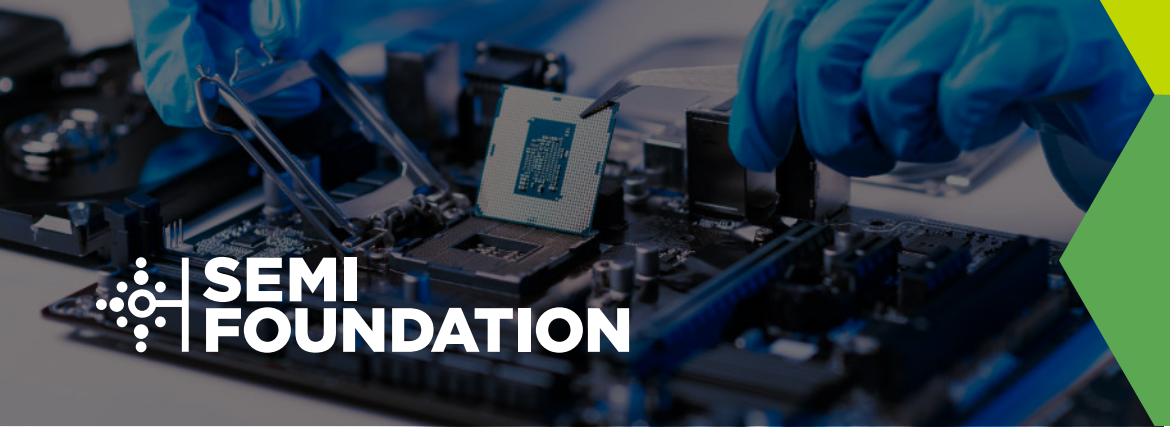

SEMI FOUNDATION

LEVEL OF KNOWLEDGE
1. Learner has been introduced to the concept and has a basic definition (“What”)
2. Learner understands the process or practice behind the concept and can articulate it (“How”)
3. Learner understands the significance of the concept as it relates to the overall process flow (“Why”)
4. Learner can explain in detail the impact of the concept, and what would happen if anything about the concept were to vary (“Why 2.0”)

SAFETY	Process Technician	Process Engineer
Chemical safety and material properties, handling, storage, and disposal (K)(S)	4	4
Electrical safety principals, electrical overstress, electrostatic discharge (K)	4	4
OSHA standards and application (K)	4	4
Cleanroom safety practices (S)	4	4

GENERAL PROCESSES, CONCEPTS, & TECHNIQUES	Process Technician	Process Engineer
Semiconductor theory, processes, and fabrication techniques (K)	2	3
Semiconductor physics (K)	2	4
Device manufacturing basics (K)	2	4
Tool availability / uptime and impact on performance and efficiency (K)	3	4

SPECIFIC PROCESSES, CONCEPTS, & TECHNIQUES	Process Technician	Process Engineer
Preparing silicon wafers, raw materials and chemicals (S)	Not Required	3
Chemicals and wet lab (K), wet and dry etch (S)	2	4
Etching and removal processes (K)	2	4
Deposition processes (K)	2	4
Lithography (K)	2	4
Photomask (K)	2	4
Diffusion (K)	2	4
Plasma chemistry (K)	Not Required	4
Vacuum technology, systems and components (K)	3	4
Electrical characterization (K)	3	4

ELECTRICAL PRINCIPLES	Process Technician	Process Engineer
Current, voltage and resistance (K)	2	3
Ohms law, power and energy (K)	2	3
Series/parallel circuits (K)	2	3
Capacitance/capacitor, inductance/inductors (K)	2	3
Diodes, full/half-rectifiers (K)	2	3
P & N type semiconductors (K)	2	3
Device physics, CMOS, etc.	2	3
Magnetism/magnetic circuits (K)	2	3
Transformers	Not Required	3
AC/DC measuring instruments, multimeter, oscilloscopes (S)	2	3
Electrical testing tools (K)	2	3
Integrated circuits, circuit analysis and circuit schematics (S)	2	3
Schematics and tool knowledge (K)	2	3
Circuit layout and design (K)	Not Required	3

CHEMISTRY & ELEMENTARY PHYSICS	Process Technician	Process Engineer
Atomic structure, mole concept, empirical formula (K)	1	4
Periodic table/nomenclature (K)	1	4
Chemical equations, molarity (K)	1	4
Limiting reactions (K)	1	4
Covalent bonds/dipole moments, intramolecular forces (K)	3	4
Kinetic molecular theory of gas (K)	3	4
The ideal gas law (K)	3	4
Gases - H2, O2, etc. (K)	3	4
Acids, bases, pH, organic/inorganic compounds (K)	3	4
Semiconductor physics (K)	3	3
Photoresist and their chemistry (K)	3	4
Chemistry of dopants - boron, phosphorous, etc. (K)	3	4
Chemistry of interconnect material - AU, Al, etc.	1	3

MATH	Process Technician	Process Engineer
College algebra and statistics (For technician programs, consider offering a contextualized math course and/or can offer scaffolded math programming)	2	4

TESTING, DIAGNOSTICS, & TROUBLESHOOTING	Process Technician	Process Engineer
Perform engineering experiments, record measurements, complete reports (A)	1	4
Perform Statistical Process Control (SPC) at multiple process steps (A)	2	4
Testing and troubleshooting product assemblies and systems (A)	4	3
Perform failure analysis (optical and electron microscopy) (A)	Not Required	4
Debugging hardware/software (A)	3	3
Analyze and repair machine failures (S)	1	3
Fixing and calibrating manufacturing tools (S)	1	3
Use model-based problem-solving to diagnose and troubleshoot issues (A)	4	3
QA / QC (S)	2	4

MAINTENANCE	Process Technician	Process Engineer
Knowledge of predictive/preventative maintenance services (K)	Not Required	3
Read instructions and plans; total productive maintenance (TPM) (S)	Not Required	3
Hand tools for preventative and corrective maintenance (K)	Not Required	Not Required
Conduct routine maintenance, calibration and troubleshooting of manufacturing lines, machines, and equipment (A)	Not Required	Not Required
Report and document performed measurements, maintenance, and repair work (S)	Not Required	3

OPERATIONAL	Process Technician	Process Engineer
Using measuring instruments (S)	4	4
Work spec instructions (S)	3	4
Following technical specifications, work procedure instructions, standard operating procedures, guidelines, formulas, production plans, and processing charts (S)	4	4
Complete documentation and reporting related to finished work (S)	4	4
Set, adjust, and re-adjust computerized or mechanical equipment controls according to specs (S)	2	4
Monitor equipment and adjust controls using computer terminals (S)	2	4
Cooperate with stock department and engineering departments to manage service stock, materials, and consumables for repair and maintenance (A)	2	4
Lean manufacturing (K)	2	4