yield and costs
- Tracking how device defects escalate
- Identifying yield sensitive critical steps
- Investigating and correcting yield drops

Lesson 8: Metrology and Process Control

- Catching defects with precise metrology
- Measuring critical dimensions and overlay
- Optical and electron metrology techniques

Electrical metrology for device functionality
Defect mapping inspection and classification
Statistical process control and charts

ⓘ **Important Note:** *This outline is subject to change.*