

MACHINE TECHNOLOGY 1, 2, 3, AND 4
Course Codes: 6230, 6231, 6232, and 6233
NEW NAME: MACHINE TOOL TECHNOLOGY EFFECTIVE 2018-19

COURSE DESCRIPTION: Machine Tool Technology offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster. This program offers a broad foundation of knowledge and skills to prepare students for employment in machining positions.

The content includes but is not limited to broad, transferable skills, and stresses the understanding of all aspects of the modern machining industry, including CNC/CAD/CAM, and demonstrates such elements of the industry as planning, management, technical and production skills, underlying principles of technology, labor issues, community issues, and health, safety, and environmental issues.

SC students completing Machine Tool Technology secondary program must complete the 10-hour General Industry OSHA course/assessment and receive card.

OBJECTIVE: Given the necessary equipment, supplies, and facilities, the student will complete all of the following core standards successfully.

CREDITS:	1 (120 hours), 2 (240 hours) 3 units (360 hours)
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PREREQUISITE(S):	None
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RECOMMENDED GRADE LEVEL:	9 - 12
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COMPUTER ACCESS REQUIRED:	1:1
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RECOMMENDED MAXIMUM ENROLLMENT:	24
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RESOURCES:	<u>MySCTextbooks</u>
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A. SAFETY

Effective professionals know the academic subject matter, including safety as required for proficiency within their area. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in any program of study.

1. Review school safety policies and procedures.
2. Review classroom safety rules and procedures.
3. Review safety procedures for using equipment in the classroom.
4. Identify major causes of work-related accidents in office environments.
5. Demonstrate safety skills in an office/work environment.

B. STUDENT ORGANIZATIONS

Effective professionals know the academic subject matter, including professional development, required for proficiency within their area. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in any program of study.

1. Identify the purpose and goals of a Career and Technology Student Organization (CTSO).
2. Explain how CTSOs are integral parts of specific clusters, majors, and/or courses.
3. Explain the benefits and responsibilities of being a member of a CTSO.
4. List leadership opportunities that are available to students through participation in CTSO conferences, competitions, community service, philanthropy, and other activities.
5. Explain how participation in CTSOs can promote lifelong benefits in other professional and civic organizations.

C. TECHNOLOGY KNOWLEDGE

Effective professionals know the academic subject matter, including the ethical use of technology as needed in their role. The following accountability criteria are considered essential for students in any program of study.

1. Demonstrate proficiency and skills associated with the use of technologies that are common to a specific occupation.
2. Identify proper netiquette when using e-mail, social media, and other technologies for communication purposes.
3. Identify potential abuse and unethical uses of laptops, tablets, computers, and/or networks.
4. Explain the consequences of social, illegal, and unethical uses of technology (e.g., piracy; illegal downloading; licensing infringement; inappropriate uses of software, hardware, and mobile devices in the work environment).
5. Discuss legal issues and the terms of use related to copyright laws, fair use laws, and ethics pertaining to downloading of images, photographs, documents, video, sounds, music, trademarks, and other elements for personal use.
6. Describe ethical and legal practices of safeguarding the confidentiality of business-related information.
7. Describe possible threats to a laptop, tablet, computer, and/or network and methods of avoiding attacks.

D. PERSONAL QUALITIES AND EMPLOYABILITY SKILLS

Effective professionals know the academic subject matter, including positive work practices and interpersonal skills, as needed in their role. The following accountability criteria are considered essential for students in any program of study.

1. Demonstrate punctuality.
2. Demonstrate self-representation.
3. Demonstrate work ethic.
4. Demonstrate respect.
5. Demonstrate time management.
6. Demonstrate integrity.
7. Demonstrate leadership.
8. Demonstrate teamwork and collaboration.
9. Demonstrate conflict resolution.
10. Demonstrate perseverance.
11. Demonstrate commitment.
12. Demonstrate a healthy view of competition.
13. Demonstrate a global perspective.
14. Demonstrate health and fitness.
15. Demonstrate self-direction.
16. Demonstrate lifelong learning.

E. PROFESSIONAL KNOWLEDGE

Effective professionals know the academic subject matter, including positive work practices and interpersonal skills, as needed in their role. The following accountability criteria are considered essential for students in any program of study.

1. Demonstrate effective speaking and listening skills.
2. Demonstrate effective reading and writing skills.
3. Demonstrate mathematical reasoning.
4. Demonstrate job-specific mathematics skills.
5. Demonstrate critical-thinking and problem-solving skills.
6. Demonstrate creativity and resourcefulness.
7. Demonstrate an understanding of business ethics.
8. Demonstrate confidentiality.
9. Demonstrate an understanding of workplace structures, organizations, systems, and climates.
10. Demonstrate diversity awareness.
11. Demonstrate job acquisition and advancement skills.
12. Demonstrate task management skills.
13. Demonstrate customer-service skills.

MACHINE TOOL TECHNOLOGY LEVEL 1

F. JOB PROCESS PLANNING AND MANAGEMENT

Effective machine tool operators demonstrate effective job planning and management skills in machine tool operations. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

1. Develop a process for a part requiring milling, drilling, turning, or grinding.
2. Fill out an operation sheet detailing the process plan and required speeds and feeds.

G. MATERIALS

Effective machine tool operators demonstrate appropriate knowledge and usage of various materials used in machine tool operations. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

1. Define metallurgy and understand how metals are classified.
2. Identify the different classification systems for metals, ISO standard, unified numbering system and color coding.
3. Understand different techniques for machining diverse ferrous metals.
4. Identify the different classifications of carbon steel.
5. Identify the different types of carbon steels (e.g. hot-rolled, cold-rolled, alloy steels.
6. Recognize the different characteristics of various types of metals (e.g. ferrous, nonferrous, High Temperature, and rare.
7. Understand and identify the factors which determine machinability.

H. PRINT READING/DRAWING

Effective machine tool operators demonstrate effective skills for reading and interpreting print and drawings as used in machine tool operations. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

1. Blueprint Basics
 - a. Understand industrial language terms.
 - b. Understand the use of blueprints.
 - c. Understand the basics of how a blueprint is laid out.
2. Blueprint Standards
 - a. Match ISO and ANSI with their definitions.
 - b. Identify the symbols associated with ISO and ANSI standards.
 - c. Identify the meaning of orthographic projection.
 - d. Decipher the difference between 3rd and 1st angle projection.
 - e. Identify where different standards are used throughout the world.
3. Drawing Views
 - a. List the six principle views associated with orthographic projection.

- b. Decipher the difference between 3rd and 1st angle projection.
- c. Decipher the difference between one, two and three view drawings.
- e. Identify what a section view represents.
- 4. Drawing Types
 - a. Identify section lines.
 - b. Decipher the difference between engineering drawings and blueprints.
 - c. Interpret detailed drawings.
 - d. Identify shape and size descriptions of detailed drawings.
 - e. Identify specifications of detailed drawings.
 - f. Interpret assembly drawings.
 - g. Identify assembly drawings.
- 5. Blueprint Layout
 - a. Identify the 5 standard paper sizes for blueprints.
 - b. Decipher the different sections of a blueprint.
 - c. Understand the basic blueprint template.
 - d. Identify and interpret the seven different components of a blueprint title block.

I. QUALITY CONTROL AND INSPECTION

Effective machine tool operators demonstrate effective skills for quality control and inspection as used in machine tool operations. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

- 1. Develop an inspection plan and inspect simple parts using precision tools and techniques.
- 2. Prepare reports on the compliance of the parts.
- 3. Precision Measurements
 - a. Steel Rules
 - 1) Identify the types of measurements that can be measured accurately with steel rules.
 - 2) Understand the physical attributes of steel rules.
 - 3) Understand the different configurations of steel rules.
 - 4) Decipher between a fractional scale and a decimal scale.
 - 5) Identify what scale needs to be used based on the dimensional size on the part print.
 - 6) Understand how to properly position a steel rule on a part.
 - 7) Determine the measurement value using a fractional scale.
 - 8) Determine the measurement value using a decimal scale.
 - b. Slide Calipers
 - 1) Decipher between a vernier, dial, and digital precision caliper.
 - 2) Identify the three different measurements that can be taken with precision calipers.
 - 3) Clean and calibrate precision calipers.
 - 4) Identify specifications that should be measured with a precision calipers.
 - 5) Identify the different components of precision calipers.
 - 6) Use, read and interpret an inch Vernier precision caliper.
 - 7) Use, read and interpret a metric Vernier precision caliper.

- 8) Use, read and interpret a dial precision caliper.
- 9) Use, read and interpret a digital precision caliper.
- c. Micrometers
 - 1) Identify different types of micrometers.
 - 2) Identify the different components of micrometers.
 - 3) Understand the mechanics of a micrometer.
 - 4) Properly handle and maintain micrometers.
 - 5) Properly test and calibrate micrometers.
 - 6) Use, read and interpret outside micrometers.
 - 7) Use, read and interpret depth micrometers.

J. JOB EXECUTION

Effective machine tool operators demonstrate basic job execution skills in machine tool operations, including manual operations. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

- 1. Manual Operations: Bench work
 - a. Using aluminum, hand drill and hand tap holes.
 - b. Use hand drills, hand taps, tap wrench, files, scrapers, and coated abrasives to deburr parts.
 - c. Use arbor presses to perform press fits. Use bench vises and hand tools appropriately.
- 2. Manual Operations: Layout
 - a. Layout the location of hole centers and surfaces within an accuracy of $\pm .015$.
- 3. Contour Band Sawing
 - a. Set up and perform contour sawing to a layout.
 - b. Choose and mount appropriate blades.
 - c. Weld, break, and re-weld blades as necessary.
- 4. Drill Press
 - a. Setup and operate drill presses.
 - b. Perform routine drill press operations.
- 5. Turning Operations: Between Centers Turning
 - a. Setup and carry out between centers turning operations for straight turning.
- 6. Turning Operations: Chucking
 - a. Setup and carry out chucking operations for turning.
- 7. Milling: Square Up a Block
 - a. Set up and perform squaring up the six surfaces of a block to within $\pm .002$ and $.002$ over 4.5" squareness.
- 8. Vertical Milling
 - a. Setup and operate vertical milling machines. Perform routine milling and location of hole centers within $\pm .005$ ".

K. GENERAL HOUSEKEEPING AND MAINTENANCE

Effective machine tool operators demonstrate appropriate housekeeping and maintenance. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

1. Keep the duty station clean and safe for work.
2. Keep the tools, workbenches, and manual equipment clean, maintained, and safe for work.

L. PREVENTIVE MAINTENANCE: MACHINE TOOLS

Effective machine tool operators demonstrate appropriate preventative maintenance on machine tools. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

1. Inspect and assess the general condition of an assigned machine tool.
2. Make routine adjustments as necessary and as authorized.
3. Report to supervision problems that are beyond the scope of authority.
4. Carry out daily, weekly, and/or monthly routine upkeep chores cited on checklists for a given machine tool.

M. TOOLING MAINTENANCE

Effective machine tool operators demonstrate appropriate tooling maintenance. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

1. Inspect and assess the condition of tooling.
2. Refurbish tooling where appropriate.
3. Refer tooling for repair or regrind where appropriate.

N. INDUSTRIAL SAFETY AND ENVIRONMENTAL PROTECTION

Effective machine tool operators demonstrate appropriate industrial safety and environmental protection awareness. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

1. Machine Operations and Material Handling
 - a. Carry out assigned responsibilities while adhering to safe practices in accordance with OSHA requirements and deadlines.
 - b. Document safety activities as required.
2. Hazardous Materials Handling and Storage
 - a. Handle and store hazardous materials as assigned while adhering to safe practices in

- accordance with OSHA and EPA requirements and guidelines.
- b. Document safety activities as required.

O. CAREER MANAGEMENT AND EMPLOYMENT RELATIONS

Effective machine tool operators demonstrate appropriate knowledge and skills in career development. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

1. Analyze modern machine careers.
2. Develop and explain a short-term career plan and resume.

MACHINE TOOL TECHNOLOGY 2

(A-E at the beginning of Level 1)

F. JOB PROCESS PLANNING AND MANAGEMENT

Effective machine tool operators demonstrate effective job planning and management skills in machine tool operations. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

1. Write a detailed process plan that includes a quality plan for a part requiring milling, drilling, turning, or grinding.
2. Produce an operation sheet detailing the process plan.
3. Identify all critical dimensions and required speeds and feeds.
4. Provide sketches as needed.

G. PRINT READING/DRAWING (GD&T)

Effective machine tool operators demonstrate effective skills for reading and interpreting print and drawings as used in machine tool operations. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

1. Fundamentals of Geometric Dimensioning
 - a. Verify the purpose of dimensions in a drawing.
 - b. Match commonly used dimension symbols and terminologies with their purpose.
 - c. Identify size dimensions.
 - d. Identify diameter dimensions.
 - e. Identify radius dimensions.
 - f. Identify angular dimensions.
 - g. Identify datum dimensions.
 - h. Identify location dimensions.
 - i. Understand dimensioning standards for threaded fasteners.
 - j. Calculate dimensions on a blueprint.
 - k. Demonstrate how precision dimensions are expressed.
 - l. Understand what the drawing scale means.
2. Fundamentals of Geometric Tolerancing
 - a. Verify different tolerancing methods used in GD&T.
 - b. Identify tolerances located on an engineering drawing.
 - c. Identify different tolerance types.
 - d. Verify the purpose of tolerances.
 - e. Identify the symbols used when tolerancing.
 - f. Identify the terms used when tolerancing.
 - g. Identify and interpret the different tolerancing methods.
 - h. Interpret clearance, interference, and transition fits.

H. QUALITY CONTROL AND INSPECTION

Effective machine tool operators demonstrate effective skills for quality control and inspection as used in machine tool operations. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

1. Develop an inspection plan and inspect simple parts using precision tools and techniques.
2. Prepare reports on the compliance of the parts.
3. Precision Measurement
 - a. Slide Calipers
 - 1) Decipher between a vernier, dial, and digital precision caliper.
 - 2) Identify the three different measurements that can be taken with precision calipers.
 - 3) Clean and calibrate precision calipers.
 - 4) Identify specifications that should be measured with a precision calipers.
 - 5) Identify the different components of precision calipers.
 - 6) Use, read and interpret an inch Vernier precision caliper.
 - 7) Use, read and interpret a metric Vernier precision caliper.
 - 8) Use, read and interpret a dial precision caliper.
 - 9) Use, read and interpret a digital precision caliper.
 - b. Micrometers
 - 1) Identify different types of micrometers.
 - 2) Identify the different components of micrometers.
 - 3) Understand the mechanics of a micrometer.
 - 4) Properly handle and maintain micrometers.
 - 5) Properly test and calibrate micrometers.
 - 6) Use, read and interpret outside micrometers.
 - 7) Use, read and interpret depth micrometers.

I. JOB EXECUTION

Effective machine tool operators demonstrate basic job execution skills in machine tool operations, including manual operations. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

1. Lay Out Bolt Circles, Angles, Points of Tangency, and Profiles of a Line
 - a. 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.
2. Contour Band Sawing
 - a. Set up and perform contour sawing to a layout.
 - b. Choose and mount appropriate blades.
 - c. Weld, break, and re-weld blades as necessary.

3. Turning: Between Centers Taper Turning
 - a. Set up and perform between centers turning for straight and tapered turning by offsetting the tailstock.
4. Turning: Chucking, O.D. and I.D. Tapers Using a Taper Attachment
 - a. Set up and perform tapered boring and turning using a taper attachment.
5. Vertical Mill: Precision Location of Holes
 - a. Set up and perform boring for location, size, and finish.
6. Milling: Keyseats
 - a. Set up and perform milling keyseats on a shaft.
7. Surface Grinding, Horizontal Spindle, Reciprocating Table
 - a. Setup and operate manual surface grinders with an 8" and smaller diameter wheel.
 - b. Perform routine surface grinding, location of surfaces, and squaring of surfaces.
 - c. Perform wheel dressing.
 - d. Perform visual safety inspection.
 - e. Mount and dress a grinding wheel in preparation for surface grinding.
 - f. Ring test grinding wheel.
8. CNC Programming and Operations
 - a. Set up and operate a computerized-numerical-control (CNC) machine for lathe and mill operations.
 - b. Develop a program using NC (G-code) for the manufacture of a simple part using the principles of Cartesian coordinates.

J. GENERAL HOUSEKEEPING AND MAINTENANCE

Effective machine tool operators demonstrate appropriate housekeeping and maintenance. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

1. Keep the duty station clean and safe for work.
2. Keep the tools, workbenches, and manual equipment clean, maintained, and safe for work.

K. PREVENTIVE MAINTENANCE: MACHINE TOOLS

Effective machine tool operators demonstrate appropriate preventative maintenance on machine tools. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

1. Inspect and assess the general condition of an assigned machine tool.
2. Make routine adjustments as necessary and as authorized.
3. Report to supervision problems which are beyond the scope of authority.
4. Carry out daily, weekly, and/or monthly routine upkeep chores cited on checklists for a given machine tool.

L. TOOLING MAINTENANCE

Effective machine tool operators demonstrate appropriate tooling maintenance. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

1. Inspect and assess the condition of tooling.
2. Refurbish tooling where appropriate.
3. Refer tooling for repair or regrind where appropriate.

M. INDUSTRIAL SAFETY AND ENVIRONMENTAL PROTECTION: MACHINE OPERATIONS AND MATERIAL HANDLING

Effective machine tool operators demonstrate appropriate industrial safety and environmental protection awareness. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

1. Carry out assigned responsibilities while adhering to safe to safe practices in accordance with OSHA requirements and guidelines.
2. Document safety activities as required.

N. HAZARDOUS MATERIALS HANDLING AND STORAGE

Effective machine tool operators demonstrate appropriate handling and storage of hazardous materials. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

1. Handle and store hazardous materials as assigned while adhering to safe practices in accordance with OSHA and EPA requirements and guidelines.
2. Document safety activities as required.

O. CAREER MANAGEMENT AND EMPLOYMENT RELATIONS

Effective machine tool operators demonstrate appropriate knowledge and skills in career development. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

1. Analyze modern machine careers.
2. Develop and explain a short-term career plan and resume.

MACHINE TOOL TECHNOLOGY 3

(A-E at the beginning Level 1)

F. JOB PLANNING AND MANAGEMENT: JOB PROCESS

Effective machine tool operators demonstrate effective job planning and management skills in machine tool operations. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

1. Write a detailed process plan that includes a quality plan for a part requiring milling, drilling, turning, or grinding.
2. Produce an operation sheet detailing the process plan.
3. Identify all critical dimensions and required speeds and feeds.
4. Provide sketches as needed.

G. PRINT READING/DRAWING (GD&T)

Effective machine tool operators demonstrate effective skills for reading and interpreting print and drawings as used in machine tool operations. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

1. Fundamentals of Geometric Dimensioning
 - a. Verify the purpose of dimensions in a drawing.
 - b. Match commonly used dimension symbols and terminologies with their purpose.
 - c. Identify size dimensions.
 - d. Identify diameter dimensions.
 - e. Identify radius dimensions.
 - f. Identify angular dimensions.
 - g. Identify datum dimensions.
 - h. Identify location dimensions.
 - i. Understand dimensioning standards for threaded fasteners.
 - j. Calculate dimensions on a blueprint.
 - k. Demonstrate how precision dimensions are expressed.
 - l. Understand what the drawing scale means.
2. Fundamentals of Geometric Tolerancing
 - a. Verify different tolerancing methods used in GD&T.
 - b. Identify tolerances located on an engineering drawing.
 - c. Identify different tolerance types.
 - d. Verify the purpose of tolerances.
 - e. Identify the symbols used when tolerancing.
 - f. Identify the terms used when tolerancing.
 - g. Identify and interpret the different tolerancing methods.
 - h. Interpret clearance, interference, and transition fits.

H. QUALITY CONTROL AND INSPECTION

Effective machine tool operators demonstrate effective skills for quality control and inspection as used in machine tool operations. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

1. Develop an inspection plan and inspect assigned project parts using precision tools and techniques.
2. Prepare reports on the compliance of the parts.

I. JOB EXECUTION

Effective machine tool operators demonstrate basic job execution skills in machine tool operations, including manual operations. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

1. Lay Out Bolt Circles, Angles, Points of Tangency, and Profiles of a Line
 - a. 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.
2. Contour Band Sawing
 - a. Set up and perform contour sawing to a layout.
 - b. Choose and mount appropriate blades.
 - c. Weld, break, and re-weld blades as necessary.
3. Turning: Between Centers Taper Turning
 - a. Set up and perform between centers turning for straight and tapered turning by offsetting the tailstock.
4. Turning: Chucking, O.D. and I.D. Tapers Using a Taper Attachment
 - a. Set up and perform tapered boring and turning using a taper attachment.
5. Vertical Mill: Precision Location of Holes
 - a. Set up and perform boring for location, size, and finish.
6. Milling: Keyseats
 - a. Set up and perform milling keyseats on a shaft.
7. Surface Grinding, Horizontal Spindle, Reciprocating Table
 - a. Setup and operate manual surface grinders with an 8" and smaller diameter wheel.
 - b. Perform routine surface grinding, location of surfaces, and squaring of surfaces.
 - c. Perform wheel dressing.
 - d. Perform visual safety inspection.
 - e. Mount and dress a grinding wheel in preparation for surface grinding.
 - f. Ring test grinding wheel.
8. CNC: Write Simple Programs for CNC Mill and Lathe (upon equipment availability)
 - a. Write simple programs using M and G codes from the machine programming manuals using a computer and editor software. Simple programs are single plane, cutter centerline, linear and circular interpolation, single cutter, as specified on the print.

- b. Set up and operate a CNC Milling Machine.
- c. Set up and operate a CNC Lathe.

J. GENERAL HOUSEKEEPING AND MAINTENANCE

Effective machine tool operators demonstrate appropriate housekeeping and maintenance. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

- 1. Keep the duty station clean and safe for work.
- 2. Keep the tools, workbenches, and manual equipment clean, maintained, and safe for work.

K. PREVENTIVE MAINTENANCE: MACHINE TOOLS

Effective machine tool operators demonstrate appropriate preventative maintenance on machine tools. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

- 1. Inspect and assess the general condition of an assigned machine tool.
- 2. Make routine adjustments as necessary and as authorized.
- 3. Report to supervision problems which are beyond the scope of authority.
- 4. Carry out daily, weekly, and/or monthly routine upkeep chores cited on checklists for a given machine tool.

L. TOOLING MAINTENANCE

Effective machine tool operators demonstrate appropriate tooling maintenance. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

- 1. Inspect and assess the condition of tooling.
- 2. Refurbish tooling where appropriate.
- 3. Refer tooling for repair or regrind where appropriate.

M. PROCESS ADJUSTMENT AND IMPROVEMENT FOR PROCESS ADJUSTMENT-SINGLE PART PRODUCTION

Effective machine tool operators demonstrate effective skills for process improvement and adjustment in single part production as used in machine tool operations. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

- 1. Analyze the performance of a single-part production process.
- 2. Formulate process adjustments or improvements where appropriate.

3. Where appropriate, notify supervision of the proposed adjustment and/or improvement.
4. Where authorized, carry out the strategies for process adjustment and/or improvement.
5. Critique a process for improvement in quality and productivity.

N. CAREER MANAGEMENT AND EMPLOYMENT RELATIONS

Effective machine tool operators demonstrate appropriate knowledge and skills in career development. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

1. Job Application and Interviewing
 - a. Complete job application form and demonstrate interviewing skills.
2. Teamwork and Interpersonal Relations
 - a. Demonstrate appropriate interpersonal skills in job performance evaluations, group communication, decision-making, and conflict resolution.
3. Organizational Structures and Work Relations
 - a. Identify and explain the major departments or functions in a metalworking company and how they affect production units.
4. Employment Relations
 - a. Understand and explain employment rights and responsibilities in metalworking companies.

MACHINE TOOL TECHNOLOGY 4

(A-E at the beginning Level 1)

F. JOB PLANNING AND MANAGEMENT: JOB PROCESS

Effective machine tool operators demonstrate effective job planning and management skills in machine tool operations. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

1. Write a detailed process plan that includes a quality plan for a part requiring milling, drilling, turning, or grinding.
2. Produce an operation sheet detailing the process plan.
3. Identify all critical dimensions and required speeds and feeds.

G. QUALITY CONTROL AND INSPECTION

Effective machine tool operators demonstrate effective skills for quality control and inspection as used in machine tool operations. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

1. Develop an inspection plan and inspect assigned project parts using precision tools and techniques.
2. Prepare reports on the compliance of the parts.

H. JOB EXECUTION

Effective machine tool operators demonstrate basic job execution skills in machine tool operations, including manual operations. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

1. Machine Tool Power Tapping: Taper Reaming and Pipe Tapping
 - a. Set up, drill, taper ream, and tap a series of holes to part print specification.
2. Surface Grinding: Finish Flats to $\pm .0005$
 - a. 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.
 - b. Dress the wheel as necessary.
3. Surface Grinding: Finish Flats as Simple Angles and Grind Contour Radii
 - a. Set up and perform the finish surface grinding of flat surfaces at simple angles with respect to one another.
 - b. Dress the wheel as necessary.
4. Grinding Wheel Preparation and Balancing
 - a. Set up and perform the preparation and balancing of a grinding wheel 14" diameter or greater.

- b. Place the wheel into service.
- 5. CNC: Write Programs for CNC Mill and Lathe (upon equipment availability)
 - a. Write programs using M and G codes from the machine programming manuals using a computer and editor software. Programs are single plane, cutter centerline, linear and circular interpolation, single cutter, as specified on the print (NIMS Level 1 recommended).
 - b. Set up and operate a CNC Milling Machine (NIMS Level 1 recommended).
 - c. Set up and operate a CNC Lathe (NIMS Level 1 recommended).

I. GENERAL HOUSEKEEPING AND MAINTENANCE

Effective machine tool operators demonstrate appropriate housekeeping and maintenance. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

- 1. Keep the duty station clean and safe for work.
- 2. Keep the tools, workbenches, and manual equipment clean, maintained, and safe for work.

J. PREVENTIVE MAINTENANCE: MACHINE TOOLS

Effective machine tool operators demonstrate appropriate preventative maintenance on machine tools. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

- 1. Inspect and assess the general condition of an assigned machine tool.
- 2. Make routine adjustments as necessary and as authorized.
- 3. Report to supervision problems which are beyond the scope of authority.
- 4. Carry out daily, weekly, and/or monthly routine upkeep chores cited on checklists for a given machine tool.

K. TOOLING MAINTENANCE

Effective machine tool operators demonstrate appropriate tooling maintenance. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

- 1. Inspect and assess the condition of tooling.
- 2. Refurbish tooling where appropriate.
- 3. Refer tooling for repair or regrind where appropriate.

L. PROCESS ADJUSTMENT AND IMPROVEMENT: PROCESS ADJUSTMENT-SINGLE PART PRODUCTION

Effective machine tool operators demonstrate effective skills for process improvement

and adjustment in single part production as used in machine tool operations. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

1. Analyze the performance of a single-part production process.
2. Formulate process adjustments or improvements where appropriate.
3. Where appropriate, notify supervision of the proposed adjustment and/or improvement.
4. Where authorized, carry out the strategies for process adjustment and/or improvement.
5. Critique a process for improvement in quality and productivity.

M. CAREER MANAGEMENT AND EMPLOYMENT RELATIONS

Effective machine tool operators demonstrate appropriate knowledge and skills in career development. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Machine Tool Technology program of study.

1. Job Application and Interviewing
 - a. Complete job application form and demonstrate interviewing skills.
2. Teamwork and Interpersonal Relations
 - a. Demonstrate appropriate interpersonal skills in job performance evaluations, group communication, decision-making, and conflict resolution.
3. Organizational Structures and Work Relations
 - a. Identify and explain the major departments or functions in a metalworking company and how they affect production units.
4. Employment Relations
 - a. Understand and explain employment rights and responsibilities in metalworking companies.

[Course Materials and Resources](#)

[Course Academic Standards and Indicators](#)