2005 Mississippi Curriculum Framework

Secondary Machine Tool Operation

(Program CIP: 48.0503 — Machine Shop Technology/Assistant)

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Standards in this document are based on information from the following organizations:

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Foreword

Secondary vocational-technical education programs in Mississippi are faced with many challenges resulting from sweeping educational reforms at the national and state levels. Schools and teachers are increasingly being held accountable for providing true learning activities to every student in the classroom. This accountability is measured through increased requirements for mastery and attainment of competency as documented through both formative and summative assessments.

The courses in this document reflect the statutory requirements as found in Section 37-3-49, Mississippi Code of 1972, as amended (Section 37-3-46). In addition, this curriculum reflects guidelines imposed by federal and state mandates (Laws, 1988, ch. 487, §14; Laws, 1991, ch. 423, §1; Laws, 1992, ch. 519, §4 eff. from and after July 1, 1992; Carl D. Perkins Vocational Education Act III, 1998; and No Child Left Behind Act of 2001).

Each secondary vocational-technical course consists of a series of instructional units which focus on a common theme. All units have been written using a common format which includes the following components:

- Unit Number and Title
- Suggested Time on Task - An estimated number of clock hours of instruction that should be required to teach the competencies and objectives of the unit. A minimum of 140 hours of instruction is required for each Carnegie unit credit. The curriculum framework should account for approximately 75-80 percent of the time in the course.
- Competencies and Suggested Objectives
  - A competency represents a general concept or performance that students are expected to master as a requirement for satisfactorily completing a unit. Students will be expected to receive instruction on all competencies.
  - The suggested objectives represent the enabling and supporting knowledge and performances that will indicate mastery of the competency at the course level.
- Suggested Teaching Strategies - This section of each unit indicates strategies that can be used to enable students to master each competency. Emphasis has been placed on strategies which reflect active learning methodologies. Teachers should feel free to modify or enhance these suggestions based on needs of their students and resources available in order to provide optimum learning experiences for their students.
- Suggested Assessment Strategies - This section indicates strategies that can be used to measure student mastery. Examples of suggested strategies could include rubrics, class participation, reflection, and journaling. Again, teachers should feel free to modify or enhance these suggested assessment strategies based on local needs and resources.

- Integrated Academic Topics, Workplace Skills, Technology Standards, and Occupational Standards - This section identifies related academic topics as required in the Subject Area Assessment Program (SATP) in Algebra I, Biology I, English II, and U. S. History from 1877, which are integrated into the content of the unit. It also identifies the general workplace skills as identified in the Secretary's Commission on Achieving Necessary Skills (SCANS) report as being critical for all workers in the 21st Century. In addition, national technology standards and occupational skills standards associated with the competencies and suggested objectives for the unit are also identified.
- References - A list of suggested references is provided for each unit. The list includes some of the primary instructional resources that may be used to teach the competencies and suggested objectives. Again, these resources are suggested and the list may be modified or enhanced based on needs and abilities of students and on available resources.

Table of Contents

Program Description

Machine Tool Operation prepares a student for entry-level employment in machining careers and/or for further study at the postsecondary level. Emphasis is on safety, math, measuring tools and instruments, hand and bench tools, blueprint reading, lathe operations, milling operations, lay out, grinding machine operations, and computerized numerical control (CNC).

The content of the Machine Tool Operation curriculum framework follows the recommended national standards as formulated by the National Institute for Metalworking Skills (NIMS), www.nims.org.

Students that complete the Machine Tool Operation curriculum will be eligible for NIMS Level I certification. The NIMS Website, has materials (blueprints; Level I, II, and III Skills) that can be printed and used in class.

Course Outline

Machine Tool Operation I

Course CIP Code: 48.0503

Unit	Title	Hours
Unit 1:	Orientation, Leadership, and Employability Skills	15.0
Unit 2:	Safety	10.0
Unit 3:	Math, Measuring Tools, and Instruments	25.0
Unit 4:	Hand and Bench Tools	10.0
Unit 5:	Introduction to Blueprints	15.0
Unit 6:	Drill Press and Band Saw Theory and Operation	20.0
Unit 7:	Lathe Theory and Operation	70.0
Unit 8:	Milling Machine Theory and Operation	60.0

Machine Tool Operation II

Course CIP Code: 48.0509

Unit	Title	Hours
Unit 1:	Orientation, Leadership, and Employability Skills (Review)	10.0
Unit 2:	Safety (Review)	10.0
Unit 3:	Grinding Machine Theory and Operation	35.0
Unit 4:	Advanced Lathe and Milling Machine Theory and Operation	145.0
Unit 5:	Computerized Numerical Control	35.0

Machine Tool Operation I
Unit 1: Orientation, Leadership, and Employability Skills (15 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Describe local program and vocational/career technical center policies and procedures. a. Describe local program and vocational/career technical center policies and procedures including dress code, attendance, academic requirements, discipline, and transportation regulations.	**Teaching:** • Present local program and vocational/career technical center policies and procedures.[E2] • Students will read the handbook to become aware of what is expected of them in relation to the policies and procedures of the school. This will include dress code, attendance, academic requirements, discipline, and transportation regulations. Students will work together in pairs. A student with a higher reading ability will team up with a student with a lower reading ability to get a better understanding of the school's program policies and procedures. Submit written report on rules and regulations. [E2, E3, E8] **Assessment:** • Assess student orientation, policies, and procedures knowledge through instructor observations and written unit test. File completed test to document student mastery of the school and program policies and procedures. • The report will be evaluated for clarity and content.
2. Describe employment opportunities and responsibilities. a. Describe employment opportunities including potential earnings, employee benefits, job availability, place of employment, working conditions, and educational requirements. b. Describe basic employee responsibilities.	**Teaching:** • Define trade terms related to basic employability skills. • Students will interview individuals in the automotive industry. Students will be provided questions by the instructor. The student will write a report on the interview and present the report to the class.[E1, E2] • Students will research the phone book, Internet, and newspapers for employment opportunities.[E3, E8] • Students will participate in a mock interview. Industry representatives will interview students. • Invite a guest speaker to speak on industry

	related information. • Students will use career software, such as Choices, to measure their aptitudes and abilities for particular careers.[E3, E8] • Students will use available resources (college catalogs and websites) to research information about postsecondary educational opportunities.[E2, E3, E4, E5, E10] • Students will select a career in the field and outline educational and skill requirements, expected job growth, and entry-level salaries.[E1, E3, E8, E9] **Assessment:** • Assessment will be determined by matching test for definitions. Lessons involving writing and math skills will be integrated with the appropriate department. • A checklist will be used to evaluate each student. • The presentation and report on the automotive industry interview will be evaluated using a rubric. • Use a checklist to evaluate the presentation. • Review career software printout to assess student aptitudes and abilities.
3. Explore leadership skills and personal development opportunities provided students by student organizations to include SkillsUSA. a. Demonstrate effective teambuilding and leadership skills. b. Practice appropriate work ethics.	**Teaching:** • Discuss the role of a team member and leader. Assign the students roles within a team and have them role play a situation in which there is a conflict which must be resolved. Utilize the lessons from SkillsUSA or other resources to provide additional training.[E3, E8] • Discuss appropriate work ethics standards. Have the students list what they believe to be the most common problems within the automotive profession. **Assessment:** • Assess the role play using a checklist for documentation. • Lessons from other resources should be assessed according to the recommended resource guide.

	• The list of work ethic practices will be graded for clarity and content.
4. Demonstrate the ability to follow verbal and written instructions and communicate effectively in on-the-job situations.	**Teaching:** • Have the students perform an activity involving verbal instructions. Divide the students into groups and have one team be the customer and the other be the service advisor. The customer will describe the concern, and the service advisor will provide an explanation of the processes that will need to be followed for them to properly diagnose the concern. Have the groups switch roles and repeat the process. E2, E3, E4, E8 • The student will be given a work order. The work order will contain written instructions of a specific job. The student will complete the work order. **Assessment:** • The lesson will be assessed using a presentation rubric. • The work order will be evaluated using a checklist.
5. Discuss the history of machine tool industry to include materials, terminology, and techniques.	**Teaching:** • Discuss the history of the machine tool industry. Have the students research the history of the machine tool industry and develop a presentation for the class. H1, H2 **Assessment:** • Assess the presentation using a presentation checklist.

STANDARDS

National Institute for Metalworking Skills

NIMSI-1	Job Planning and Management
NIMSI-2	Job Execution
NIMSI-3	Quality Control and Inspection
NIMSI-4	Process Adjustment and Control
NIMSI-5	General Maintenance
NIMSI-6	Industrial Safety and Environmental Protection
NIMSI-7	Career MGT and Employment Relations

Academic Standards

E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.
H1 Explain how geography, economics, and politics have influenced the historical development of the United States in the global community.
H2 Describe the impact of science and technology on the historical development of the United States in the global community.

Workplace Skills for the 21st Century

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

Davis, D. (1996). *Practical problems in mathematics for manufacturing*. Albany, NY: Delmar.

Fitzpatrick, M. (2005). *Machining and CNC technology*. New York: McGraw Hill.

Kibbe, R., Neely, J., Meyer, R., & White, W. (2002). *Machine tool practices* (7th ed.). Upper Saddle River, NJ: Prentice Hall.

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Walker, J. (2004). *Machining fundamentals*. Tinley Park, IL: Goodheart-Willcox. (Instructor manual and student lab manual available)

Machine Tool Operation I
Unit 2: Safety **(10 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Describe general safety rules for working in a shop/lab and industry. a. Describe how to avoid on-site accidents. b. Explain the relationship between housekeeping and safety. c. Explain the importance of following all safety rules and company safety policies. d. Explain the importance of reporting all on-the-job injuries and accidents. e. Explain the need for evacuation policies and the importance of following them. f. Explain the employer's substances abuse policy and how it relates to safety. g. Explain the safety procedures when working near pressurized or high temperature.	**Teaching:** **This can be used for the entire unit.** • Identify, discuss, and demonstrate terms, rules, and procedures related to shop/lab and industry safety.[E3, E8] • Required written tests will follow each section of guidelines for safety rules and procedures. • Provide the students with a list of terms and have them define the terms. Pair the students to quiz each other on the definitions in preparation for a written exam.[E2, E3, E4, E8] • Use the guidelines provided for personal safety (i.e., clothing, jewelry, hair, eyes, and ears). Divide the students into pairs and assign each pair one of the guidelines. Each pair will demonstrate the "do's and don'ts" of the guideline. • Have an industry speaker present to the class the necessity of safety in the work environment. The students will write a summary of the presentation.[E1, E2, E9] • Divide the students into teams and have them develop scenarios of hazards and accidents using the trade publications and the Internet. This will include tools, spills, working around welding, ladders or scaffolds, use of MSDS information, fires, and electrical situations. In a game type situation, one team will read a scenario and the other teams will compete to be the first to provide the proper safety measures which should have been used to prevent the hazardous situation. Points will be awarded to the teams with the correct answers.[E2, E4] • Required written tests will follow each section of guidelines for safety rules and procedures. • NOTE: SAFETY IS TO BE TAUGHT AS AN ONGOING PART OF THE COURSE THROUGHOUT THE YEAR.
2. Identify and apply safety around machine tool operations. a. Use proper safety practices when performing machine tool operations. b. Recognize and explain personal protective equipment. c. Inspect and care for personal protective equipment.	
3. Explain lifting. a. Identify and explain the procedures for lifting heavy objects.	
4. Explain the Material Safety Data Sheet (MSDS). a. Explain the function of the MSDS. b. Interpret the requirements of the MSDS.	
5. Explain fires. a. Explain the process by which fires start. b. Explain fire prevention of various flammable liquids.	

c. Explain the classes of fire and the types of extinguishers. 6. Explain safety in and around automotive and electrical situations. a. Explain injuries when electrical contact occurs. b. Explain safety around automotive and electrical hazards. c. Explain action to take when an electrical shock occurs.	**Assessment:** • Student participation will be monitored by the instructor and the written exam will be graded. The student must achieve 100% accuracy. • The "do's and don'ts" exercise will be critiqued with a peer review. • The summary of the speaker's presentation will be critiqued using a rubric. • The teams will be rewarded according the points earned from the game. This could be extra points, classroom privileges, etc. • Written exams will be graded.

STANDARDS

National Institute for Metalworking Skills

NIMSI-1	Job Planning and Management
NIMSI-2	Job Execution
NIMSI-3	Quality Control and Inspection
NIMSI-4	Process Adjustment and Control
NIMSI-5	General Maintenance
NIMSI-6	Industrial Safety and Environmental Protection
NIMSI-7	Career MGT and Employment Relations

Academic Standards

E1	Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2	Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3	Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4	Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5	Complete oral and written presentations which exhibit interaction and consensus within a group.
E8	Read, discuss, analyze, and evaluate literature from various genres and other written material.
E9	Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10	Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

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Walker, J. (2004). *Machining fundamentals.* Tinley Park, IL: Goodheart-Willcox. (Instructor manual and student lab manual available)

Machine Tool Operation I
Unit 3: Math, Measuring Tools, and Instruments (25 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Apply the four basic math skills with whole numbers, fractions, and percent. a. Add, subtract, multiple, and divide whole numbers, decimals, and fractions. b. Convert whole numbers to fractions, and convert fractions to whole numbers. c. Convert decimals to percent and percent to decimals. d. Convert fractions to decimals. e. Convert fractions to percent.	**Teaching:** • Have students complete a short pretest to apply the four basic math skills with whole numbers, fractions, and percent .[A1] • Give students the correct answers to problems, and ask at least one student who got the answers for whole numbers correct to write the problems on the chalkboard or a piece of chart paper. Have students who did not get the problems correct listen as the student at the board/paper works the problems. Do this procedure for fractions and percent as well, having students rotate through the skills until each student has spent time with each set of problems. Have a different student lead the discussion each time students rotate so that the students who are just learning how to work the problems have a chance to teach the other students.[E2, E4, E5] • Provide students with additional problems to apply the four basic math skills with whole numbers, fractions, and percent while working in small groups and then alone. **Assessment:** • Using a checklist to monitor group work as students perform calculations. • Evaluate students on a posttest with whole number, fraction, and percent problems.
2. Perform basic mathematical calculations related to machine shop operations. a. Convert metric to English measurements. b. Solve basic angles and sides. c. Calculate the amount of material for a given project. d. Compute distances according to a drawn plan.	**Teaching:** • Have students use stiff paper (or materials in the shop) to build a simple model, measuring the pieces using both standard and metric rulers to ensure that the model is to proper scale with the design.[A2] • Have the student solve for unknown sides and angles in a right triangle using math formulas and calculator.[A1, A2] • Provide the student with a list of material dimensions for a given project. The

	student can calculate the amount of material needed by using math.[A1, A2] • Have the student compute the dimensions for a blueprint provided by the instructor.[A1, A2] **Assessment:** • Evaluate each student's measurement for accuracy using a checklist. • Have students complete a test using math to perform basic mathematical calculations.
3. Identify and perform functions using various measuring tools and instruments (micrometers, dial indicators, height gauge, and digital caliper). a. Read a rule to the nearest 1/32nd inch. b. Lay out lines with a rule. c. Describe the care and use of various rules. d. Demonstrate how to calculate sides of a triangle and the use of Pythagorean Theorem.	**Teaching:** • Have the students watch a video on the use and care of measuring tools. Discuss the uses and procedures for various rules. • Distribute to students an assignment sheet. The students will match the measurement shown by selecting the appropriate ruler. • Distribute a small machined part with simple features (holes, slots, etc.). The student with paper, pencil, and a pocket rule will record the dimensions of the part features to within the instructor-given tolerance.[A1] • Distribute to students an assignment sheet, combination square and rule, lay out dye, scribe, and material. The student will perform a lay out of lines with a rule following the instructions provided.[A2] • Provide each student with information sheets identifying the uses of and procedures for measuring instruments. Discuss and identify the different measuring instruments to the class. • Demonstrate to the class techniques for using the different precision instruments. • Have the students watch a video explaining the uses and procedures for measuring instruments. • Provide each student with an assignment sheet. The student will identify the various precision measurements and their uses. • Distribute a small machined part with simple features (holes, slots, etc). The student with pencil, paper, and precision

	measuring instruments will record the dimensions of the part features to within .005 of an inch. • Provide each student with a job sheet (measure work piece with inside micrometer, depth micrometer, and outside micrometer). Have the student select the appropriate equipment and follow the procedures by demonstrating its proper use to the class. • Provide each student with a job sheet (lay out work piece on a surface plate using the height gage). Have the student select the appropriate equipment and follow the procedures by demonstrating its proper use to the class. • Provide each student with a job sheet [nspect a part for circularity (roundness) using the dial indicator, v-block and surface plate]. Have the student select the appropriate equipment and follow procedures by demonstrating its proper use to the class. **Assessment**: • Evaluate each student's measurement for accuracy. • Evaluate the student's assignment sheets. • Evaluate the student's shop safety rules using a checklist. • Evaluate each student's job sheets for accuracy, equipment, and procedures. • Evaluate each student's assignment sheet for identification and use of precision measuring instruments.

STANDARDS

National Institute for Metalworking Skills

NIMSI-1	Job Planning and Management
NIMSI-2	Job Execution
NIMSI-3	Quality Control and Inspection
NIMSI-4	Process Adjustment and Control
NIMSI-5	General Maintenance
NIMSI-6	Industrial Safety and Environmental Protection

Secondary Machine Tool Operation

NIMSI-7 Career MGT and Employment Relations

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.

Workplace Skills for the 21st Century

WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T6 Technology problem-solving and decision-making tools

Suggested References

Davis, D. (1996). *Practical problems in mathematics for manufacturing*. Albany, NY: Delmar.

Fitzpatrick, M. (2005). *Machining and CNC technology*. New York: McGraw Hill.

Kibbe, R., Neely, J., Meyer, R., & White, W. (2002). *Machine tool practices* (7th ed.). Upper Saddle River, NJ: Prentice Hall.

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Machine Tool Operation I
Unit 4: Hand and Bench Tools (10 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Demonstrate the proper use and maintenance of metalworking hand and power tools. a. Identify and discuss the use of hand and bench tools used in the machine shop. b. Discuss rules of safety. c. Select and demonstrate the use of the tools.	**Teaching:** • Identify basic hand and power tools (e.g., hammer, screwdriver, saw, wrench, pliers, drill) used in the welding field (Contren Core Text Introduction to Hand Tools and Introduction to Power Tools Units and Level I Hand and Power Tools Unit) and how they have advanced through time.[E3, E8, H2] • Discuss safety factors, proper use, and maintenance.[E2, E5] • Describe accidents that can occur while using tools. • Divide students into groups and give each group a scenario/case study (written or on video) involving an accident. Have each group identify safety mistakes in each situation; determine correct procedures; and present the scenario, mistakes found, and procedures which should have been used to the class.[E2, E3, E4, E5, E9, E10] • Demonstrate the uses of various hand and power tools for the class. • Provide each student with a description of a project to be completed. Have the student select the appropriate tool for the project and demonstrate its proper use to the class.[E2, E3, E4, E5, E9, E10] • Assign each student a specific set of tools (i.e., hammers, power saws, wrenches, etc.). Have students use the Internet to research and write or type (if technology resources are available) a report on the proper procedures for maintenance of the assigned set of tools.[E1, E3, E4, E5, E9, E10] **Assessment:** • Have each student complete a test to identify specific tools. • Using a checklist, evaluate the case study presentation for content and delivery. • Using a checklist, evaluate the selection of

	the proper tool for the assigned project and demonstration of its use. • Using a checklist, evaluate the maintenance report.
2. Demonstrate the use and maintenance of hand taps and hand dies. a. Identify and discuss the use of hand taps and hand dies. b. State the safety rules in the use of thread cutting. c. Determine tap drill size using tap drill chart. d. Demonstrate drilling a blind or through holes with a hand held electric or pneumatic drill. e. Tap a blind or through hole demonstrating proper use of taper, plug, and bottom taps. f. Produce external threads with a hand die.	**Teaching:** • Explain screw thread terminology and specifications to the students while working in the shop-lab. The student will be able to identify screw thread terminology and specifications, select taps and dies for given applications, and cut threads with both tap and die. This knowledge will be evident by achieving a specified score on job sheets and unit test. • Give each student an information sheet describing how screw threads are defined, thread nomenclature and specifications, and thread measurement. Discuss identification, selection, and proper use of hand taps and hand dies to the class. • Discuss safety factors, proper use, handling, and storage of hand taps and hand dies. • Provide each student with a tap-drill chart. Explain how to use the chart by selecting a specific drill bit diameter to produce a hole for the required tap. • Provide the students with a list of drill bit diameters. Have each student use the tap-drill chart to determine the proper tap for the hole diameters given. • Demonstrate using the tap-drill chart, electric or pneumatic drill, drill bit, and hand tap and following safety rules produce internal threads to the class. **Assessment:** • Job sheets and the unit test will be graded. • Each student will be given a project sheet. The project sheet will list equipment and specific procedures for cutting internal threads with a tap and cutting external threads with a die. Have the student select the appropriate tools and equipment for the project and demonstrate the operation to the class. The project sheet will be

	evaluated and the completed project will be compared to the model.

STANDARDS

National Institute for Metalworking Skills

NIMSI-1	Job Planning and Management
NIMSI-2	Job Execution
NIMSI-3	Quality Control and Inspection
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NIMSI-5	General Maintenance
NIMSI-6	Industrial Safety and Environmental Protection
NIMSI-7	Career MGT and Employment Relations

Academic Standards

E1	Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2	Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3	Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4	Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5	Complete oral and written presentations which exhibit interaction and consensus within a group.
E8	Read, discuss, analyze, and evaluate literature from various genres and other written material.
E9	Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10	Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP3	Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4	Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP7	Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8	Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T4 Technology communications tools
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

Davis, D. (1996). *Practical problems in mathematics for manufacturing*. Albany, NY: Delmar.

Fitzpatrick, M. (2005). *Machining and CNC technology.* New York: McGraw Hill.

Kibbe, R., Neely, J., Meyer, R., & White, W. (2002). *Machine tool practices* (7th ed.). Upper Saddle River, NJ: Prentice Hall.

Krar, S., Rapisarda, M., & Check, A. (1998). *Machine tool and manufacturing technology.* Albany, NY: Thomson. (Instructor manual and student lab manual available)

Neely, J. (2000). *Basic machine tool operations*. Upper Saddle River, NJ: Prentice Hall.

Taylor, D. (2003). *Elementary blueprint reading for machinists* (5th ed.). Albany, NY: Delmar.

Valentino, J., & Goldenberg, J. (2003). *Introduction to computer numerical control (CNC)* (3rd ed.). Upper Saddle River, NJ: Prentice Hall.

Walker, J. (2004). *Machining fundamentals.* Tinley Park, IL: Goodheart-Willcox. (Instructor manual and student lab manual available)

Machine Tool Operation I
Unit 5: Introduction to Blueprints (15 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Read, analyze, and design a blueprint. a. Identify terms, views, lines, and symbols commonly used on blueprints. b. Interpret a plan to determine lay out. c. Interpret welding drawings. d. Describe the information in a title block. e. Explain the architect's and engineer's scales. f. Identify, describe, and apply auxiliary views, finishes, materials, section lines, and cutting plane lines. a. Identify, distinguish, and apply primary and secondary auxiliary views on a drawing. b. Identify, describe, and apply surface finishes shown on a plan. c. Identify materials used as indicated by section lines, and demonstrate correct selection. d. Describe and apply the use of the cutting plane line. g. Design a blueprint.	**Teaching:** • Using a blueprint (may use AutoCAD if available), explain all terms, symbols, and abbreviations on the blueprint and how they are used to locate various elements. Give each student a copy of the symbols and abbreviations (Contren Core Text Introduction to Blueprints Unit). Discuss drawings, material list, blueprint components, and architect's and engineer's scales.[E3, E8] • Divide students into pairs and have them quiz each other on the terms and symbols. • Have each student interpret a plan, specifications, and drawings; match them to an actual picture of the area; and interpret the information to the class.[E2, E4, E9] • Have students work as a team to prepare a blueprint of an instructor-given project to present to a client (Contren Core Text Introduction to Blueprints Unit). Have students type a letter/report to the client and prepare blueprints including symbols, specifications and drawings, equipment and materials, title block, lines, and scales for the client.[E1, E4, E5, E9] • Have students contact a welding supply store manager (may simulate a call) or review advertisements on the Internet to determine the procedure for purchase of the materials and the estimated cost. Have students include an estimated cost of material in the information sent to the client in the activity above. [A1, A5, E9, E10] • To determine the accuracy of the blueprint, have students complete a project according to the blueprint specifications (Contren Core Text Introduction to Blueprints Unit).[A1, A5, E10]

	Assessment: • Monitor group work as students quiz each other, and use a check sheet of symbols to monitor student success (Contren Core Text Introduction to Blueprints Unit). • Determine if each student matches the plan to the correct picture, and evaluate his or her interpretation of the information to the class for accuracy, clarity, and presentation skills. • The blueprint will be evaluated using a rubric for accuracy, and grade the letter/report for accuracy of content, grammar, and organization. • Evaluate the estimated cost of materials for cost effectiveness. • Evaluate the project according to a checklist or rubric from Contren Unit.

STANDARDS

National Institute for Metalworking Skills

NIMSI-1	Job Planning and Management
NIMSI-2	Job Execution
NIMSI-3	Quality Control and Inspection
NIMSI-4	Process Adjustment and Control
NIMSI-5	General Maintenance
NIMSI-6	Industrial Safety and Environmental Protection
NIMSI-7	Career MGT and Employment Relations

Academic Standards

A1	Recognize, classify, and use real numbers and their properties.
A5	Utilize various formulas in problem-solving situations.
E1	Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2	Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3	Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4	Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.

E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T4 Technology communications tools
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

Davis, D. (1996). *Practical problems in mathematics for manufacturing*. Albany, NY: Delmar.

Fitzpatrick, M. (2005). *Machining and CNC technology*. New York: McGraw Hill.

Kibbe, R., Neely, J., Meyer, R., & White, W. (2002). *Machine tool practices* (7th ed.). Upper Saddle River, NJ: Prentice Hall.

Krar, S., Rapisarda, M., & Check, A. (1998). *Machine tool and manufacturing technology.* Albany, NY: Thomson. (Instructor manual and student lab manual available)

Neely, J. (2000). *Basic machine tool operations*. Upper Saddle River, NJ: Prentice Hall.

Taylor, D. (2003). *Elementary blueprint reading for machinists* (5th ed.). Albany, NY: Delmar.

Valentino, J., & Goldenberg, J. (2003). *Introduction to computer numerical control (CNC)* (3rd ed.). Upper Saddle River, NJ: Prentice Hall.

Walker, J. (2004). *Machining fundamentals.* Tinley Park, IL: Goodheart-Willcox. (Instructor manual and student lab manual available)

Machine Tool Operation I
Unit 6: Drill Press and Band Saw Theory and Operation (20 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Discuss drill press and band saw theory and operation.	**Teaching:** **Note: These strategies can be used for the entire unit. Safety will be reviewed and reinforced before and during the unit.** • The instructor will present a video on the given task. The student will develop several questions and answers from the video. [E1] • The instructor will demonstrate identification and interpretation of the specific task concerns. The student will utilize a variety of resources to write a report to identify and interpret task concerns. [E1, E2, E3, E5, E8, E9, E10] • Divide the students into groups and assign each group a specific task. Have each group construct a poster listing components and the diagram of the task. [E4, E3, E5] • Actual pictures from the lab will be shown and discussed about the specific task. The students will perform each task assigned. **Assessment:** • The questions and answers will be evaluated for content and clarity. • A report will be presented to the class. A rubric will be used to evaluate the presentation. • Evaluate the poster for content and clarity. • A checklist will be used to evaluate the task.
2. Set up and demonstrate the safe use and maintenance of the drill press and the vertical and horizontal band saws. a. List the factors which determine cutting speeds (rpm) for drilling. b. Complete NIMS Drill Level I project for the appropriate piece of equipment.	**Teaching:** **The instructor will explain and demonstrate the following. The students will demonstrate the following before performing live work.** • Set up and demonstrate the safe use and maintenance of the drill press and the vertical and horizontal band saws. • List the factors which determine cutting speeds (rpm) for drilling.

	• Complete NIMS Drill Level I project for the appropriate piece of equipment. **Assessment:** • A written test will be given for the terminology. • A checklist will be used to observe the students while they are performing safety inspections and procedures for operation. • The NIMS project will be graded for accuracy.

STANDARDS

National Institute for Metalworking Skills

NIMSI-1	Job Planning and Management
NIMSI-2	Job Execution
NIMSI-3	Quality Control and Inspection
NIMSI-4	Process Adjustment and Control
NIMSI-5	General Maintenance
NIMSI-6	Industrial Safety and Environmental Protection
NIMSI-7	Career MGT and Employment Relations

Academic Standards

E1	Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2	Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3	Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4	Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5	Complete oral and written presentations which exhibit interaction and consensus within a group.
E8	Read, discuss, analyze, and evaluate literature from various genres and other written material.
E9	Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10	Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

Davis, D. (1996). *Practical problems in mathematics for manufacturing*. Albany, NY: Delmar.

Fitzpatrick, M. (2005). *Machining and CNC technology*. New York: McGraw Hill.

Kibbe, R., Neely, J., Meyer, R., & White, W. (2002). *Machine tool practices* (7th ed.). Upper Saddle River, NJ: Prentice Hall.

Krar, S., Rapisarda, M., & Check, A. (1998). *Machine tool and manufacturing technology.* Albany, NY: Thomson. (Instructor manual and student lab manual available)

Neely, J. (2000). *Basic machine tool operations*. Upper Saddle River, NJ: Prentice Hall.

Taylor, D. (2003). *Elementary blueprint reading for machinists* (5th ed.). Albany, NY: Delmar.

Valentino, J., & Goldenberg, J. (2003). *Introduction to computer numerical control (CNC)* (3rd ed.). Upper Saddle River, NJ: Prentice Hall.

Walker, J. (2004). *Machining fundamentals.* Tinley Park, IL: Goodheart-Willcox. (Instructor manual and student lab manual available)

Machine Tool Operation I
Unit 7: Lathe Theory and Operation (70 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Identify the parts, rules, and care of the engine lathe. a. Set up a lathe and determine the rpm and feed rate according to manufacturer's specifications for the basic lathe operations. b. Explain the advantages and disadvantages of carbide tip cutting tools and demonstrate how to free-hand grind a high speed steel (hss) turning tool. • Explain the turning of a piece of stock. • Describe how to chuck a piece of stock. • Describe facing, center drilling, filing, tapping, and cutoff.	**Teaching:** **Note: These strategies can be used for the entire unit. Safety will be reviewed and reinforced before and during the unit.** • The instructor will present a video on the given task. The student will develop several questions and answers from the video. E1 • The instructor will demonstrate identification and interpretation of the specific task concerns. The student will utilize a variety of resources to write a report to identify and interpret task concerns. E1, E2, E3, E5, E8, E9, E10 • Divide the students into groups and assign each group a specific task. Have each group construct a poster listing components and the diagram of the task. E4, E3, E5 • Actual pictures from the lab will be shown and discussed about the specific task. The students will perform each task assigned. **Assessment:** • The questions and answers will be evaluated for content and clarity. • A report will be presented to the class. A rubric will be used to evaluate the presentation. • Evaluate the poster for content and clarity. • A checklist will be used to evaluate the task.
2. Perform the following procedures for facing operation. a. Identify terms and procedures for lathe operations. b. Discuss rules of safety. c. Demonstrate centering a work piece in a four-jaw chuck on the lathe. d. Face a part to length. e. Perform a straight turning operation. f. Perform a chamfer operation.	**Teaching:** **The instructor will explain and demonstrate the following. The students will demonstrate the following before performing live work.** • Identify terms and procedures for lathe operations. • Discuss rules of safety. • Demonstrate centering a work piece in a four-jaw chuck on the lathe.

g. Perform a center drilling operation. h. Perform a knurling operation. i. Perform a cutoff operation. j. Tap a blind hole. k. Cut external and internal threads on the lathe. l. Complete NIMS turning-chucking Level I project. m. Complete NIMS turning between centers Level I project. n. Install a chuck on a lathe. o. Mount and align a part in a four-jaw chuck on a lathe to instructor's specifications. p. Turn a taper with a compound rest and a taper attachment. q. Perform a boring operation. r. Perform wet and dry cuts.	• Face a part to length. • Perform a straight turning operation. • Perform a chamfer operation. • Perform a center drilling operation. • Perform a knurling operation. • Perform a cutoff operation. • Tap a blind hole. • Cut external and internal threads on the lathe. • Complete NIMS turning-chucking Level I project. • Complete NIMS turning between centers Level I project. • Install a chuck on a lathe. • Mount and align a part in a four-jaw chuck on a lathe to instructor's specifications. • Turn a taper with a compound rest and a taper attachment. • Perform a boring operation. • Perform wet and dry cuts. **Assessment:** • A written test will be given for the terminology. • A checklist will be used to observe the students while they are performing safety inspections and procedures for operation.

STANDARDS

National Institute for Metalworking Skills

NIMSI-1	Job Planning and Management
NIMSI-2	Job Execution
NIMSI-3	Quality Control and Inspection
NIMSI-4	Process Adjustment and Control
NIMSI-5	General Maintenance
NIMSI-6	Industrial Safety and Environmental Protection
NIMSI-7	Career MGT and Employment Relations

Academic Standards

E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.

E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

Davis, D. (1996). *Practical problems in mathematics for manufacturing*. Albany, NY: Delmar.

Fitzpatrick, M. (2005). *Machining and CNC technology*. New York: McGraw Hill.

Kibbe, R., Neely, J., Meyer, R., & White, W. (2002). *Machine tool practices* (7th ed.). Upper Saddle River, NJ: Prentice Hall.

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Neely, J. (2000). *Basic machine tool operations*. Upper Saddle River, NJ: Prentice Hall.

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Valentino, J., & Goldenberg, J. (2003). *Introduction to computer numerical control (CNC)* (3rd ed.). Upper Saddle River, NJ: Prentice Hall.

Walker, J. (2004). *Machining fundamentals.* Tinley Park, IL: Goodheart-Willcox. (Instructor manual and student lab manual available)

Machine Tool Operation I
Unit 8: Milling Machine Theory and Operation (60 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Differentiate between the types of milling machines. a. Identify the different types and parts of milling machines. b. Explain the use and safety of each type of milling machine.	**Teaching:** **Note: These strategies can be used for the entire unit. Safety will be reviewed and reinforced before and during the unit.** • The instructor will present a video on the given task. The student will develop several questions and answers from the video. E1 • The instructor will demonstrate identification and interpretation of the specific task concerns. The student will utilize a variety of resources to write a report to identify and interpret task concerns. E1, E2, E3, E5, E8, E9, E10 • Divide the students into groups and assign each group a specific task. Have each group construct a poster listing components and the diagram of the task. E4, E3, E5 • Actual pictures from the lab will be shown and discussed about the specific task. The students will perform each task assigned. **Assessment:** • The questions and answers will be evaluated for content and clarity. • A report will be presented to the class. A rubric will be used to evaluate the presentation. • Evaluate the poster for content and clarity. • A checklist will be used to evaluate the task.
2. Identify the parts, cutting tools, and basic maintenance of a horizontal and vertical milling machine. a. Identify the major parts of a horizontal and vertical mill. b. Identify the cutting tools used on a horizontal and vertical mill. c. Clean and lubricate a horizontal and vertical mill following manufacturer's specifications.	**Teaching:** **The instructor will explain and demonstrate the following tasks. The students will demonstrate the following tasks before performing live work.** • Identify the major parts of a horizontal and vertical mill. • Identify the cutting tools used on a horizontal and vertical mill. • Clean and lubricate a horizontal and

d. Determine the rpm and feed rate.	vertical mill following manufacturer's specifications. • Determine the rpm and feed rate. **Assessment:** • A written test will be given for the terminology. • A checklist will be used to observe the students while they are performing safety inspections and procedures for operation.
3. Perform operations on a specific machine. a. Perform operations on a horizontal milling machine. (1) Perform a side milling operation to specifications and a surfacing/cutting operation with a horizontal mill to specifications, mill a key seat, mill a given angle, align the head square to the table, and divide head operations. b. Perform operations on a vertical milling machine. (1) Perform an end milling operation, side milling, slotting, drilling, reaming, boring, and fly cutting, mounting cutters and cutter holders, and mounting and aligning a swivel vise; mill a key seat, a given angle, and a straight boring operation; align the head square to the table, mill operation with head tilted to 45 degrees, and divide head operations.	**Teaching:** **The instructor will explain and demonstrate the following tasks. The students will demonstrate the following tasks before performing live work.** • Use a horizontal milling machine to perform a side milling operation to specifications and a surfacing/cutting operation with a horizontal mill to specifications, mill a key seat, mill a given angle, align the head square to the table, and divide head operations. • Use a vertical milling machine to perform an end milling operation, side milling, slotting, drilling, reaming, boring, and fly cutting, mounting cutters and cutter holders, and mounting and aligning a swivel vise; mill a key seat, a given angle, and a straight boring operation; align the head square to the table, mill operation with head tilted to 45 degrees, and divide head operations. **Assessment:** • A written test will be given for the terminology. • A checklist will be used to observe the students while they are performing safety inspections and procedures for operation.

STANDARDS

National Institute for Metalworking Skills

NIMSI-1 Job Planning and Management
NIMSI-2 Job Execution

Secondary Machine Tool Operation

NIMSI-3	Quality Control and Inspection
NIMSI-4	Process Adjustment and Control
NIMSI-5	General Maintenance
NIMSI-6	Industrial Safety and Environmental Protection
NIMSI-7	Career MGT and Employment Relations

Academic Standards

E1	Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2	Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3	Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4	Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5	Complete oral and written presentations which exhibit interaction and consensus within a group.
E8	Read, discuss, analyze, and evaluate literature from various genres and other written material.
E9	Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10	Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP3	Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4	Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP5	Selects, applies, and maintains/troubleshoots technology.
WP8	Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1	Basic operations and concepts
T5	Technology research tools
T6	Technology problem-solving and decision-making tools

Suggested References

Davis, D. (1996). *Practical problems in mathematics for manufacturing*. Albany, NY: Delmar.

Fitzpatrick, M. (2005). *Machining and CNC technology*. New York: McGraw Hill.

Kibbe, R., Neely, J., Meyer, R., & White, W. (2002). *Machine tool practices* (7th ed.). Upper Saddle River, NJ: Prentice Hall.

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Walker, J. (2004). *Machining fundamentals.* Tinley Park, IL: Goodheart-Willcox. (Instructor manual and student lab manual available)

Machine Tool Operation II
Unit 1: Orientation, Leadership,and Employability Skills (Review) (10 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Describe local program and vocational/career technical center policies and procedures. a. Describe local program and vocational/career technical center policies and procedures including dress code, attendance, academic requirements, discipline, and transportation regulations.	**Teaching:** • Present local program and vocational/career technical center policies and procedures.[E2] • Students will read the handbook to become aware of what is expected of them in relation to the policies and procedures of the school. This will include dress code, attendance, academic requirements, discipline, and transportation regulations. Students will work together in pairs. A student with a higher reading ability will team up with a student with a lower reading ability to get a better understanding of the school's program policies and procedures. Submit written report on rules and regulations. [E2, E3, E8] **Assessment:** • Assess student orientation, policy, and procedure knowledge through instructor observations and written unit test. File completed test to document student mastery of the school and program policies and procedures. • The report will be evaluated for clarity and content.
2. Describe employment opportunities and responsibilities. a. Describe employment opportunities including potential earnings, employee benefits, job availability, place of employment, working conditions, and educational requirements. b. Describe basic employee responsibilities.	**Teaching:** • Define trade terms related to basic employability skills. • Students will interview individuals in the automotive industry. Students will be given questions provided by the instructor. The student will write a report on the interview and present the report to the class.[E1, E2] • Students will research the phone book, Internet, and newspapers for employment opportunities.[E3, E8] • Students will participate in a mock interview. Industry representatives will interview students.

	• Invite a guest speaker to speak on industry related information. • Students will use career software, such as Choices, to measure their aptitudes and abilities for particular careers. E3, E8 • Students will use available resources (college catalogs and websites) to research information about postsecondary educational opportunities. E2, E3, E4, E5, E10 • Students will select a career in the field and outline educational and skills requirements, expected job growth, and entry-level salaries. E1, E3, E8, E9 **Assessment:** • Assessment will be determined by matching test for definitions. Lessons involving writing and math skills will be integrated with the appropriate department. • A checklist will be used to evaluate each student. • The presentation and report on the automotive industry interview will be evaluated using a rubric. • Use a checklist to evaluate the presentation. • Review career software printout to assess student aptitudes and abilities.

STANDARDS

National Institute for Metalworking Skills

NIMSI-1 Job Planning and Management
NIMSI-2 Job Execution
NIMSI-3 Quality Control and Inspection
NIMSI-4 Process Adjustment and Control
NIMSI-5 General Maintenance
NIMSI-6 Industrial Safety and Environmental Protection
NIMSI-7 Career MGT and Employment Relations

Academic Standards

E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.

Secondary Machine Tool Operation

E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T4 Technology communications tools
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

Davis, D. (1996). *Practical problems in mathematics for manufacturing*. Albany, NY: Delmar.

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Walker, J. (2004). *Machining fundamentals.* Tinley Park, IL: Goodheart-Willcox. (Instructor manual and student lab manual available)

Machine Tool Operation II
Unit 2: Safety (Review) **(10 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Describe general safety rules for working in a shop/lab and industry. a. Describe how to avoid on-site accidents. b. Explain the relationship between housekeeping and safety. c. Explain the importance of following all safety rules and company safety policies. d. Explain the importance of reporting all on-the-job injuries and accidents. e. Explain the need for evacuation policies and the importance of following them. f. Explain the employer's substances abuse policy and how it relates to safety. g. Explain the safety procedures when working near pressurized or high temperature.	**Teaching:** **This can be used for the entire unit.** • Identify, discuss, and demonstrate terms, rules, and procedures related to shop/lab and industry safety.[E3, E8] • Required written tests will follow each section of guidelines for safety rules and procedures. • Provide the students with a list of terms and have them define the terms. Pair the students to quiz each other on the definitions in preparation for a written exam.[E2, E3, E4, E8] • Use the guidelines provided for personal safety (i.e., clothing, jewelry, hair, eyes, and ears). Divide the students into pairs and assign each pair one of the guidelines. Each pair will demonstrate the "do's and don'ts" of the guideline. • Have an industry speaker present to the class: the necessity of safety in the work environment. The students will write a summary of the presentation.[E1, E2, E9] • Divide the students into teams and have them develop scenarios of hazards and accidents using the trade publications and the Internet. This will include tools, spills, working around welding, ladders or scaffolds, use of MSDS information, fires, and electrical situations. In a game type situation, one team will read a scenario and the other teams will compete to be the first to provide the proper safety measures which should have been used to prevent the hazardous situation. Points will be awarded to the teams with the correct answers.[E2, E4] • Required written tests will follow each section of guidelines for safety rules and procedures. • NOTE: SAFETY IS TO BE TAUGHT AS AN ONGOING PART OF THE COURSE THROUGHOUT THE YEAR.
2. Identify and apply safety around machine tool operations. a. Use proper safety practices when performing machine tool operations. b. Recognize and explain personal protective equipment. c. Inspect and care for personal protective equipment.	
3. Explain lifting. a. Identify and explain the procedures for lifting heavy objects.	
4. Explain the Material Safety Data Sheet (MSDS). a. Explain the function of the MSDS. b. Interpret the requirements of the MSDS.	
5. Explain fires. a. Explain the process by which fires start. b. Explain fire prevention of various flammable liquids.	

c. Explain the classes of fire and the types of extinguishers. 6. Explain safety in and around automotive and electrical situations. a. Explain injuries when electrical contact occurs. b. Explain safety around automotive and electrical hazards. c. Explain action to take when an electrical shock occurs.	**Assessment:** • Student participation will be monitored by the instructor and the written exam will be graded. The student must achieve 100% accuracy. • The "do's and don'ts" exercise will be critiqued with a peer review. • The summary of the speaker's presentation will be critiqued using a rubric. • The teams will be rewarded according the points earned from the game. This could be extra points, classroom privileges, etc. • Written exams will be graded.

STANDARDS

National Institute for Metalworking Skills

NIMSI-1	Job Planning and Management
NIMSI-2	Job Execution
NIMSI-3	Quality Control and Inspection
NIMSI-4	Process Adjustment and Control
NIMSI-5	General Maintenance
NIMSI-6	Industrial Safety and Environmental Protection
NIMSI-7	Career MGT and Employment Relations

Academic Standards

E1	Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2	Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3	Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4	Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5	Complete oral and written presentations which exhibit interaction and consensus within a group.
E8	Read, discuss, analyze, and evaluate literature from various genres and other written material.
E9	Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10	Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

Davis, D. (1996). *Practical problems in mathematics for manufacturing*. Albany, NY: Delmar.

Fitzpatrick, M. (2005). *Machining and CNC technology*. New York: McGraw Hill.

Kibbe, R., Neely, J., Meyer, R., & White, W. (2002). *Machine tool practices* (7th ed.). Upper Saddle River, NJ: Prentice Hall.

Krar, S., Rapisarda, M., & Check, A. (1998). *Machine tool and manufacturing technology.* Albany, NY: Thomson. (Instructor manual and student lab manual available)

Neely, J. (2000). *Basic machine tool operations*. Upper Saddle River, NJ: Prentice Hall.

Taylor, D. (2003). *Elementary blueprint reading for machinists* (5th ed.). Albany, NY: Delmar.

Valentino, J., & Goldenberg, J. (2003). *Introduction to computer numerical control (CNC)* (3rd ed.). Upper Saddle River, NJ: Prentice Hall.

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Machine Tool Operation II
Unit 3: Grinding Machine Theory and Operation (35 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Demonstrate the safe use and maintenance of bench, pedestal, and other types of grinders. a. Define grinding machine operations. b. Identify different types of grinding wheels and their applications. c. List reasons for truing and balancing grinding wheels. d. Identify the major parts of a grinder and their functions. e. State rules of grinding machine safety.	**Teaching:** **Note: These strategies can be used for the entire unit. Safety will be reviewed and reinforced before and during the unit.** • The instructor will present a video on the given task. The student will develop several questions and answers from the video. E1 • The instructor will demonstrate identification and interpretation of the specific task concerns. The student will utilize a variety of resources to write a report to identify and interpret task concerns. E1, E2, E3, E5, E8, E9, E10 • Divide the students into groups and assign each group a specific task. Have each group construct a poster listing components and the diagram of the task. E4, E3, E5 • Actual pictures from the lab will be shown and discussed about the specific task. The students will perform each task assigned. **Assessment:** • The questions and answers will be evaluated for content and clarity. • A report will be presented to the class. A rubric will be used to evaluate the presentation. • Evaluate the poster for content and clarity. • A checklist will be used to evaluate the task.
2. Set up and safely operate grinding machines. a. Set up a grinding machine to meet a specific job. b. Operate the controls of grinding machines. c. True and dress a grinding wheel. d. Grind a work piece square and parallel.	**Teaching:** **The instructor will explain and demonstrate the following. The students will demonstrate the following before performing live work.** • Set up a grinding machine to meet a specific job. • Operate the controls of grinding machines. • True and dress a grinding wheel. • Grind a work piece square and parallel.

	Assessment: • A written test will be given for the terminology. • A checklist will be used to observe the students while they are performing safety inspections and procedures for operation.

STANDARDS

National Institute for Metalworking Skills

NIMSI-1	Job Planning and Management
NIMSI-2	Job Execution
NIMSI-3	Quality Control and Inspection
NIMSI-4	Process Adjustment and Control
NIMSI-5	General Maintenance
NIMSI-6	Industrial Safety and Environmental Protection
NIMSI-7	Career MGT and Employment Relations

Academic Standards

E1	Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2	Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3	Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4	Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5	Complete oral and written presentations which exhibit interaction and consensus within a group.
E8	Read, discuss, analyze, and evaluate literature from various genres and other written material.
E9	Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10	Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP2	Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3	Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.

WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP5 Selects, applies, and maintains/troubleshoots technology.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

Davis, D. (1996). *Practical problems in mathematics for manufacturing*. Albany, NY: Delmar.

Fitzpatrick, M. (2005). *Machining and CNC technology.* New York: McGraw Hill.

Kibbe, R., Neely, J., Meyer, R., & White, W. (2002). *Machine tool practices* (7th ed.). Upper Saddle River, NJ: Prentice Hall.

Krar, S., Rapisarda, M., & Check, A. (1998). *Machine tool and manufacturing technology.* Albany, NY: Thomson. (Instructor manual and student lab manual available)

Neely, J. (2000). *Basic machine tool operations*. Upper Saddle River, NJ: Prentice Hall.

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Machine Tool Operation II
Unit 4: Advanced Lathe and Milling Machine Theory and Operation (145 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Review the major parts, safety and operating rules, care, and maintenance of the engine lathe and milling machine.	**Teaching:** **Note: These strategies can be used for the entire unit. Safety will be reviewed and reinforced before and during the unit.** • The instructor will present a video on the given task. The student will develop several questions and answers from the video. E1 • The instructor will demonstrate identification and interpretation of the specific task concerns. The student will utilize a variety of resources to write a report to identify and interpret task concerns. E1, E2, E3, E5, E8, E9, E10 • Divide the students into groups and assign each group a specific task. Have each group construct a poster listing components and the diagram of the task. E4, E3, E5 • Actual pictures from the lab will be shown and discussed about the specific task. The students will perform each task assigned. **Assessment:** • The questions and answers will be evaluated for content and clarity. • A report will be presented to the class. A rubric will be used to evaluate the presentation. • Evaluate the poster for content and clarity. • A checklist will be used to evaluate the task.
2. Identify tools, instruments, and procedures in performing a lay out and constructing projects. a. Perform a lay out. b. Fabricate a project.	**Teaching:** **The instructor will explain and demonstrate the following tasks. The students will demonstrate the following tasks before performing live work.** • Perform a lay out. • Fabricate a project. **Assessment:** • A written test will be given for the

	terminology. • A checklist will be used to observe the students while they are performing safety inspections and procedures for operation.

STANDARDS

National Institute for Metalworking Skills

NIMSI-1	Job Planning and Management
NIMSI-2	Job Execution
NIMSI-3	Quality Control and Inspection
NIMSI-4	Process Adjustment and Control
NIMSI-5	General Maintenance
NIMSI-6	Industrial Safety and Environmental Protection
NIMSI-7	Career MGT and Employment Relations

Academic Standards

E1	Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2	Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3	Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4	Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5	Complete oral and written presentations which exhibit interaction and consensus within a group.
E8	Read, discuss, analyze, and evaluate literature from various genres and other written material.
E9	Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10	Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP2	Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3	Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4	Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.

Secondary Machine Tool Operation

WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

Davis, D. (1996). *Practical problems in mathematics for manufacturing*. Albany, NY: Delmar.

Fitzpatrick, M. (2005). *Machining and CNC technology.* New York: McGraw Hill.

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Machine Tool Operation II
Unit 5: Computerized Numerical Control (35 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Describe computerized numerical control (CNC), including the codes and the input of a pre-written program. a. Describe the operations of CNC. b. Describe codes used in a CNC machine.	**Teaching:** **Note: These strategies can be used for the entire unit. Safety will be reviewed and reinforced before and during the unit.** • The instructor will present a video on the given task. The student will develop several questions and answers from the video. E1 • The instructor will demonstrate identification and interpretation of the specific task concerns. The student will utilize a variety of resources to write a report to identify and interpret task concerns. E1, E2, E3, E5, E8, E9, E10 • Divide the students into groups and assign each group a specific task. Have each group construct a poster listing components and the diagram of the task. E4, E3, E5 • Actual pictures from the lab will be shown and discussed about the specific task. The students will perform each task assigned. **Assessment:** • The questions and answers will be evaluated for content and clarity. • A report will be presented to the class. A rubric will be used to evaluate the presentation. • Evaluate the poster for content and clarity. • A checklist will be used to evaluate the task.
2. Safely operate a computerized numerical control (CNC) machine. a. Debug the program. b. Download the program. c. Execute the program. d. Input a pre-written program into a PC. e. Print a hard copy of the program.	**Teaching:** **The instructor will explain and demonstrate the following tasks. The students will demonstrate the following tasks before performing live work.** • Debug and download the program. • Execute the program. • Input a pre-written program into a PC. • Print a hard copy of the program.

	Assessment: • A written test will be given for the terminology. • A checklist will be used to observe the studentsd while they are performing safety inspections and procedures for operation.

STANDARDS

National Institute for Metalworking Skills

NIMSI-1	Job Planning and Management
NIMSI-2	Job Execution
NIMSI-3	Quality Control and Inspection
NIMSI-4	Process Adjustment and Control
NIMSI-5	General Maintenance
NIMSI-6	Industrial Safety and Environmental Protection
NIMSI-7	Career MGT and Employment Relations

Academic Standards

E1	Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2	Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3	Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4	Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5	Complete oral and written presentations which exhibit interaction and consensus within a group.
E8	Read, discuss, analyze, and evaluate literature from various genres and other written material.
E9	Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10	Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP2	Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3	Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.

WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

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Walker, J. (2004). *Machining fundamentals.* Tinley Park, IL: Goodheart-Willcox. (Instructor manual and student lab manual available)

Recommended Tools and Equipment

CAPITALIZED ITEMS

1. Lathes with accessories including digital readout (10)
   13 " or 14"x 60"or 72" (8)
   18" x 60" (1)
   15" x 48" (1)
2. Vertical mills, 9" x 42" bed with accessories including digital readout (2)
3. Horizontal mill (1)
4. Surface grinder, automatic (2)
5. Tool and cutter grinder (1)
6. Vertical band saw: 20" (1)
7. Horizontal band saw: 10" (1)
8. Drill press: 20" minimum (with accessories) (1)
9. Hydraulic press: 25 tons (1)
10. CNC lathe and/or mill (1)
11. Pedestal grinders (2)
12. Air compressor (1)
13. Blade welder, band saw (1)
14. Work benches (6)
15. Dividing head (1)
16. Rotary table (1)
17. Drills, taper shank – 1/2" – 2" (2 sets)
18. Taper shank reamer – 1/2" – 1" (1set)
19. Computers (2)
20. Toll post grinder (1)
21. Dust collection system (as required)
22. Height gauge, electronic (1)
23. Surface plate: 24" x 36" (1)
24. Welding machine (1)
25. Arbor press: 5 tons (1)
26. Safety glass cabinet with safety glasses (1)
27. Hand reamers set: 1/8" – 1/2" by 1/64ths (1)
28. Tap and die set, high speed steel: 1/4-20 through 1" NC – NF

NON-CAPITALIZED ITEMS

1. Vises: 4" (6)
2. Printer (1)
3. Boring head and boring bar set (1)
4. Cutting torch with hoses and regulator (1)
5. Drill set (3 in 1 set) – 1/16 – 1/2 by 64ths, A – Z, and #1 – #60 (3)
6. High speed steel drill and counter drill x 60 degrees, 5-piece set #1 – #6 (1)
7. High speed steel: 6 flute countersink 82 degrees, 8 piece set (1/8" – 1") (1)

8. Metric screw pitch gauge, Acme screw pitch gauge, 60 degrees, V-sharp screw pitch gauge (1 each)
9. Set end mill high speed steel 1/8", 3/4" by 1/16", 2" flute-center cut (double end) (1)
10. Single end ball end mill, 7/8" through 1" (1 set)
11. Key way broach set – 1/8" through 3/8" (1)
12. Horizontal milling cutter (set) per machine specifications (1)
13. Boring head with C.T. boring bar set (per machine specifications) (1)
14. Abrasive (shop roll) – 1' wide x 100 grit, 180 grit, 220 grit (1 each)
15. Buffing wheel and buffing compound (1)
16. Bench grinders (wheels) to machine specifications (3)
17. Surface grinder (wheels) to machine specifications (as required)
18. Wheel dressing stick (1)
19. Grinder wheel dresser (1)
20. Cluster diamond dress for surface grinder and holder (1)
21. Radius angle dresser, for surface grinder and diamonds (1)
22. Micrometers: 10 @ 0" – 1": 5 @ 1" – 2":2:2" – 3": and 2 @ 3" – 4" (19)
23. Depth micrometers: 2 @ 0" – 6" (2)
24. Vernier calipers: 6" (2)
25. Dial calipers: 6" (6)
26. Digital caliper: 6" (1)
27. Set of gauge telescopic 5/16" – 6", 6 piece (1)
28. Set small hole gage: 1/8" – 1/2", 4 piece set (1)
29. Dial indicators with magnetic base and 1" travel (2)
30. Sets, test indicators and surface gages (2)
31. Gage block set (rectangular) (1)
32. Angle plates, 6"x 6" and 3"x 3" (2)
33. "V" block set (1)
34. Sine bar: 5" (1)
35. Precision grinding vise: 4" (1)
36. Set steel parallel (10 pieces)
37. Combination square set (4 pieces) 4R graduation with 12" blades (10)
38. Set precision square set (4 pieces) (1)
39. Scales 6", 4R graduation (20)
40. Drill point gauge (1)
41. Steel protractors: 6" (4)
42. Radius gauge set (1)
43. Acme thread gauge (1)
44. Center gauges (4)
45. Spring calipers: inside, outside, and hermaphrodite: 3" x 6" (2)
46. Dividers: 3" and 6" (2)
47. Edge finders, electronic (3)
48. Level precision, 12" (1)
49. Trammel points (1)
50. Metal scribes (6)
51. Set, punch center, 8-piece (1)
52. Set, punch drive pin, 8-piece set (4" long) (1)

53. Combination wrench set (1)
54. Set, 21-pieces, 1/2" drive socket set (1)
55. Set of pliers (1)
56. Set, pipe wrench, 8", 10",and 12" (1)
57. Set, adjustable wrench, 6", 10", 12" (1)
58. 25' power tape (1)
59. Screwdriver set (6 pieces) (1)
60. Files, 12 with handles and file cards (1)
61. Dead blow hammers (2)
62. Ball peen hammers (2)
63. Pistol pump oilers (6)
64. Grease gun (1)
65. Sets, Allen wrenches, metric and English (4)
66. C-clamps, 6" (6)
67. Set, steel stamp: numbers and letters (1)
68. Electrical engraver (1)
69. Retractable air hoses and reels (3)
70. 4" disc grinder (1)
71. Air pressure regulator (1)
72. Drill motors: 1/4" (2)
73. Drill motor: 1/2" (1)
74. Shop vacuum, wet and dry (1)
75. Dolly (1)
76. Hack saws (6)
77. Die grinder (1)
78. Magnetizer-demagnetizer (1)
79. Utility cart (1)
80. Taper attachment (as required)
81. Diamond grinding wheel (as required)
82. Magnetic sine plate (1)
83. 1-2-3 Blocks (1 set)
84. Check plate (1)

RECOMMENDED INSTRUCTIONAL AIDS

1. TV and VCR combination (1)
2. AV cart (1)
3. Teacher desks and chairs (2)
4. Filing cabinet (1)
5. Bookcase (1)

Student Competency Profile for Machine Tool Operation I

Student:_____

This record is intended to serve as a method of noting student achievement of the competencies in each unit. It can be duplicated for each student and serve as a cumulative record of competencies achieved in the course.

In the blank before each competency, place the date on which the student mastered the competency.

Unit 1: Orientation, Leadership, and Employability Skills

_____1. Describe local program and vocational/career technical center policies and procedures.
_____2. Describe employment opportunities and responsibilities.
_____3. Explore leadership skills and personal development opportunities provided students by student organizations to include SkillsUSA.
_____4. Demonstrate the ability to follow verbal and written instructions and communicate effectively in on-the-job situations.
_____5. Discuss the history of machine tool industry to include materials, terminology, and techniques.

Unit 2: Safety

_____1. Describe general safety rules for working in a shop/lab and industry.
_____2. Identify and apply safety around machine tool operations.
_____3. Explain lifting.
_____4. Explain the Material Safety Data Sheet (MSDS).
_____5. Explain fires.
_____6. Explain safety in and around automotive and electrical situations.

Unit 3: Math, Measuring Tools, and Instruments

_____1. Apply the four basic math skills with whole numbers, fractions, and percent.
_____2. Perform basic mathematical calculations related to machine shop operations.
_____3. Identify and perform functions using various measuring tools and instruments (micrometers, dial indicators, height gauge, and digital caliper).

Unit 4: Hand and Bench Tools

_____1. Demonstrate the proper use and maintenance of metalworking hand and power tools.
_____2. Demonstrate the use and maintenance of hand taps and hand dies.

Unit 5: Introduction to Blueprints

_____1. Read, analyze, and design a blueprint.

Unit 6: Drill Press and Band Saw Theory and Operation

_____1. Discuss drill press and band saw theory and operation.
_____2. Set up and demonstrate the safe use and maintenance of the drill press and the vertical and horizontal band saws.

Unit 7: Lathe Theory and Operation

_____1. Identify the parts, rules, and care of the engine lathe.
_____2. Perform procedures for facing operation.

Unit 8: Milling Machine Theory and Operation

_____1. Differentiate between the types of milling machines.
_____2. Identify the parts, cutting tools, and basic maintenance of a horizontal and vertical milling machine.
_____3. Perform operations on a specific machine.

Student Competency Profile for Machine Tool Operation II

Student:_____

This record is intended to serve as a method of noting student achievement of the competencies in each unit. It can be duplicated for each student and serve as a cumulative record of competencies achieved in the course.

In the blank before each competency, place the date on which the student mastered the competency.

Unit 1: Orientation, Leadership, and Employability Skills

_____1. Describe local program and vocational/career technical center policies and procedures.
_____2. Describe employment opportunities and responsibilities.

Unit 2: Safety

_____1. Describe general safety rules for working in a shop/lab and industry.
_____2. Identify and apply safety around machine tool operations.
_____3. Explain lifting.
_____4. Explain the Material Safety Data Sheet (MSDS).
_____5. Explain fires.
_____6. Explain safety in and around automotive and electrical situations.

Unit 3: Grinding Machine Theory and Operation

_____1. Demonstrate the safe use and maintenance of bench, pedestal, and other types of grinders.
_____2. Set up and safely operate grinding machines.

Unit 4: Advanced Lathe and Milling Machine Theory and Operation

_____1. Review the major parts, safety and operating rules, care, and maintenance of the engine lathe and milling machine.
_____2. Identify tools, instruments, and procedures in performing a lay out and constructing projects.

Unit 5: Computerized Numerical Control

_____1. Describe computerized numerical control (CNC), including the codes and the input of a pre-written program.
_____2. Safely operate a computerized numerical control (CNC) machine.

Appendix A: National Institute for Metalworking Skills Standards[1]

NIMS Level I Skill Standards

NIMSI-1 Job Planning and Management
NIMSI-2 Job Execution
NIMSI-3 Quality Control and Inspection
NIMSI-4 Process Adjustment and Control
NIMSI-5 General Maintenance
NIMSI-6 Industrial Safety and Environmental Protection
NIMSI-7 Career MGT and Employment Relations

[1] *National institute for metalworking skills*. Retrieved October 6, 2004, from http://www.nims.org

Appendix B: Academic Standards

Algebra I[2]

Competencies and Suggested Objective(s)

A1 Recognize, classify, and use real numbers and their properties.
- a. Describe the real number system using a diagram to show the relationships of component sets of numbers that compose the set of real numbers.
- b. Model properties and equivalence relationships of real numbers.
- c. Demonstrate and apply properties of real numbers to algebraic expressions.
- d. Perform basic operations on square roots excluding rationalizing denominators.

A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
- a. Analyze relationships between two variables, identify domain and range, and determine whether a relation is a function.
- b. Explain and illustrate how change in one variable may result in a change in another variable.
- c. Determine the rule that describes a pattern and determine the pattern given the rule.
- d. Apply patterns to graphs and use appropriate technology.

A3 Simplify algebraic expressions, solve and graph equations, inequalities and systems in one and two variables.
- a. Solve, check, and graph linear equations and inequalities in one variable, including rational coefficients.
- b. Graph and check linear equations and inequalities in two variables.
- c. Solve and graph absolute value equations and inequalities in one variable.
- d. Use algebraic and graphical methods to solve systems of linear equations and inequalities.
- e. Translate problem-solving situations into algebraic sentences and determine solutions.

A4 Explore and communicate the characteristics and operations of polynomials.
- a. Classify polynomials and determine the degree.
- b. Add, subtract, multiply, and divide polynomial expressions.
- c. Factor polynomials using algebraic methods and geometric models.
- d. Investigate and apply real-number solutions to quadratic equations algebraically and graphically.
- e. Use convincing arguments to justify unfactorable polynomials.
- f. Apply polynomial operations to problems involving perimeter and area.

A5 Utilize various formulas in problem-solving situations.
- a. Evaluate and apply formulas (e.g., circumference, perimeter, area, volume, Pythagorean Theorem, interest, distance, rate, and time).
- b. Reinforce formulas experimentally to verify solutions.

[2] *Mississippi mathematics framework—Algebra I*. (2003). Retrieved September 10, 2003, from http://marcopolo.mde.k12.ms.us/frameworks/mathematics/ma_algebra_i.html

c. Given a literal equation, solve for any variable of degree one.
d. Using the appropriate formula, determine the length, midpoint, and slope of a segment in a coordinate plane.
e. Use formulas (e.g., point-slope and slope-intercept) to write equations of lines.

A6 Communicate using the language of algebra.
a. Recognize and demonstrate the appropriate use of terms, symbols, and notations.
b. Distinguish between linear and non-linear equations.
c. Translate between verbal expressions and algebraic expressions.
d. Apply the operations of addition, subtraction, and scalar multiplication to matrices.
e. Use scientific notation to solve problems.
f. Use appropriate algebraic language to justify solutions and processes used in solving problems.

A7 Interpret and apply slope as a rate of change.
a. Define slope as a rate of change using algebraic and geometric representations.
b. Interpret and apply slope as a rate of change in problem-solving situations.
c. Use ratio and proportion to solve problems including direct variation (y=kx).
d. Apply the concept of slope to parallel and perpendicular lines.

A8 Analyze data and apply concepts of probability.
a. Collect, organize, graph, and interpret data sets, draw conclusions, and make predictions from the analysis of data.
b. Define event and sample spaces and apply to simple probability problems.
c. Use counting techniques, permutations, and combinations to solve probability problems.

Biology I[3]

Competencies and Suggested Objective(s)

B1 Utilize critical thinking and scientific problem solving in designing and performing biological research and experimentation.
a. Demonstrate the proper use and care for scientific equipment used in biology.
b. Observe and practice safe procedures in the classroom and laboratory.
c. Apply the components of scientific processes and methods in the classroom and laboratory investigations.
d. Communicate results of scientific investigations in oral, written, and graphic form.

B2 Investigate the biochemical basis of life.
a. Identify the characteristics of living things.
b. Describe and differentiate between covalent and ionic bonds using examples of each.
c. Describe the unique bonding and characteristics of water that makes it an essential component of living systems.

[3] *Mississippi science framework—Biology I.* (2003). Retrieved September 10, 2003, from http://marcopolo.mde.k12.ms.us/frameworks/science/sci_biology_I.html

d. Classify solutions using the pH scale and relate the importance of pH to organism survival.
e. Compare the structure, properties and functions of carbohydrates, lipids, proteins and nucleic acids in living organisms.
f. Explain how enzymes work and identify factors that can affect enzyme action.

B3 Investigate cell structures, functions, and methods of reproduction.
a. Differentiate between prokaryotic and eukaryotic cells.
b. Distinguish between plant and animal (eukaryotic) cell structures.
c. Identify and describe the structure and basic functions of the major eukaryotic organelles.
d. Describe the way in which cells are organized in multicellular organisms.
e. Relate cell membrane structure to its function in passive and active transport.
f. Describe the main events in the cell cycle and cell mitosis including differences in plant and animal cell divisions.
g. Relate the importance of meiosis to sexual reproduction and the maintenance of chromosome number.
h. Identify and distinguish among forms of asexual and sexual reproduction.

B4 Investigate the transfer of energy from the sun to living systems.
a. Describe the structure of ATP and its importance in life processes.
b. Examine, compare, and contrast the basic processes of photosynthesis and cellular respiration.
c. Compare and contrast aerobic and anaerobic respiration.

B5 Investigate the principles, mechanisms, and methodology of classical and molecular genetics.
a. Compare and contrast the molecular structures of DNA and RNA as they relate to replication, transcription, and translation.
b. Identify and illustrate how changes in DNA cause mutations and evaluate the significance of these changes.
c. Analyze the applications of DNA technology (forensics, medicine, agriculture).
d. Discuss the significant contributions of well-known scientists to the historical progression of classical and molecular genetics.
e. Apply genetic principles to solve simple inheritance problems including monohybrid crosses, sex linkage, multiple alleles, incomplete dominance, and codominance.
f. Examine inheritance patterns using current technology (gel electrophoresis, pedigrees, karyotypes).

B6 Investigate concepts of natural selection as they relate to diversity of life.
a. Analyze how organisms are classified into a hierarchy of groups and subgroups based on similarities and differences.
b. Identify characteristics of kingdoms including monerans, protists, fungi, plants and animals.
c. Differentiate among major divisions of the plant and animal kingdoms (vascular/non-vascular; vertebrate/invertebrate).
d. Compare the structures and functions of viruses and bacteria relating their impact on other living organisms.

e. Identify evidence of change in species using fossils, DNA sequences, anatomical and physiological similarities, and embryology.
f. Analyze the results of natural selection in speciation, diversity, adaptation, behavior and extinction.

B7 Investigate the interdependence and interactions that occur within an ecosystem.
a. Analyze the flow of energy and matter through various cycles including carbon, oxygen, nitrogen and water cycles.
b. Interpret interactions among organisms in an ecosystem (producer/consumer/decomposer, predator/prey, symbiotic relationships and competitive relationships).
c. Compare variations, tolerances, and adaptations of plants and animals in major biomes.
d. Investigate and explain the transfer of energy in an ecosystem including food chains, food webs, and food pyramids.
e. Examine long and short-term changes to the environment as a result of natural events and human actions.

English II[4]

Competencies and Suggested Objective(s)

E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
a. Produce individual and/or group compositions and/or projects to persuade, tell a story, describe, create an effect, explain or justify an action or event, inform, entertain, etc.
b. Produce writing typically used in the workplace such as social, business, and technical correspondence; explanation of procedures; status reports; research findings; narratives for graphs; justification of decisions, actions, or expenses; etc.
c. Write a response, reaction, interpretation, analysis, summary, etc., of literature, other reading matter, or orally presented material.
d. Revise to ensure effective introductions, details, wording, topic sentences, and conclusions.

E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
a. Listen to determine the main idea and supporting details, to distinguish fact from opinion, and to determine a speaker's purpose or bias.
b. Speak with appropriate intonation, articulation, gestures, and facial expression.
c. Speak effectively to explain and justify ideas to peers, to inform, to summarize, to persuade, to entertain, to describe, etc.

E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
a. Read, view, and listen to distinguish fact from opinions and to recognize persuasive and manipulative techniques.

[4] *Mississippi language arts framework—English II*. (2003). Retrieved September 10, 2003, from http://marcopolo.mde.k12.ms.us/frameworks/language_arts/la_10.html

b. Access both print and non-print sources to produce an I-Search paper, research paper, or project.
c. Use computers and audio-visual technology to access and organize information for purposes such as resumes, career search projects, and analytical writings, etc.
d. Use reference sources, indices, electronic card catalog, and appropriate research procedures to gather and synthesize information.

E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
a. Interact with peers to examine real world and literary issues and ideas.
b. Show growth in critical thinking, leadership skills, consensus building, and self-confidence by assuming a role in a group, negotiating compromise, and reflecting on individual or group work.

E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
a. Share, critique, and evaluate works in progress and completed works through a process approach.
b. Communicate effectively in a group to present completed projects and/or compositions.
c. Edit oral and written presentations to reflect correct grammar, usage, and mechanics.

E6 Explore cultural contributions to the history of the English language and its literature.
a. Explore a variety of works from various historical periods, geographical locations, and cultures, recognizing their influence on language and literature.
b. Identify instances of dialectal differences which create stereotypes, perceptions, and identities.
c. Recognize root words, prefixes, suffixes, and cognates.
d. Relate how vocabulary and spelling have changed over time.

E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
a. Listen to and read aloud selected works to recognize and respond to the rhythm and power of language to convey a message.
b. Read aloud with fluency and expression.
c. Analyze the stylistic devices, such as alliteration, assonance, word order, rhyme, onomatopoeia, etc., that make a passage achieve a certain effect.
d. Demonstrate how the use of language can confuse or inform, repel or persuade, or inspire or enrage.
e. Analyze how grammatical structure or style helps to create a certain effect.

E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
a. Read and explore increasingly complete works, both classic and contemporary, for oral discussion and written analysis.
b. Read, discuss, and interpret literature to make connections to life.
c. Read from a variety of genres to understand how the literary elements contribute to the overall quality of the work.

d. Identify qualities in increasingly complex literature that have produced a lasting impact on society.
e. Read for enjoyment, appreciation, and comprehension of plot, style, vocabulary, etc.

E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
a. Infuse the study of grammar and vocabulary into written and oral communication.
b. Demonstrate, in the context of their own writing, proficient use of the conventions of standard English, including, but not limited to, the following: complete sentences, subject-verb agreement, plurals, spellings, homophones, possessives, verb forms, punctuation, capitalization, pronouns, pronoun-antecedent agreement, parallel structure, and dangling and misplaced modifiers.
c. Give oral presentations to reinforce the use of standard English.
d. Employ increasingly proficient editing skills to identify and solve problems in grammar, usage, and structure.

E10 Use language and critical thinking strategies to serve as tools for learning.
a. Use language to facilitate continuous learning, to record observations, to clarify thought, to synthesize information, and to analyze and evaluate language.
b. Interpret visual material orally and in writing.

U. S. History from 1877[5]

Competencies and Suggested Objective(s)

H1 Explain how geography, economics, and politics have influenced the historical development of the United States in the global community.
a. Apply economic concepts and reasoning when evaluating historical and contemporary social developments and issues (e.g., gold standard, free coinage of silver, tariff issue, laissez faire, deficit spending, etc.).
b. Explain the emergence of modern America from a domestic perspective (e.g., frontier experience, Industrial Revolution and organized labor, reform movements of Populism and Progressivism, Women's Movement, Civil Rights Movement, the New Deal, etc.).
c. Explain the changing role of the United States in world affairs since 1877 through wars, conflicts, and foreign policy (e.g., Spanish-American War, Korean conflict, containment policy, etc.).
d. Trace the expansion of the United States and its acquisition of territory from 1877 (e.g., expansionism and imperialism).

H2 Describe the impact of science and technology on the historical development of the United States in the global community.
a. Analyze the impact of inventions on the United States (e.g., telephone, light bulb, etc.).
b. Examine the continuing impact of the Industrial Revolution on the development of our nation (e.g., mass production, computer operations, etc.).

[5] *Mississippi social studies framework—U.S. History from 1877*. (2003). Retrieved September 10, 2003, from http://marcopolo.mde.k12.ms.us/frameworks/social_studies/ss_us_history.html

c. Describe the effects of transportation and communication advances since 1877.

H3 Describe the relationship of people, places, and environments through time.

a. Analyze human migration patterns since 1877 (e.g., rural to urban, the Great Migration, etc.).

b. Analyze how changing human, physical, geographic characteristics can alter a regional landscape (e.g., urbanization, Dust Bowl, etc.).

H4 Demonstrate the ability to use social studies tools (e.g., timelines, maps, globes, resources, graphs, a compass, technology, etc.).

a. Interpret special purpose maps, primary/secondary sources, and political cartoons.

b. Analyze technological information on graphs, charts, and timelines.

c. Locate areas of international conflict (e.g., Caribbean, Southeast Asia, Europe, etc.).

H5 Analyze the contributions of Americans to the ongoing democratic process to include civic responsibilities.

a. Examine various reform movements (e.g., Civil Rights, Women's Movement, etc.).

b. Examine the government's role in various movements (e.g., arbitration, 26th Amendment, etc.).

c. Examine the role of government in the preservation of citizens' rights (e.g., 19th Amendment, Civil Rights Act of 1964).

d. Examine individuals' duties and responsibilities in a democratic society (e.g., voting, volunteerism, etc.).

Appendix C: Workplace Skills for the 21st Century[6]

WP1 Allocates resources (time, money, materials and facilities, and human resources).
WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP5 Selects, applies, and maintains/troubleshoots technology.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

[6] *Secretary's commission on achieving necessary skills*. Retrieved July 13, 2004, from http://wdr.doleta.gov/SCANS/

Appendix D: National Educational Technology Standards for Students[7]

T1 Basic operations and concepts
- Students demonstrate a sound understanding of the nature and operation of technology systems.
- Students are proficient in the use of technology.

T2 Social, ethical, and human issues
- Students understand the ethical, cultural, and societal issues related to technology.
- Students practice responsible use of technology systems, information, and software.
- Students develop positive attitudes toward technology uses that support lifelong learning, collaboration, personal pursuits, and productivity.

T3 Technology productivity tools
- Students use technology tools to enhance learning, increase productivity, and promote creativity.
- Students use productivity tools to collaborate in constructing technology-enhanced models, prepare publications, and produce other creative works.

T4 Technology communications tools
- Students use telecommunications to collaborate, publish, and interact with peers, experts, and other audiences.
- Students use a variety of media and formats to communicate information and ideas effectively to multiple audiences.

T5 Technology research tools
- Students use technology to locate, evaluate, and collect information from a variety of sources.
- Students use technology tools to process data and report results.
- Students evaluate and select new information resources and technological innovations based on the appropriateness for specific tasks.

T6 Technology problem-solving and decision-making tools
- Students use technology resources for solving problems and making informed decisions.
- Students employ technology in the development of strategies for solving problems in the real world.

[7] *ISTE: National educational technology standards (NETS).* Retrieved July 13, 2004, from http://cnets.iste.org/