



- 3. Layout
    - a. Studying blueprints, sketches, or tool description
    - b. Planning sequence of operations
    - c. Measuring, marking and scribing stock
  - 4. Bench Work
    - a. Filing, using abrasive cloths, deburring
    - b. Lapping, tapping, threading
    - c. Assembling parts
    - d. Verifying dimensions and alignment using instruments such as micrometer, height gauge, gauge blocks
    - e. Selecting and applying lubricants
  - 5. Process Adjustment and Improvement
    - a. Trace defects
    - b. Troubleshoot and problem solve
    - c. Use Statistical Process Control (SPC)
  - 6. Quality Assurance/Inspection
- B. Saws 100
- 1. Selecting cutting blade
  - 2. Clamping stock
  - 3. Selecting proper speed
  - 4. Operation
  - 5. Care and cleaning of tools
- C. Drills 200
- 1. Various types of drill presses
  - 2. Tapping, reaming, lapping, counterboring, countersinking and honing
  - 3. Grinding drills
  - 4. Selecting proper speeds and feeds
  - 5. Selecting and applying lubricants
  - 6. Care and cleaning of machine; checking oil levels (optional)\*\*
- D. Turning 2000
- 1. Centering, facing, straight turning, shoulder turning, taper turning, threading, knurling, chuckwork (drilling, boring, reaming, finishing, chuck and face plate turning),

steady rest and follow rest, offset tailstock and compound, recessing, filing, lapping, polishing, form turning, tapping, tools and centers.

2. Understand tool and work offsets
3. Select proper tools, speeds and feeds
4. Understand conversational programming
5. Selecting and applying lubricants
6. Care and cleaning of machine

E. Milling

2000

1. Selecting cutters
2. Holding work by various methods (vice, clamps, dividing head, circular table)
3. Rough milling, plain or slab milling, surface milling
4. Sawing, boring, flycutter milling, using slotting attachment and vertical head, keyway cutting, slotting, gang milling, form milling, taper and face milling, internal milling, radius cutting
5. Spline milling, rack cutting, cutter milling, gear cutting (optional)\*\*
6. Milling to irregular laid out line
7. Understand tool and work offsets
8. Selecting proper tools, speeds and feeds
9. Understand conversational programming
10. Selecting and applying lubricants
11. Care and cleaning of machine

F. Surface Grinder

300

1. Selecting grinding wheels
2. Mounting wheels
3. Magnetic chuck
4. Dressing wheels
5. Holding work by various methods
6. Plain or surface grinding, angle grinding, form grinding, dovetail grinding, squaring
7. Selecting proper speeds and feeds
8. Care and cleaning of machine

G. Universal Grinder, Cylindrical Grinder, Cutter Grinder  
Electrical Discharge Machining (EDM) (Optional)\*\*

300

1. Selecting, mounting, and dressing wheels, balancing wheels

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2. Setting up attachments
3. Setting up for clearance and cutting angles
4. Selecting proper speeds and feeds
5. Straight, taper, angle, face, form, I.D. and tool grinding
6. Grinding plain, spiral and end mills, reamers, form cutters and drills.
7. Care and cleaning of machines

H. Advanced Toolmaking 2100

1. Design and build simple jigs and fixtures
2. Build tools, jigs, and fixtures, from engineering drawings/specifications
3. Plan, organize, and schedule reosurces required to complete ssigned work

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Total Hours 8000

\*The hours listed are over the whole term of the Apprenticeship; they are not necessarily continuous in nature.

\*\*If optional Work Processes are not selected, the hours should be devoted to further mastery of required Work Processes.

*Apprenticeship work processes are applicable only to training curricula for apprentices in approved programs. Apprenticeship work processes have no impact on classification determinations under Article 8 or 9 of the Labor Law. For guidance regarding classification for purposes of Article 8 or 9 of the Labor Law, please refer to <http://www.labor.state.ny.us/workerprotection/publicwork/PDFs/Article8FAQS.pdf>*

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APPENDIX B  
TOOL MAKER  
RELATED INSTRUCTION

Safety

- Personal Protective Equipment
- Fundamentals of Trade Safety, including OSHA standards
- Hazardous Materials
- First Aid (minimum 6.5 hours every 3 years)

Blueprint Reading and Drawing

- Elementary Blueprint Reading and Shop Drawing
- Advanced Blueprint Reading and Shop Drawing
- Geometric Dimensioning and Tolerancing (GD&T)
- Fundamentals of C.A.D. (optional)

Mathematics

- Fundamentals (algebra, geometry, trigonometry)
- Applications to the Trade
- Precision Measurement

Industrial and Labor Relations (20 hours)

- History and Background (6 hours, 1<sup>st</sup> year)
- Current Laws and Practices (14 hours, 2<sup>nd</sup> year)

Sexual Harassment Prevention Training (minimum 3 hours)

Trade Theory and Science (Courses to be selected from the following topics)

- Practical Metallurgy
- Tools and Machines
- Layout
- Production Processes
- Tool Design
- Jig and Fixture Design
- Gauge Design
- Introduction to CNC Programming
- Fundamentals of Mechanics (including stresses and loads)
- Welding
- Heat Treatment
- Metal Plating
- Statistical Process Control

Other Related Courses, as necessary

A minimum of 144 hours of Related Instruction are required for each Apprentice for each year.  
(Additional Related Instruction may be required by an individual sponsor.)

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