EFEMs and Wafer Handling

COURSE OUTLINE

Category	**Semiconductors**
Duration	16 hours
Recommended Prerequisites	Foundations of Semiconductor Manufacturing Foundations of Robotics Advanced Robotic Programming

Activity 1: Introduction to EFEMs

- Role of EFEMs in manufacturing
- Semiconductor fabrication industry overview
- Automated wafer handling and cleanliness
- Workflow integration in the fab
- Wafer carrier arrival and retrieval
- EFEM subsystems and their roles

Activity 2: Safety Features and Safe Practices for EFEM Operation

- Importance of EFEM safety features
- Emergency stop button locations
- Safety interlocks prevent unsafe access
- Warning labels and hazard identification
- Lockout and tagout procedures
- Responding to safety incidents

Activity 3: Load Ports and FOUPs

- Importance of automated wafer handling
- Functions of EFEM load ports
- FOUP design and kinematic coupling
- Wafer mapping and identification systems
- Safe loading and unloading procedures
- Load port maintenance and cleaning
- Documenting maintenance checklist logs

Activity 4: Structure and Function of the EFEM Transfer Robot

- Role of the transfer robot
- Integration into the EFEM system
- Wafer handling process steps
- Robot arms axes and controller
- Vacuum versus edge grip effectors
- Robot degrees of freedom
- Link and linear operation modes

Activity 5: Programming the Transfer Robot

- Introduction to the teach pendant
- Teach pendant physical layout
- Navigating menus and display screens
- Switching teach and host modes
- Safe jog movement procedures
- Registering and editing position data
- Executing GET and PUT operations
- Troubleshooting common programming errors

Activity 6: EFEM Pre-Aligners

- Role of pre-aligner precision
- Pre aligner structure and components
- Vacuum versus edge grip mechanisms
- Wafer center and notch detection
- Pre aligner sensor and chuck
- Data processing and alignment correction

Activity 7: Programming Robot and Pre-Aligner Coordination

- Robot and pre-aligner workflow
- Communication and data flow synchronization
- Handling alignment and handoff routines
- Action and control programming commands
- Troubleshooting sequence and timing errors
- Using safety interlocks during setup
- Executing safe system recovery

Activity 8: Transfer Robot Maintenance

- Importance of regular robot maintenance
- Preventive versus corrective maintenance
- Visual inspection and cleaning tasks
- Replacing backup batteries safely
- Checking end effectors and sensors
- Lockout tagout for hazard isolation
- Documenting and reporting maintenance findings

Activity 9: Pre-Aligner Maintenance

- Pre aligner safety and hazards
- Personal protective equipment requirements
- Routine visual and operational inspections
- Cleaning wafer chucks and sensors
- Troubleshooting common pre aligner faults
- Replacing batteries and sensor modules
- Post replacement verification and calibration

Activity 10: Integrating EFEMs with Load Lock Systems

- EFEM and load lock integration
- Physical placement and electrical connections
- Connecting data and control cables
- Wafer transfer sequence steps
- Robotic arm and chamber synchronization
- Vacuum and pressure safety interlocks
- Troubleshooting wafer transfer issues

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