

Machine Technology 1, 2, 3, and 4  
Course Codes: 6230, 6231, 6232, and 6233  
Units: 1, 2, or 3

**NOTE:** SC students completing Machine Technology secondary programs must complete the applicable 10-hour OSHA course/assessment and receive card. (SC requirement)

**NIMS Machining Skills, Level 1 (Required)**

|             |      |                                                                                                                                                                                                                                      |
|-------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Duty Area:  | 1.   | Job Planning and Management                                                                                                                                                                                                          |
| Duty Title: | 1.1  | Job Process Planning                                                                                                                                                                                                                 |
| Duty:       |      | Develop a process plan for a part requiring milling, drilling, turning, or grinding. Fill out an operation sheet detailing the process plan and required speeds and feeds.                                                           |
| Duty Area:  | 2.   | Job Execution                                                                                                                                                                                                                        |
| Duty Title: | 2.1  | Manual Operations: Benchwork                                                                                                                                                                                                         |
| Duty:       |      | Using aluminum, hand drill and hand tap holes. Use hand drills, hand taps, tap wrench, files, scrapers, and coated abrasives to deburr parts. Use arbor presses to perform press fits. Use bench vises and hand tools appropriately. |
| Duty Title: | 2.2  | Manual Operations: Layout                                                                                                                                                                                                            |
| Duty:       |      | Layout the location of hole centers and surfaces within an accuracy of +/- .015.                                                                                                                                                     |
| Duty Title: | 2.3  | Turning Operations: Between Centers Turning                                                                                                                                                                                          |
| Duty:       |      | Setup and carry out between centers turning operations for straight turning.                                                                                                                                                         |
| Duty Title: | 2.4  | Turning Operations: Chucking                                                                                                                                                                                                         |
| Duty:       |      | Setup and carry out chucking operations for turning.                                                                                                                                                                                 |
| Duty Title: | 2.5  | Milling: Square Up a Block                                                                                                                                                                                                           |
| Duty:       |      | Set up and perform squaring up the six surfaces of a block to within +/- .002 and .002 over 4.5" squareness.                                                                                                                         |
| Duty Title: | 2.6  | Vertical Milling                                                                                                                                                                                                                     |
| Duty:       |      | Setup and operate vertical milling machines. Perform routine milling and location of hole centers within +/- .005".                                                                                                                  |
| Duty:       | 2.7a | Surface Grinding, Grinding Wheel Safety                                                                                                                                                                                              |
| Duty:       |      | Ring test grinding wheels, perform visual safety inspection, mount and dress a grinding wheel in preparation for surface grinding.                                                                                                   |
| Duty;       | 2.9  | CNC Programming                                                                                                                                                                                                                      |
| Duty:       |      | Develop a program for the manufacture of a simple part using the principles of Cartesian coordinates.                                                                                                                                |

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| Duty Area:  | 3.  | Quality Control and Inspection                                                                                                                                                                                                                                                                                    |
| Duty Title: | 3.1 | Part Inspection                                                                                                                                                                                                                                                                                                   |
| Duty:       |     | Develop an inspection plan and inspect simple parts using precision tools and techniques. Prepare reports on the compliance of the parts.                                                                                                                                                                         |
| Duty Area:  | 5.  | General Maintenance                                                                                                                                                                                                                                                                                               |
| Duty Title: | 5.1 | General Housekeeping and Maintenance'                                                                                                                                                                                                                                                                             |
| Duty:       |     | Keep the duty station clean and safe for work. Keep the tools, workbenches, and manual equipment clean, maintained, and safe for work.                                                                                                                                                                            |
| Duty Title: | 5.2 | Preventive Maintenance, Machine Tools                                                                                                                                                                                                                                                                             |
| Duty:       |     | Inspect and assess the general condition of an assigned machine tool. Make routine adjustments as necessary and as authorized. Report to supervision problems that are beyond the scope of authority. Carry out daily, weekly, and/or monthly routine upkeep chores cited on checklists for a given machine tool. |
| Duty Title: | 5.3 | Tooling Maintenance                                                                                                                                                                                                                                                                                               |
| Duty:       |     | Inspect and assess the condition of tooling. Refurbish tooling where appropriate. Refer tooling for repair or regrind where appropriate.                                                                                                                                                                          |
| Duty Area:  | 6.  | Industrial Safety and Environmental Protection                                                                                                                                                                                                                                                                    |
| Duty Title: | 6.1 | Machine Operations and Material Handling                                                                                                                                                                                                                                                                          |
| Duty:       |     | Carry out assigned responsibilities while adhering to safe practices in accordance with OSHA requirements and guidelines. Document safety activities as required.                                                                                                                                                 |
| Duty Title: | 6.2 | Hazardous Materials Handling and Storage                                                                                                                                                                                                                                                                          |
| Duty:       |     | Handle and store hazardous materials as assigned while adhering to safe practices in accordance with OSHA and EPA requirements and guidelines. Document safety activities as required.                                                                                                                            |
| Duty Area:  | 7.  | Career Management and Employment Relations                                                                                                                                                                                                                                                                        |
| Duty Title: | 7.1 | Career Planning                                                                                                                                                                                                                                                                                                   |
| Duty:       |     | Develop and explain a short-term career plan and resume.                                                                                                                                                                                                                                                          |

### **NIMS Machining Skills, Level II (Required)**

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| Duty Area:  | 1.  | Job Planning and Management                                                                                                                                                                                                                                                 |
| Duty Title: | 1.1 | Job Process                                                                                                                                                                                                                                                                 |
| Duty:       |     | Write a detailed process plan that includes a quality plan for a part requiring milling, drilling, turning, or grinding. Produce an operation sheet detailing the process plan; identify all critical dimensions and required speeds and feeds. Provide sketches as needed. |

Duty Area: 2. Job Execution

Duty Title: 2.1 Lay Out Bolt Circles, Angles, Points of Tangency, and Profiles of a Line

Duty: Set up and lay out bolt circles, locations of surfaces related by non-right angles, locations of points of tangency between arcs and lines, and profiles of a line which is non-arc based.

Duty Title: 2.2 Contour Bandsawing

Duty: Set up and perform contour sawing to a layout. Choose and mount appropriate blades; weld, break, and re-weld blades as necessary.

Duty Title: 2.3 Turning: Between Centers Taper Turning

Duty: Set up and perform between centers turning for straight and tapered turning by offsetting the tailstock.

Duty Title: 2.4 Turning: Chucking, O.D. and I.D. Tapers Using a Taper Attachment

Duty: Set up and perform tapered boring and turning using a taper attachment.

Duty Title: 2.5 Vertical Mill: Precision Location of Holes

Duty: Set up and perform boring for location, size, and finish.

Duty Title: 2.6 Milling: Keyseats

Duty: Set up and perform milling keyseats on a shaft.

Duty Title: 2.7 Milling: Cut a Deep Slot with a Staggetooth Cutter

Duty: Set up and perform the cutting of a deep slot using a staggetooth cutter.

Duty Title: 2.8 Milling: Use Rotary Tables

Duty: Set up and perform the development of surfaces at a specified non-right angle using a rotary table. Set up and establish hole locations in various relationships to one another using a rotary table. The holes are in the same plane. Establish the profile of a radius with respect to two surfaces and the connecting points of tangency.

Duty Title: 2.9 Milling: Dividing Head Operations

Duty: Set up and perform operations requiring a dividing head. Set up and establish hole locations in various relationships to one another using a dividing head. Establish the profile of a radius with respect to two surfaces and the connecting points of tangency.

Duty Title: 2.19 CNC: Write Simple RS274-D Programs

Duty: Write simple RS274-D programs using M and G codes from the Machinerys Handbook using a computer and editor software. Simple programs are single plane, cutter centerline, linear and

circular interpolation, single cutter, with no canned cycles as specified on the print.

Duty Title: 2.20 CNC: Operate a CNC Milling Machine  
Duty: Operate a CNC milling machine.

Duty Title: 2.21 CNC: Operate a CNC Lathe  
Duty: Operate a CNC lathe.

Duty Area: 5. General Maintenance

Duty Title: 5.1 General Housekeeping and Maintenance  
Duty: Keep the duty station clean and safe for work. Keep the tools, workbenches, and manual equipment clean, maintained, and safe for work.

Duty Title: 5.2 Preventive Maintenance: Machine Tools  
Duty: Inspect and assess the general condition of an assigned machine tool. Make routine adjustments as necessary and as authorized. Report to supervision problems which are beyond the scope of authority. Carry out daily, weekly, and/or monthly routine upkeep chores cited on checklists for a given machine too.

Duty Title: 5.3 Tooling Maintenance  
Duty: Inspect and assess the condition of tooling. Refurbish tooling where appropriate. Refer tooling for repair or regrind where appropriate.

Duty Area: 6. Industrial Safety and Environmental Protection

Duty Title: 6.1 Machine Operations and Material Handling  
Duty: Carry out assigned responsibilities while adhering to safe practices in accordance with OSHA requirements and guidelines. Document safety activities as required.

Duty Title: 6.2 Hazardous Materials Handling and Storage  
Duty: Handle and store hazardous materials as assigned while adhering to safe practices in accordance with OSHA and EPA requirements and guidelines. Document safety activities as required.

Duty Area: 7. Career Management and Employment Relations

Duty Title: 7.1 Career Planning  
Duty: Develop and explain a short-term career plan and resume.

## Advanced Elective Standards

The following are advanced NIMS standards that are **not required** for secondary Machine Tool Technology programs; instructors are encouraged to implement these additional standards if their schools' schedules permit.

### Level 1 (Advanced; not required at the secondary level)

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| Duty Area:  | 2.   | Job Execution                                                                                                                                                                                                                                                                                                                             |
| Duty Title: | 2.7b | Surface Grinding, Horizontal Spindle, Reciprocating Table                                                                                                                                                                                                                                                                                 |
| Duty:       |      | Setup and operate manual surface grinders with an 8" and smaller diameter wheel. Perform routine surface grinding, location of surfaces, and squaring of surfaces. Perform wheel dressing.                                                                                                                                                |
| Duty Title: | 2.8  | Drill Press                                                                                                                                                                                                                                                                                                                               |
| Duty:       |      | Setup and operate drill presses. Perform routine drill press operations.                                                                                                                                                                                                                                                                  |
| Duty Area:  | 3.   | Quality Control and Inspection                                                                                                                                                                                                                                                                                                            |
| Duty Title: | 3.2  | Process Control                                                                                                                                                                                                                                                                                                                           |
| Duty:       |      | Follow a sampling plan. Inspect the samples for the required data. Enter the data on appropriate charts. Graph the data. Respond to the warning conditions indicated by the process charts.                                                                                                                                               |
| Duty Area:  | 4.   | Process Adjustment and Improvement                                                                                                                                                                                                                                                                                                        |
| Duty Title: | 4.1  | Process Adjustment-Single Part Production                                                                                                                                                                                                                                                                                                 |
| Duty:       |      | Analyze the performance of a single-part production process. Formulate process adjustments or improvements where appropriate. Where appropriate, notify supervision of the proposed adjustment and/or improvement. Where authorized, carry out the strategies for process adjustment and/or improvement.                                  |
| Duty Title: | 4.2  | Participation in Process Improvement                                                                                                                                                                                                                                                                                                      |
| Duty:       |      | Analyze the performance of a production process as a member of a process team. With the team formulate process adjustments or improvements where appropriate. Notify supervision of the proposed adjustments and/or improvement, where appropriate. Carry out the strategies for process adjustment and/or improvement, where authorized. |
| Duty Area:  | 7.   | Career Management and Employment Relations                                                                                                                                                                                                                                                                                                |
| Duty Title: | 7.2  | Job Application and Interviewing                                                                                                                                                                                                                                                                                                          |
| Duty:       |      | Complete job application form and demonstrate interviewing skills.                                                                                                                                                                                                                                                                        |
| Duty Title: | 7.3  | Teamwork and Interpersonal Relations                                                                                                                                                                                                                                                                                                      |
| Duty:       |      | Demonstrate appropriate interpersonal skills in job performance evaluations, group communication and decision-making, and conflict resolution.                                                                                                                                                                                            |

Duty Title: 7.4 Organizational Structures and Work Relations  
Duty: Identify and explain the major departments or functions in a metalworking company and how they affect production units.

Duty Title: 7.5 Employment Relations  
Duty: Understand and explain employment rights and responsibilities in metalworking companies.

## **Level II (Advanced; not required at the secondary level)**

Duty Area: 2. Job Execution  
Duty Title: 2.10 Basic Horizontal Boring Mill Operations  
Duty: Set up and perform boring for location, size, and finish and mill a slot for location and size.

Duty Title: 2.11 Drilling: Radial Drill  
Duty: Set up and perform drilling operations using a radial drill.

Duty Title: 2.12 Machine Tool Power Tapping: Taper Reaming and Pipe Tapping  
Duty: Set up, drill, taper ream, and tap a series of holes to part print specification.

Duty Title: 2.13 Surface Grinding: Finish Flats to  $\pm .0005$   
Duty: Grind a block's six faces to finished dimensions having tolerances of  $\pm .0005$  and squareness of .0005 over 4", and 32 microinch surface finish. Dress the wheel as necessary.

Duty Title: 2.14 Surface Grinding: Finish Flats at Simple Angles and Grind Contour Radii  
Duty: Set up and perform the finish surface grinding of flat surfaces at simple angles with respect to one another. Dress the wheel as necessary.

Duty Title: 2.15 Grinding Wheel Preparation and Balancing  
Duty: Set up and perform the preparation and balancing of a grinding wheel 14" diameter or greater. Place the wheel into service.

Duty Title: 2.16 Cylindrical Grinding  
Duty: Set up and perform between centers grinding for straight diameters. Dress the grinding wheel as necessary.

Duty Title: 2.17 EDM: Produce Electrode and Operate a Plunge EDM  
Duty: Produce an electrode and operate a plunge electric discharge machine.

Duty Title: 2.18 EDM: Operate a 2 Axis Wire EDM  
Duty: Operate a 2 axis wire electric discharge machine.

Duty Area: 3. Quality Control and Inspection  
Duty Title: 3.1 Inspection: Optical Comparator

Duty: Set up and perform the inspection of profiles in shadow and in reflection.

Duty Title: 3.2 Inspection: Manual Coordinate Measuring Machine  
Duty: Set up and perform the inspection of parts.

Duty Area: 4. Process Adjustment and Control  
Duty Title: 4.1 Participate in Capability Studies  
Duty: Participate as a team member in a capability study. Perform the required statistical calculations to support the capability study. Prepare, with the assistance of the team leader, the necessary shop reports for the capability study.

Duty Area: 7. Career Management and Employment Relations  
Duty Title: 7.2 Job Application and Interviewing  
Duty: Complete job application form and demonstrate interviewing skills.

Duty Title: 7.3 Teamwork and Interpersonal Relations  
Duty: Demonstrate appropriate interpersonal skills in job performance evaluations, group communication and decision-making, and conflict resolution.

Duty Title: 7.4 Organizational Structures and Work Relations  
Duty: Identify and explain the major departments or functions in a metalworking company and how they affect production units.

Duty Title: 7.5 Employment Relations  
Duty: Understand and explain employment rights and responsibilities in metalworking companies.

#### Resources:

National Institute for Metalworking Skills, Inc. (NIMS)

<http://www.nims-skills.org/downloads/downloads.htm>