2026 Advanced Manufacturing

Program CIP: 15.0613 — Manufacturing Technology/Technician

Direct inquiries to:

Project Manager
Research and Curriculum Unit
Mississippi State University
P.O. Drawer DX
Mississippi State, MS 39762
662.325.2510
helpdesk@rcu.msstate.edu

Program Supervisor
Office of Career and Technical Education
and Workforce Development
Mississippi Department of Education
P.O. Box 771
Jackson, MS 39205
601.359.3974

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and Workforce Development
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Jackson, MS 39205

Research and Curriculum Unit
Mississippi State University
Mississippi State, MS 39762
helpdesk@rcu.msstate.edu

The Research and Curriculum Unit (RCU), located in Starkville, as part of Mississippi State University (MSU), was established to foster educational enhancements and innovations. In keeping with the land-grant mission of MSU, the RCU is dedicated to improving the quality of life for Mississippians. The RCU enhances the intellectual and professional development of Mississippi students and educators while applying knowledge and educational research to the lives of the people of the state. The RCU works within the context of curriculum development and revision, research, assessment, professional development, and industrial training.

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Acknowledgments

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Dr. Lance Evans, State Superintendent of Education, Executive Secretary
Mr. Matt Miller, Southern Supreme Court District Representative, Chair
Mr. Matt Mayo, Central Supreme Court District Representative, Vice-Chair
Dr. Wendi Barrett, Teacher Representative
Mr. Glen East, Administrator Representative
Mr. Bill Jacobs, At-Large Representative
Dr. Ronnie McGehee, At-Large Representative
Mr. Mike Pruitt, At-Large Representative
Mrs. Billye Jean Stroud, Northern Supreme Court District Representative
Mrs. Mary Werner, At-Large Representative
Mr. Crosby Parker, Senior Student Representative
Ms. Michelle Xie, Junior Student Representative

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Carver Middleton, Research Engineer, Mississippi State University Athlete Engineering
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Beth Turner, Director of Workforce Development, Desoto County Schools
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Shane Wigley, Former Director, Marshall County Career and Technical Education

Standards

Standards and alignment crosswalks are referenced in the appendices. Depending on the curriculum, these crosswalks should identify alignment to the standards mentioned below, as well as possible related academic topics as required in the Subject Area Testing Program in Algebra I, Biology I, English II, and U.S. History from 1877, which could be integrated into the content of the units. Mississippi's CTE Advanced Manufacturing is aligned to the following standards:

Advance CTE— Manufacturing Career Cluster
This Career Cluster® is focused on planning, managing, and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance and manufacturing, and process engineering.
https://careertech.org/what-we-do/career-clusters/manufacturing/

College- and Career-Readiness Standards
College- and career-readiness standards emphasize critical thinking, teamwork, and problem-solving skills. Students will learn the skills and abilities demanded by the workforce of today and the future. Mississippi adopted Mississippi College- and Career-Readiness Standards (MCCRS) to provide a consistent, clear understanding of what students are expected to learn and so teachers and parents know what they need to do to help them.
mdek12.org/oae/college-and-career-readiness-standards

Career and Technical Student Organizations (CTSOs)
Mississippi's Career and Technical Education (CTE) curricula are aligned with the programs, activities, and competitive events offered through Career and Technical Student Organizations (CTSOs). These organizations provide students with opportunities to apply classroom knowledge in real-world contexts, develop leadership and employability skills, and connect with industry and community partners. Each pathway includes an appendix identifying the CTSOs most closely connected to the curriculum, ensuring that students' classroom learning is reinforced through co-curricular experiences that prepare them for success in both post-secondary education and the workforce.
mdek12.org/cte/so/

Smart Automation Certification Alliance (SACA): C-101 Certified Industry 4.0 Associate-Basic Operations Skill Standards
The Smart Automation Certification Alliance (SACA) is a non-profit foundation that creates modular, industry-driven Industry 4.0 certifications for various sectors. Developed and endorsed by global experts, SACA's certifications are based on rigorous international skill standards and thorough testing. They define the essential knowledge and skills needed to succeed in modern, automated production environments.
saca.org/smart-automation-certifications/associate-certifications/

Preface

Secondary CTE programs in Mississippi face many challenges resulting from sweeping educational reforms at the national and state levels. Schools and teachers are increasingly being held accountable for providing applied 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. This document provides information, tools, and solutions that will aid students, teachers, and schools in creating and implementing applied, interactive, and innovative lessons. Through best practices, alignment with national standards and certifications, community partnerships, and a hands-on, student-centered concept, educators will be able to truly engage students in meaningful and collaborative learning opportunities.

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; Strengthening Career and Technical Education for the 21st Century Act, 2019 [Perkins V]; and Every Student Succeeds Act, 2015).

Mississippi Teacher Professional Resources

The following are resources for Mississippi teachers:

Curriculum, Assessment, Professional Learning

- Program resources can be found at the RCU's website, rcu.msstate.edu.

Learning Management System: An Online Resource

- Learning management system information can be found at the RCU's website, under Professional Learning.

Should you need additional instructions, contact the RCU at 662.325.2510 or helpdesk@rcu.msstate.edu.

Executive Summary

Pathway Description
Advanced Manufacturing is a pathway within the Advanced Manufacturing Career Cluster. This program is designed for students interested in the high-demand field of automated and advanced manufacturing. The course offers a comprehensive curriculum that includes basic factory safety, hand and power tools, employability skills, welding, assembly, construction drawings, materials handling, circuits and electronics, and robotics.

College, Career, and Certifications
The automated and advanced manufacturing industry is located throughout Mississippi, and numerous community colleges and universities offer educational programs related to it. Students who complete this pathway will be prepared for an entry-level position at many of the factories across the state or to pursue further education. They will also have the opportunity to take the Smart Automation Certification Alliance (SACA) - Industry 4.0 Standards: C-101 Certified Industry 4.0 Associate-Basic Operations Skill Standards.

Grade Level and Class Size Recommendations
It is recommended that students enter this program as 10th or 11th graders. Exceptions to this are a district-level decision based on class size, enrollment numbers, student maturity, and CTE delivery method. This is a hands-on, lab- or shop-based course. Therefore, a maximum of 15 students is recommended per class, with only one class with the teacher at a time.

Student Prerequisites
For students to experience success in the program, the following student prerequisites are suggested:

1. C or higher in English (the previous year)
2. C or higher in high school-level math (last course taken, or the instructor can specify the level of math instruction needed)
3. Instructor approval

or

1. Instructor approval

Assessment
The latest assessment blueprint for the curriculum can be found at rcu.msstate.edu/curriculum.

Applied Academic Credit
The latest academic credit information can be found at mdek12.org/ese/approved-course-for-the-secondary-schools.

Educator Licensure
The latest educator licensure information can be found at mdek12.org/oel/apply-for-an-educator-license.

Professional Learning
If you have specific questions about the content of any training sessions provided, please contact the RCU at 662.325.2510 or helpdesk@rcu.msstate.edu.

Course Outlines

Option 1—Four 1-Carnegie Unit Courses

This curriculum consists of four 1-credit courses that should be completed in the following sequence:

1. **Basics of Advanced Manufacturing—Course Code: 991730**
2. **Fundamentals of Advanced Manufacturing—Course Code: 991740**
3. **Processes of Advanced Manufacturing—Course Code: 991750**
4. **Production in Advanced Manufacturing—Course Code: 991755**

Course Description: Basics of Advanced Manufacturing
This course identifies the basic skills and knowledge students need to master in order to move ahead in the advanced manufacturing field. Material covered in this course includes employability skills, safety, construction math and drawings, materials handling, tools, and more.

Course Description: Fundamentals of Advanced Manufacturing
This course emphasizes the fundamentals necessary for a career in the advanced manufacturing field. It includes an introduction to fabrication, welding, and assembly.

Course Description: Processes of Advanced Manufacturing
This course focuses on the various processes and mechanics within advanced manufacturing. Material covered in this course includes precision measurement, circuits, electronics, hydraulics, and pneumatics.

Course Description: Production in Advanced Manufacturing
This capstone course focuses on more advanced segments of advanced manufacturing, such as programmable logic controllers and robotics. Along with some employability skills, the students will spend a large amount of time with assembly simulation in real-world applications.

Basics of Advanced Manufacturing—Course Code: 991730

Unit	Unit Title	Hours
1	Orientation and Program Overview	5
2	Safety in Advanced Manufacturing	5
3	Employability Skills	10
4	Fundamentals of Student Organizations	10
5	Math in the Manufacturing Industry	25
6	Hand Tools	25
7	Power Tools	30
8	Technical Drawings	30
Total		**140**

Fundamentals of Advanced Manufacturing—Course Code: 991740

Unit	Unit Title	Hours
9	Fabrication	50
10	Welding and Cutting	50
11	Basic Assembly	40
Total		**140**

Processes of Advanced Manufacturing—Course Code: 991750

Unit	Unit Title	Hours
12	Advanced Manufacturing Program Overview	10
13	Machine and Tool Safety Overview	20
14	Precision Measurement	40
15	Machine Operation	30
16	Circuits and Electronics	20
17	Hydraulics and Pneumatics	20
Total		**140**

Production in Advanced Manufacturing —Course Code: 991755

Unit	Unit Title	Hours
18	Programmable Logic Controllers (PLCs)	30
19	Robotics and Automation	30
20	Additive and Subtractive Manufacturing Systems	30
21	Advanced Manufacturing Systems	40
22	Workforce Readiness	10
Total		**140**

Option 2—Two 2-Carnegie Unit Courses

This curriculum consists of two 2-credit courses, which should be completed in the following sequence:

1. **Advanced Manufacturing I—Course Code: 991710**
2. **Advanced Manufacturing II—Course Code: 991711**

Course Description: Advanced Manufacturing I
This course encompasses the basic skills and knowledge students need to master in order to move ahead in the advanced manufacturing field. Material covered in this course includes employability skills, safety, construction math and drawings, materials handling, tools, and more.
This course also emphasizes the fundamentals necessary for a career in the advanced manufacturing field, including an introduction to fabrication, welding, and assembly.

Course Description: Advanced Manufacturing II
This course focuses on the various processes and mechanics within advanced manufacturing. Material covered in this course includes precision measurement, circuits, electronics, hydraulics, and pneumatics. This course also covers more advanced segments of advanced manufacturing, such as programmable logic controllers and robotics. Along with some employability skills, the students will finish the course with a large amount of time spent doing assembly simulation in real-world applications.

Advanced Manufacturing I—Course Code: 991710

Unit	Unit Title	Hours
1	Orientation and Program Overview	5
2	Safety in Advanced Manufacturing	5
3	Employability Skills	10
4	Fundamentals of Student Organizations	10

5	Math in the Manufacturing Industry	25
6	Hand Tools	25
7	Power Tools	30
8	Technical Drawings	30
9	Fabrication	50
10	Welding and Cutting	50
11	Basic Assembly	40
Total		**280**

Advanced Manufacturing II—Course Code: 991711

Unit	Unit Title	Hours
12	Advanced Manufacturing Program Overview	10
13	Machine and Tool Safety Overview	20
14	Precision Measurement	40
15	Machine Operation	30
16	Circuits and Electronics	20
17	Hydraulics and Pneumatics	20
18	Programmable Logic Controllers (PLCs)	30
19	Robotics and Automation	30
20	Additive and Subtractive Manufacturing Systems	30
21	Advanced Manufacturing Systems	40
22	Workforce Readiness	10
Total		**280**

Career Pathway Outlook

Overview

Advanced manufacturing leverages cutting-edge technologies, including additive manufacturing (3D printing), robotics, artificial intelligence (AI), and the Industrial Internet of Things (IIoT), to create sophisticated, high-quality, and customizable products at reduced costs. This enhances product innovation and streamlines production processes, leading to significant gains in efficiency, resource optimization, and waste reduction. The adaptability and responsiveness of advanced manufacturing processes enable manufacturers to respond rapidly to market demands and evolving customer preferences, bolstering their competitiveness in a global landscape. In contrast to traditional manufacturing, which relies on fixed production lines and manual labor, advanced manufacturing utilizes modular and reconfigurable systems that can be easily adapted to produce a diverse range of products. This flexibility, coupled with real-time data analytics and predictive maintenance capabilities, minimizes downtime, enhances overall equipment effectiveness (OEE), and fosters a more agile and resilient manufacturing ecosystem. Careers in advanced manufacturing demand a highly skilled workforce proficient in digital literacy, data analysis, programming, and automation technologies. Strong problem-solving abilities, critical thinking, and a collaborative mindset are essential for success in this dynamic and rapidly evolving field. Continuous learning and upskilling are essential for staying current with technological advancements and maintaining a competitive edge in the industry.

Needs of the Future Workforce

Advanced manufacturing in Mississippi is poised for significant growth, with employment projected to outpace the average for all occupations. As one of the identified high-priority sectors, this surge is driven by the increasing complexity of machinery and the need for skilled workers to maintain and optimize their operations. The state's focus on fostering advanced manufacturing through initiatives like the Mississippi Works Fund and educational partnerships further solidifies this promising outlook.

Data from the U.S. Census Bureau, the U.S. Bureau of Labor Statistics (2025), and the Mississippi Department of Employment Security (2025) underscore this trend, highlighting a bright future for advanced manufacturing in Mississippi.

Table 1.1: Current and Projected Occupation Report

Description	Jobs, 2022	Projected Jobs, 2032	Change (Number)	Change (Percent)	Average Hourly Earnings, 2025
Computer Hardware Engineer	140	150	10	7.1%	$45.59
Computer Numerically Controlled Tool Operators	520	530	10	1.9%	$18.75
Computer Numerically Controlled Tool Programmers	90	100	10	11.1%	$24.00
Electrical and Electronics Engineering Technicians	850	870	20	2.4%	$30.25
Electronic Engineers	490	490	0	0%	$48.46
Machinist	2,880	3,040	160	5.6%	$23.31

Mechanical Engineer	1,590	1,710	120	7.5%	$43.52
Welders, Cutters, Solderers, and Brazers	6,370	6,830	460	7.2%	$24.61

Source: Mississippi Department of Employment Security; mdes.ms.gov (2025).

Perkins V Requirements and Academic Infusion

The Advanced Manufacturing curriculum meets Perkins V requirements of introducing students to and preparing them for high-skill, high-wage occupations in manufacturing fields. It also offers students a program of study, including secondary, postsecondary, and higher education courses, that will further prepare them for manufacturing careers. Additionally, this curriculum is integrated with academic college- and career-readiness standards. Lastly, it focuses on ongoing and meaningful professional development for teachers as well as relationships with industry.

Transition to Postsecondary Education

The latest articulation information for secondary to postsecondary can be found on the Mississippi Community College Board website, mccb.edu.

Best Practices

Innovative Instructional Technologies

Classrooms should be equipped with tools that will teach today's digital learners through applicable and modern practices. The Advanced Manufacturing educator's goal should be to include teaching strategies that incorporate current technology. To make use of the latest online communication tools—wikis, blogs, podcasts, and social media platforms, for example—the classroom teacher is encouraged to use a learning management system that introduces students to education in an online environment and places more of the responsibility of learning on the student.

Differentiated Instruction

Students learn in a variety of ways, and numerous factors—students' background, emotional health, and circumstances, for example—create unique learners. By providing various teaching and assessment strategies, students with various learning preferences can have more opportunities to succeed.

CTE Student Organizations

Teachers should investigate opportunities to sponsor a student organization. There are several here in Mississippi that will foster the types of learning expected from the Advanced Manufacturing curriculum. SkillsUSA and TSA are the student organizations with many outlets for manufacturing. Student organizations provide participants and members with growth opportunities and competitive events. They also open the doors to the world of industry careers and scholarship opportunities.

Cooperative Learning

Cooperative learning can help students understand topics when independent learning cannot. Therefore, you will see several opportunities in the Advanced Manufacturing curriculum for group work. To function in today's workforce, students need to be able to work collaboratively with others and solve problems without excessive conflict. The Advanced Manufacturing curriculum provides opportunities for students to work together and help each other complete complex tasks. There are many field experiences within the Advanced Manufacturing curriculum that will allow and encourage collaboration with professionals currently in the manufacturing field.

Work-Based Learning

Work-based learning is an extension of understanding competencies taught in the Advanced Manufacturing classroom. This curriculum is designed to necessitate active involvement by students in the community around them and the global environment. These real-world connections and applications link all types of students to knowledge, skills, and professional dispositions. Work-based learning should encompass ongoing and increasingly more complex involvement with local companies and manufacturing professionals. Thus, supervised collaboration and immersion in the manufacturing industry around the students are key to students' success, knowledge, and skill development.

Professional Organizations

Association for Career and Technical Education (ACTE)
acteonline.org

Mississippi Manufacturers Association (MMA)
mma-web.org

National Association of Manufacturers (NAM)
nam.org

National Council for Advanced Manufacturing (NACFAM)
nacfam.org

SkillsUSA
skillsusa.org

Using This Document

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.

Teacher Resources
All teachers should request to be added to the Canvas Resource Guide for their course. For questions or to be added to the guide, send a Help Desk ticket to the RCU by emailing helpdesk@rcu.msstate.edu.

Perkins V Quality Indicators and Enrichment Material
Some of the units may include an enrichment section at the end. This material will greatly enhance the learning experiences of students. If the Advanced Manufacturing program is using a national certification, work-based learning, or another measure of accountability that aligns with Perkins V as a quality indicator, this material could very well be assessed on that quality indicator. It is the responsibility of the teacher to ensure all competencies for the selected quality indicator are covered throughout the year.

Unit 1: Orientation and Program Overview

Competencies and Suggested Objectives
1. Describe and apply local program and center expectations, policies, and procedures. DOK2 a. Describe local program and career center policies and procedures, including dress code, attendance, academic requirements, discipline, shop/lab rules and regulations, and transportation regulations. b. Give a brief overview of the course, explaining to students what advanced manufacturing is, why it is important, and how it will be delivered. c. Compare and contrast local program and school policies to the expectations of employers. d. Preview course objectives, program policy, and industry standards throughout manufacturing.
2. Research and discuss work-based learning (WBL) opportunities related to advanced manufacturing. DOK2 a. Define WBL. b. Explore the opportunities available in advanced manufacturing, including WBL, job shadowing, apprenticeship programs, on-the-job training, etc.

Unit 2: Safety in Advanced Manufacturing

Competencies and Suggested Objectives
1. Apply workplace safety and health regulations related to the manufacturing industry. DOK2 a. Understand industry safety regulations and policies. b. Describe how to avoid on-site accidents. c. Explain the relationship between housekeeping and safety. d. Describe the role that safety organizations play in the manufacturing industry. • Occupational Safety and Health Administration (OSHA) • National Institute for Occupational Safety and Health (NIOSH) • Emergency Planning and Community Right-to-Know-Act (EPCRA) • Environmental Protection Agency (EPA) • State of Mississippi safety agencies e. Describe the process of completing a Job Safety Analysis (JSA). f. Explain the importance of reporting all on-the-job injuries, accidents, and near misses. g. Explain the need for evacuation policies and the importance of following them. h. Explain the causes of accidents and the impact of accident costs. i. Compare and contrast shop/lab safety rules to industry safety rules. j. Demonstrate proper use of an eyewash station. k. Describe the categories of emergencies and how to respond quickly and appropriately by creating an emergency action plan.
2. Discuss and display appropriate safety precautions around common job site hazards. DOK1 a. Describe the legal safety responsibilities within a company. b. Describe how to create a safe culture in the workplace. c. Explain the safety requirements for working in confined areas. d. Explain the different barriers and barricades and how they are used.
3. Demonstrate the appropriate use and care of personal protective equipment (PPE). DOK1 a. Describe seven types of PPE and identify commonly used PPE items. • Head • Eye • Hearing • Respiratory • Hand • Foot • Body protection b. Demonstrate proper use of PPE. c. Demonstrate appropriate care for PPE.
4. Identify and apply safety practices around welding operations. DOK1 a. Identify types of workplace hazards for welding. • National Fire Protection Association (NFPA) 70E Arc Flash b. Use proper safety practices when welding or working around welding operations. c. Use proper safety practices when welding in or near trenches and excavations. d. Explain the term “proximity work.”
5. Explain fall protection, ladder, and stair procedures and requirements. DOK1 a. Explain the use of proper fall protection. b. Inspect and safely work with various ladders and stairs.

6. Explain the safety data sheet (SDS). DOK1 a. Explain the function of the SDS. b. Interpret the requirements of the SDS. c. Discuss hazardous material exposures.
7. Discuss and display appropriate safety procedures related to fires. DOK1 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. d. Illustrate the proper steps to follow when using a fire extinguisher. e. Demonstrate the proper use of a fire extinguisher.
8. Explain safety in and around electrical situations. DOK1 a. Explain the injuries that can result from electrical contact. b. Explain safety around electrical hazards. c. Explain the actions to take when an electrical shock occurs.
9. Identify and understand the safe handling and storing of hazardous materials (HAZMAT). DOK2 a. Interpret the hazard communication (HAZCOM) labeling system. b. Interpret NFPA and Hazardous Materials Identification Systems (HMIS). c. Interpret the Department of Transportation (DOT) hazardous material ID system. d. Define three categories of hazardous materials. e. Describe handling and storing guidelines. f. Describe how to dispose of hazardous materials. g. Describe shipping guidelines for hazardous materials.
10. Describe the purpose and steps of a lockout/tagout (LOTO) safety procedure. DOK2 a. Explain how to test for a zero-energy state.

Note: Safety is to be taught as an ongoing part of the program. Students are required to complete a written safety test with 100% accuracy before entering the shop for lab simulations and projects. This test should be documented in each student's file.
Note: This unit will be ongoing throughout the year. Time allotted for this unit will be distributed over the entire year.

Unit 3: Employability Skills

Competencies and Suggested Objectives
1. Describe employment opportunities in the manufacturing industry. DOK1 a. Describe employment opportunities, including potential earnings, employee benefits, job availability, working conditions, educational requirements, required technology skills, and continuing education/training. b. Discuss the guidelines for developing a proper résumé. c. Demonstrate completing job applications.
2. Examine the Mississippi Department of Employment Security (MDES) website and its applications relating to employment opportunities. DOK1 a. Perform various searches through the MDES website, such as: • Number of jobs available for a specific area of expertise • Hourly wage • Percentage of jobs in the county • Percentage of jobs in the state
3. Demonstrate the ability to follow verbal and written instructions and communicate effectively in workplace situations. DOK1 a. Demonstrate verbal and nonverbal communication skills. b. Apply appropriate speaking and listening skills to class- and work-related situations. c. Demonstrate effective electronic communication skills.
4. Apply leadership and 21st-century skills to class- and work-related situations. DOK3 a. Define leadership. b. Discuss the attributes of a leader. c. Identify the roles a leader can assume.
5. Utilize teambuilding skills in class- and work-related situations. DOK2 a. Define team building. b. Discuss the attributes of a team. c. Identify the roles included in a team.

Note: This unit will be ongoing throughout the year. Time allotted for this unit will be distributed over the entire year.

Mississippi Career Connections
Research advanced manufacturing job opportunities in Mississippi by visiting https://servethesip.com/. After researching job opportunities, students should select one to develop a report or presentation, ensuring that the entire state is represented in all manufacturing industries. Students should locate relevant data to examine Mississippi manufacturing trends and report findings by using graphs, charts, graphics, illustrations, and/or technical writing.

Unit 4: Fundamentals of Student Organizations

Competencies and Suggested Objectives
1. Discuss the history, mission, and purpose of career and technical student organizations (CTSO). DOK1 a. Trace the history of the program area's student organizations – SkillsUSA and the Technology Student Association (TSA). b. Identify the mission, purpose, and/or goals of the program area's student organizations.
2. Explore the advantages of membership in student organizations. DOK1 a. Discuss the membership process for the program area's student organizations. b. Explain the activities related to the local chapter and the state and national organizations.
3. Discuss the organization's brand resources. DOK1 a. Identify the motto, creed, and/or pledge and discuss their meanings. b. Recognize related brand resources, such as: • Emblem • Colors • Official attire • Logos • Graphic standards
4. Describe the importance of effective communication skills. DOK1 a. Demonstrate verbal and nonverbal communication skills. b. Apply appropriate speaking and listening skills to class- and work-related situations.
5. Apply leadership skills and 21st-century skills to class- and work-related situations. DOK2 a. Define leadership. b. Discuss the attributes of a leader. c. Identify the roles a leader can assume.
6. Utilize teambuilding skills in class- and work-related situations. DOK2 a. Define teambuilding. b. Discuss the attributes of a team. c. Identify the roles included in a team.
7. Discuss the various competitions offered through the program area's CTSOs. DOK1 a. Describe each of the competitions and the skills needed to accomplish the tasks. b. Perform the tasks needed to complete an assigned requirement for a competition.

Unit 5: Math in the Manufacturing Industry

Competencies and Suggested Objectives
1. Apply the four basic math skills using whole numbers, fractions, decimals, and percentages, both with and without a calculator. DOK2 a. Add, subtract, multiply, and divide whole numbers, decimals, and fractions with and without a calculator. b. Convert whole numbers to fractions and convert fractions to whole numbers. c. Convert decimals to percentages and convert percentages to decimals. d. Convert fractions to decimals. e. Convert fractions to percentages.
2. Apply concepts of unit measurement in the workplace. DOK2 a. Demonstrate reading a standard and metric ruler and tape measure. b. Recognize and use metric units of length, weight, volume, and temperature.

Mississippi Career Connections
Students are given a set of raw materials and a parts list with precise dimension requirements (whole numbers, fractions, decimals). They must design (with appropriate dimensioning), cut, and assemble a small object (e.g., a wooden box, a simple metal bracket, etc.). Students are assessed by the accuracy of measurements, ability to convert between units of measurement, and efficient use of materials.
Students are presented with production goals, a bill of materials with varying units of measurement, and current stock levels. They should identify shortages, calculate the total material required, determine order quantities, and account for lead time considerations.
In a fabrication scenario, demonstrate the proper use of precision measurement tools, including calipers and micrometers.

Unit 6: Hand Tools

Competencies and Suggested Objectives
1. Demonstrate the use and maintenance of hand tools. DOK2 a. Identify, visually inspect, and discuss the safe use of common hand tools. b. Review safety rules applicable to hand tool use. c. Select and demonstrate safe and proper use of hand tools. d. Discuss how hand tools are incorporated into the manufacturing industry.
2. Demonstrate proper use of screwdrivers to assemble, disassemble, and tighten components. DOK2 a. Describe the types of screwdrivers and their applications. b. Determine how to select the appropriate screws, bolts, or other fasteners for a particular job. c. Select and use a slotted screwdriver to tighten fasteners. d. Select and use a Phillips screwdriver to tighten fasteners.
3. Demonstrate proper use of wrenches to assemble, disassemble, and tighten components. DOK2 a. Describe the common wrench types and their applications. b. Select and use a hex key wrench to tighten fasteners. c. Select and use a combination wrench to tighten fasteners. d. Select and use a ratchet wrench to tighten fasteners. e. Select and use a backup wrench to tighten fasteners.
4. Demonstrate proper use of a torque wrench to tighten a fastener. DOK2 a. Define torque and explain its importance with fasteners. b. Describe the operation of a click-type torque wrench. c. Describe the operation of a threaded fastener. d. Select and use a click-type torque wrench to tighten a fastener to the specified torque in Newton-meters (Nm) and foot-pounds (ft/lbs.).

Note: Safety is to be taught as an ongoing part of the program. Students are required to complete a written safety test with 100% accuracy before entering the shop for lab simulations and projects. This test should be documented in each student's file.
Note: This unit will be ongoing throughout the year. Time allotted for this unit will be distributed over the entire year.

Unit 7: Power Tools

Competencies and Suggested Objectives
1. Demonstrate the use and maintenance of power tools. DOK2 a. Discuss how power tools are used in the manufacturing industry. b. Identify, visually inspect, and discuss the safe use of common power tools. c. Select and demonstrate safe and proper use of power tools deemed necessary by the local industry.

Note: Safety is to be taught as an ongoing part of the program. Students are required to complete a written safety test with 100% accuracy before entering the shop for lab simulations and projects. This test should be documented in each student's file.
Note: This unit will be ongoing throughout the year. Time allotted for this unit will be distributed over the entire year.

Unit 8: Technical Drawings

Competencies and Suggested Objectives
1. Read, analyze, and interpret the basic components of a technical drawing. DOK3 a. Recognize and identify terms, components, and symbols commonly used on drawings. b. Relate information on construction drawings to actual features and locations. c. Distinguish between different types of technical drawings. • Multi-view • Assembly • Isometric • Sectional • Auxiliary • Exploded views d. Interpret and use drawing dimensions in both International System of Units (SI) and United States Customary Units. • Linear • Circular • Angular • Arcs • Holes e. Interpret conventional tolerances and determine types of fits, clearance, allowance, and material conditions. f. Apply drawing scales to determine part dimensions. g. Interpret drawing notes, blocks (e.g., change, material, title, tolerance), and surface finish symbols. h. Interpret basic geometric dimensioning and tolerancing (GD&T), including feature control frames, datums, and geometric symbols. i. Interpret fastener drawings and specifications, including Unified Numbering System (UNS) and SI thread standards.

Unit 9: Fabrication

Competencies and Suggested Objectives
1. Demonstrate proper safety procedures used in fabrication and fabrication tools. DOK2 a. Hold an instructor- or student-led team safety meeting to review expectations and develop a strategy for the day, including PPE, tool use, and materials handling. b. Demonstrate proper tool use and storage each class period. c. Demonstrate proper ergonomics and materials handling each class period. d. Demonstrate knowledge of chemical and electrical hazards and proper safety procedures.
2. Demonstrate various shop math skills and the proper use of measurement tools in a fabrication scenario or project. DOK2 a. Demonstrate proper use of the following semi-precision measurement tools during fabrication: • Tape measure • Ruler or scale b. Demonstrate the following functional shop math skills during fabrication: • Addition • Subtraction • Multiplication • Division • Working with decimals c. Demonstrate proper use of the following precision measurement tools during fabrication: • Calipers • Micrometers
3. Analyze and use print plans to perform fabrication skills. DOK2 a. Analyze different print plans and compare various elements of a standard title block. b. Analyze different print plans and compare and justify various scales used. c. Analyze different print plans and compare and justify the use of various view types, including top, left, right, and orthographic. d. Analyze different print plans, compare line types (from the Association of Mechanical Engineers' Alphabet of Lines) used, and report on the following most common uses: • Construction • Visible/object • Hidden • Center • Dimension • Extension • Phantom • Long break • Cutting plane • Section • Chain e. Analyze different print plans, develop a chart of the different types of labels seen, and compare with those of other classmates.

Unit 10: Welding and Cutting

Competencies and Suggested Objectives
1. Identify basic welding concepts and demonstrate safety procedures and proper welding techniques. DOK2 a. Identify the different types of welding and cutting, and create a chart of uses according to industry applications. b. Identify the different types (i.e., approaches/techniques) of welds and cuts and create a chart of uses according to industry applications. c. Participate in an instructor-led review of welding procedures and safety. d. Demonstrate emergency procedures under simulated conditions. e. Demonstrate repeated safe and proper welding techniques under the supervision of the instructor.
2. Demonstrate safe and proper procedures when welding and cutting. DOK2 a. Hold an instructor- or student-led team safety meeting to review expectations and develop a strategy for the day, including PPE, tool use, and materials handling. b. Demonstrate proper tool/equipment use and storage each class period. c. Demonstrate proper ergonomics and materials handling each class period. d. Demonstrate knowledge of chemical and electrical hazards and use proper, safe procedures.
3. Demonstrate functional shop math in a welding and cutting project or scenario. DOK2 a. Use and solve problems in real-world applications involving fractions, angles, squareness, and/or parallelism.
4. Use and read print specifications to demonstrate various welding and cutting skills in a project or scenario. DOK2 a. Demonstrate the following welding and cutting skills: • Part fit • Measurements • Material selection and handling • Proper welding techniques
5. Demonstrate proper logistics procedures in a welding and cutting project or scenario. DOK2 a. Demonstrate how to obtain materials, equipment, and hot work permits and define a workspace.
6. Demonstrate budget planning and accounting in a welding and cutting project scenario, ensuring the consideration and application of component and labor costs. DOK2
7. Explore various careers in welding and cutting. DOK1 a. Research various welding careers among two different industries or companies, making sure to include information on certifications and salaries.
8. Demonstrate appropriate habits of work in a welding and cutting project or scenario. DOK2 a. Demonstrate the following habits of work in this project and throughout the class: • On-time project completion • Attendance • Punctuality • Cooperation • Initiative

Note: Safety is to be taught as an ongoing part of the program. Students are required to complete a written safety test with 100% accuracy before entering the shop for lab simulations and projects. This test should be documented in each student's file.
Note: This unit will be ongoing throughout the year. Time allotted for this unit will be distributed over the entire year.

Unit 11: Basic Assembly

Competencies and Suggested Objectives
1. Identify safety concerns associated with assembly and demonstrate proper procedures to ensure safety during assembly. DOK2 a. Hold an instructor- or student-led team safety meeting to review expectations and develop a strategy for the day, including: • PPE • Tool use • Materials handling b. Demonstrate proper tool use and storage each class period. c. Demonstrate proper ergonomics and materials handling each class period. d. Demonstrate knowledge of chemical and electrical hazards and use proper, safe procedures for each. e. Review safety concerns associated with assembly in advanced manufacturing (i.e., the fatal four: caught in between, falls, electrocution, struck by an object).
2. Identify, describe, and practice standardized work in advanced manufacturing. DOK2 a. Examine standardized work in advanced manufacturing. b. Identify the purpose of standardized work in advanced manufacturing. c. Perform a standardized work activity to create a product.
3. Demonstrate various shop math skills and the proper use of measurement tools in an assembly scenario or project. DOK2 a. Demonstrate proper use of the following semi-precision measurement tools: • Tape measure • Ruler or scale b. Demonstrate the following functional shop math skills during assembly: • Addition • Subtraction • Multiplication • Division • Working with decimals c. Demonstrate proper use of the following precision measurement tools during assembly: • Calipers • Micrometers
4. Identify and describe basic elements of print plans for assembly. DOK1 a. Identify the following basic elements and technical specifications in print or digital form: • Title block • Scale • Line type and weight • Keys/legends and labels • Measurements • Information relevant for an assembly project

5. Demonstrate appropriate, efficient teamwork and team problem-solving skills during the assembly project scenario according to the associated rubric. DOK3 a. In student groups, develop an organizational or task chart connecting to the assembly project rubric, detailing team member accountability. b. Research proven models to develop a conflict resolution plan for each team and use as needed during the assembly project. c. Identify and explain appropriate workflow and production rates for the assembly project.
6. Explore various careers in assembly. DOK1 a. Compare and contrast assembly careers among two different industries or companies. b. Examine career trends in assembly.

Unit 12: Advanced Manufacturing Program Overview

Competencies and Suggested Objectives
1. Review local program and center expectations, policies, and procedures. DOK1 a. Review local program and career center policies and procedures, including dress code, attendance, academic requirements, discipline, shop/lab rules and regulations, and transportation regulations. b. Compare and contrast local program and school policies with the expectations of employers and summarize how those align.
2. Explore leadership skills and personal development opportunities necessary for careers in the manufacturing industry. DOK2 a. Demonstrate effective teambuilding and leadership skills. b. Demonstrate, through practice, appropriate work ethics. c. Practice effective communication.
3. Participate in an advanced manufacturing orientation. DOK2 a. Describe the types of work performed by advanced manufacturing craftworkers. b. Identify career opportunities available to advanced manufacturing craftworkers. c. Explain the purpose and objectives of an apprentice training program. d. Explain the responsibilities and characteristics of a good, advanced manufacturing craftworker. e. Explain the importance of safety in relation to advanced manufacturing craftworkers.

Unit 13: Machine and Tool Safety Overview

Competencies and Suggested Objectives
1. Review general safety rules for working in a shop/lab and industry. DOK2 a. Discuss safety issues and prevention associated with the advanced manufacturing shop area. b. Explain fire safety and prevention in the workplace.
2. Locate and interpret machine reference documents, such as start-up and shut-down procedures, operation, machine performance, settings, and adjustments. DOK2 a. Use documentation to create a preventative maintenance schedule.
3. Demonstrate proper start-up and shut-down of a computer-controlled machine. DOK2 a. Conduct pre-startup inspection and safety check of the machine. b. Connect an air hose and determine how to adjust air pressure to a predetermined setting. c. Describe different machine stop functions. d. Complete the normal startup and planned shutdown of the machine. e. Perform a machine halt, cycle stop, and emergency stop.
4. Apply machine operation safety procedures. DOK2 a. Locate safety hazards and correct machine operation to prevent accidents (e.g., reviewing the machine safety manual, installing a machine guard, etc.). b. Describe which clothing is recommended for safe machine operation. c. Describe the types of machine guards. d. Describe machine interlock and emergency control operations.
5. Demonstrate the operation and application of oils and grease. DOK2 a. Determine correct oil or grease machine lubrication by reviewing label specifications and reference manuals.
6. Perform basic preventative machine maintenance. DOK2 a. Check and refill oil and grease in reservoir levels. b. Drain pneumatic filters. c. Check and refill pneumatic lubricator levels. d. Clean machine surfaces.

Note: Safety is to be taught as an ongoing part of the program. Students are required to complete a written safety test with 100% accuracy before entering the shop for lab simulations and projects. This test should be documented in each student's file.
Note: This unit will be ongoing throughout the year. Time allotted for this unit will be distributed over the entire year.

Unit 14: Precision Measurement

Competencies and Suggested Objectives
1. Demonstrate proper procedures to ensure safety during precision measurement. DOK2 a. Hold an instructor- or student-led team safety meeting to review expectations and develop a strategy for the day, including: • PPE • Tool use • Materials handling b. Hold an instructor- or student-led safety equipment review focusing on PPE. c. Demonstrate proper tool/equipment use and storage each class period. d. Demonstrate proper ergonomics and materials handling each class period.
2. Demonstrate functional shop math skills in a precision measurement scenario. DOK2 a. Add, subtract, multiply, and divide for imperial, metric, and SI units, making sure to include fractions and decimals.
3. Demonstrate proper use of various precision measurement tools in a project or industry simulation scenario. DOK2 a. Measure samples according to the precision level needed. • Semi-precision—scales, rulers, tape measures • Precision—calipers, micrometers b. Position a machinist's rule to measure inside, outside, and circular dimensions using SI, fractional inch, and decimal inch units. c. Zero, position, and read dial and digital calipers in SI and US Customary units, measuring inside, outside, and circular dimensions. d. Read Vernier and digital micrometers in SI and US Customary units, check zero and calibration, and measure rectangular and circular dimensions. e. Convert measured samples from SI to imperial. • Convert between SI, fractional inch, and decimal inch systems. f. Select the most appropriate measurement tool for a given application. • Define accuracy, resolution, and repeatability. • Describe the accuracy and resolution of rules, calipers, and micrometers. • Identify factors that affect measurement tool repeatability and how tool selection is influenced.
4. Demonstrate appropriate, efficient teamwork and team critical thinking skills during the precision measurement project scenario. DOK3 a. In student groups, develop an organizational or task chart connecting to the assembly project rubric, detailing team member accountability. b. Develop a system that accounts for quality using a two-person (e.g., one checks, one verifies) approach. c. Research proven models to develop a conflict resolution plan for each team and use as needed during the precision measurement project.

5. Read, interpret, and create print plans to assemble and communicate information about a specific part. DOK3
   a. Read prints to verify measurements of various parts.
      - Interpret part dimensions, scales, and tolerance symbols found on assembly drawings.
      - Compare measured part dimensions to upper and lower specification limits shown on drawings.
   b. Develop basic print elements after performing precision measurements.
      - Create technical sketches or prints that include part dimensions, tolerances, and relevant notes.
   c. Assemble a designated part, selecting components according to print documents.
   d. Use specific, written terminology to describe the component above, making sure to include precision measurements, conversions, and the procedure used to assemble it.

6. Explore various careers that utilize precision measurement. DOK1
   a. Examine careers in quality control (e.g., technicians, engineers, etc.).

7. Demonstrate appropriate habits of work throughout precision measurement projects or scenarios. DOK2
   a. Practice key qualities for precision measurement (e.g., detail-oriented, dependable, etc.).
   b. Discuss the "snowball" effect on cost at different stages of mistakes (e.g., A mistake in CAD could cost pennies, which means the prototype would have a mistake that costs cents, then the line could have a mistake that costs many dollars, resulting in a final product for the end user with a mistake that could be very expensive).
   c. Use a torque wrench to tighten a fastener to the specified torque in Nm and foot-pounds and describe its importance in maintaining safe, assembly accuracy.

Unit 15: Machine Operation

Competencies and Suggested Objectives
1. Demonstrate the use of a Human-Machine Interface (HMI) panel to test machine operation manually. DOK2 a. Describe the operation of an HMI panel. b. Use an HMI panel to operate machine actuators manually. c. Use an HMI panel to single-step a machine sequence.
2. Demonstrate monitoring and operation procedures of a computer-controlled machine. DOK2 a. Define common production statistics of machines or systems, including quantity produced, rejects, and cycle times. b. Operate a machine in an automatic cycle, single cycle, and continuous cycle. c. Monitor the HMI panel for correct machine operation. d. Monitor pressure, voltage, current, and temperature indicators.
3. Interpret machine fault conditions and restart operations. DOK2 a. Describe types of machine alarm conditions. b. Clear faults and reset machine operation in response to alarm conditions on the HMI. c. Locate and interpret fault history on HMI menus.

Unit 16: Circuits and Electronics

Competencies and Suggested Objectives
1. Demonstrate proper procedures to ensure safety when working with circuits and electronics. DOK2 a. Hold an instructor- or student-led team safety meeting to review expectations and develop a strategy for the day, including: • Arc flash • Electrical wire safety • Lockout/tagout b. Hold an instructor- or student-led safety equipment review focusing on PPE. c. Demonstrate proper tool/equipment use and storage each class period. d. Demonstrate proper ergonomics and materials handling each class period. e. Demonstrate knowledge of electrical hazards and use proper, safe procedures for each.
2. Demonstrate functional shop math skills in a project/scenario(s) involving circuits and/or electronics. DOK2 a. Solve problems using current/voltage calculations and give precise answers using decimals.
3. Read, interpret, and use print plans in a project or scenario to demonstrate print reading skills with circuits and electronics, including component identification, placement, and current paths. DOK3 a. Interpret basic electrical power schematics and ladder control schematics. b. Identify schematic symbols. • Motors • Pushbuttons • Switches • Resistors • Relays • Contactors • Sensors • Power supplies c. Follow industry guidelines for electrical schematic layout and labeling.
4. Demonstrate knowledge and skills associated with circuit, electronic, and basic electrical theory and applications. DOK2 a. Identify, describe, and use series, parallel, and combination circuits. b. Define and describe voltage, resistance, current, and power. • Explain the relationship of these values, including overload and overcurrent conditions. c. Distinguish between direct and alternating voltage and use each in various scenarios. d. Describe the difference between single-phase and three-phase circuits in industrial settings. e. Explore and practice the techniques for electrical fabrication, such as wire stripping and assembly of circuits, switches/input devices, and loads/output devices. f. Use a digital multimeter to measure alternating current (AC) and direct current (DC) supply voltage, verify that machine voltage readings match specifications, reset circuit breakers, and identify fuses.

5. Explore *Ohm's law* in a project or scenario, specifically investigating power, voltage, current, resistance, and *Kirchhoff's law* of current flow. DOK2 a. Define units of measure for voltage (V), current (A), resistance (Ω), and power (W). b. Solve problems using *Ohm's law* and *Kirchhoff's current law* to calculate resistance, current, voltage, and power. c. Apply these calculations while testing and verifying circuit performance using a multimeter.
6. Explore relays and logic. DOK1 a. Explain what relays are and their uses. b. Examine the use of relay logic and define its characteristics, including AND, OR, NOT, NOR, NAND, and memory. c. Interpret the operation of 2-step electric relay sequence circuits and power diagrams. d. Identify ISO schematic symbols for limit switches, sensors, and interlock logic.
7. Discuss basic aspects of motor controls. DOK1 a. Explain how electric motors operate. b. Explain how pushbuttons are used in automated equipment. c. Examine and explain circuits using a start push button, stop push button, and magnetic relay (hands-on, simulated, or online examples can be utilized). d. Describe the operation of limit switches, inductive sensors, and capacitive sensors. e. Adjust and test the trip point of limit switches and inductive or capacitive sensors used in motor control systems.
8. Explore various careers that utilize electronic systems as part of their day-to-day operations (e.g., maintenance, design, hazards, etc.). DOK1
9. Demonstrate professional habits of work, including proper attendance, punctuality, conformance to rules, and teamwork. DOK2

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Note: This unit will be ongoing throughout the year. Time allotted for this unit will be distributed over the entire year.

Unit 17: Hydraulics and Pneumatics

Competencies and Suggested Objectives
1. Demonstrate proper procedures to ensure safety when working with hydraulics and pneumatics. DOK2 a. Hold an instructor- or student-led team safety meeting to review expectations and develop a strategy for the day, including: • Embolism • High pressure • Pinch points • Compressed gases • Flying debris b. Hold an instructor- or student-led safety equipment review focusing on PPE. c. Demonstrate proper tool/equipment use and storage each class period. d. Demonstrate proper ergonomics and materials handling each class period. e. Demonstrate knowledge of hydraulic and pneumatic hazards and use proper, safe procedures where applicable.
2. Research and discuss basic aspects of hydraulics and pneumatics in advanced manufacturing. DOK2 a. Identify common measurements associated with hydraulics and pneumatics (e.g., pressure, flow, force, area). b. Investigate how hydraulics are used in advanced manufacturing. c. Investigate how pneumatics are used in advanced manufacturing. d. Examine a hydraulic or pneumatic circuit that will extend a cylinder using a valve. e. Interpret basic hydraulic schematics using NFPA/ISO symbols. f. Interpret basic pneumatic schematics using NFPA/ISO symbols. g. Describe guidelines for drawing hydraulic and pneumatic schematics according to NFPA/ISO standards. h. Identify and describe components represented by schematic symbols. • Directional valves • Conductors • Actuators • Gauges • Regulators • Filters • Lubricators
3. Operate and adjust basic hydraulic and pneumatic components. DOK3 a. Operate a basic pneumatic valve circuit with a manual operator. b. Use pneumatic valve manual overrides to test actuators and confirm correct function. c. Adjust the stroke length of a pneumatic cylinder and connect/disconnect pneumatic hoses using Push-lok fittings. d. Describe how compressed air is generated and explain key characteristics. e. Define pneumatic pressure and calculate pressure when given force and area. f. Interpret how hydraulic systems apply *Pascal's law* to transmit force and pressure through fluids.

Note: Safety is to be taught as an ongoing part of the program. Students are required to complete a written safety test with 100% accuracy before entering the shop for lab simulations and projects. This test should be documented in each student's file.

Note: This unit will be ongoing throughout the year. Time allotted for this unit will be distributed over the entire year.

Unit 18: Programmable Logic Controllers (PLCs)

Competencies and Suggested Objectives
1. Examine the purpose and function of programmable logic controllers (PLCs) in automated systems. DOK2 a. Define PLCs and their roles in industrial automation. b. Identify key PLC components, including CPU, power supply, input/output (I/O) modules, and communication interfaces. c. Describe how discrete I/O devices are interfaced to a PLC. d. Explain the basic symbolic and absolute discrete I/O address system used in PLCs.
2. Interpret basic PLC ladder logic programs. DOK2 a. Interpret a basic PLC ladder logic diagram, identifying normally open, normally closed, output coil, internal coil, and timer instructions. b. Explain how I/O devices are represented in ladder logic. c. Interpret the operation of a seal-in ladder logic program and describe how it maintains circuit continuity. d. Identify the elements of a PLC project, including program structure, documentation, and tag organization.
3. Interpret PLC I/O and power diagrams. DOK2 a. Interpret a basic PLC I/O diagram, identifying relationships between field devices and PLC terminals. b. Interpret a basic PLC power diagram, tracing power flow from supply through protection devices to controller components. c. Describe the connection between PLC ladder logic and corresponding power and I/O diagrams.
4. Analyze basic PLC operations in an automated scenario. DOK4 a. Examine how PLCs control sequencing, timing, and decision-making in automation systems. b. Troubleshoot a simulated PLC circuit to identify and correct programming or wiring errors. c. Modify or create a simple ladder logic sequence to operate I/O devices (e.g., start/stop pushbuttons, indicator lights, relays). d. Evaluate how PLCs increase efficiency and reliability in industrial processes.

Mississippi Career Connections
Develop and test a simple PLC program. • Write a basic ladder logic program using an educational PLC or simulation software. • Test the program to operate I/O devices. • Debug and document the program using comments and labels.

Unit 19: Robotics and Automation

Competencies and Suggested Objectives
1. Identify basic robot elements. DOK2 a. Apply robot safety procedures. b. Describe the basic operation of a robot and simulation software. c. Describe the two methods of programming robot points. d. Describe types of robot safety devices. e. Describe the function of collaborative robots.
2. Research and discuss the use of robotics in advanced manufacturing. DOK2 a. Identify reasons for the use of robotics in advanced manufacturing. b. Explain how geometric measurement is used by the robot to calculate geometric position in a three-dimensional space. c. Explain how robots use user-frames and tool-frames to perform tool handling programming. d. Identify the layout of the robot cell. e. Identify safety and danger zones around the robot using a robot cell layout.
3. Demonstrate functional shop math skills in a project/scenario(s) involving robotics and automation. DOK2 a. Measure linear distance using millimeters. b. Convert millimeters to inches and inches to millimeters.
4. Examine robotic tool handling/motion control. DOK2 a. Identify the parts of the robot arm and controller. b. Explore the process for programming robots for manufacturing.

Unit 20: Additive and Subtractive Manufacturing Systems

Competencies and Suggested Objectives
1. Maintain manufacturing process reliability and quality. DOK3 a. Apply root cause analysis and the "5 Whys" method to identify causes of process or product problems. b. Respond appropriately to a nonconforming product or process issue. c. Perform basic machine cleaning and routine maintenance safely. d. Define quality and describe elements of preventative and predictive maintenance. e. Explain how cause-and-effect diagrams are used to identify root causes.
2. Identify components and operations of computer numerical control (CNC) and additive manufacturing machines. DOK3 a. Identify types and components of CNC turning centers and machining centers. b. Identify types of additive manufacturing machines (e.g., 3D printers). c. Describe the basic operation of a CNC turning center and machining center. d. Describe types of 3D printers and their basic operation.
3. Interpret CNC machine coordinates. DOK2 a. Determine the location of the machine coordinates given part zero. b. Describe a two- and three-dimensional Cartesian coordinate system. c. Define CNC machining center machine coordinates, part zero, and work coordinates. d. Describe how to locate and set part zero. e. Define CNC machining center tool offsets and explain their function.
4. Interpret a basic CNC G&M code program. DOK3 a. Interpret a basic CNC G&M code program to understand tool paths and operations. b. Describe the operation of a basic CNC G&M code program. c. Explain the functions of basic G-codes (G00, G01, G02, G03). d. Describe the operation of cutter compensation, absolute positioning, and incremental positioning.

Mississippi Career Connections
Demonstrate basic setup and operation of a CNC or additive manufacturing equipment in a lab or simulation. • Load or simulate a simple CNC program and verify tool paths. • Perform basic setup of a 3D printing process, including material loading and calibration. • Analyze the output for accuracy and identify factors affecting dimensional precision and surface quality.

Unit 21: Advanced Manufacturing Systems

Competencies and Suggested Objectives
1. Implement lean manufacturing principles and practices. DOK2 a. Define lean manufacturing and explain its purpose in improving efficiency and reducing waste. b. Identify the eight types of manufacturing waste in an advanced manufacturing environment. • Defects • Overproduction • Waiting • Non-utilized talent • Transportation • Inventory • Motion • Extra processing c. Explain non-value-added vs. value-added activities and their impact on process efficiency. d. Perform a 5S process to organize and maintain a clean, safe, and efficient work environment. • Sort • Set in order • Shine • Standardize • Sustain e. Identify other related lean practices (e.g., Just-in-Time [JIT], Kaizen, Kanban, and continuous improvement methods).
2. Interpret common manufacturing performance metrics. DOK3 a. Calculate productivity, production efficiency, machine utilization, Takt Time, and throughput. b. Define and describe key performance metrics and indicators. c. Explain the five critical manufacturing performance objectives and lean manufacturing principles.
3. Identify functional elements of advanced manufacturing. DOK2 a. Identify six functional areas of an advanced manufacturing plant. • Production • Maintenance • Quality • Logistics • Engineering • Administration b. Describe the key roles and responsibilities of employees within each functional area.
4. Describe how to adjust a basic production line to meet business needs. DOK2 a. Apply knowledge of balancing a production line to meet throughput requirements. b. Describe three basic production layout formats. • Product • Process • Cellular c. Describe methods of balancing a production line.

5. Identify applications of manufacturing materials. DOK2 a. Identify manufacturing materials for specific applications. b. Define and describe the characteristics of ferrous metals, non-ferrous metals, plastics, ceramics, and composites. c. Describe common special material requirements for the food, beverage, and pharmaceutical industries.
6. Identify advanced manufacturing processes. DOK2 a. Identify various advanced manufacturing processes by sight and description. b. Define and describe the characteristics of key processes, including assembly, metal separation, finishing, forming, heat treating, material handling, inspection, and storage.
7. Investigate cloud-based maintenance through a Supervisory Control and Data Acquisition (SCADA) system. DOK2 a. Describe basic cloud-based SCADA functions. b. Respond to a maintenance notification using a mobile device. c. Use a cloud-based notification system to request maintenance. d. View production data using a mobile device.

Unit 22: Workforce Readiness

Competencies and Suggested Objectives
1. Research and demonstrate workforce readiness for advanced manufacturing jobs. DOK2 a. Create a résumé in accordance with manufacturing industry standards. b. Demonstrate adequate interview skills in a real or simulated interview (virtual and/or face-to-face). c. Research employer expectations of multiple companies and see how they align to other manufacturing industries. d. Demonstrate adequate money management and personal finance skills. e. Gather industry professional references and record interactions. f. Explain workplace flexibility from both the employer and employee point of view. g. Demonstrate excellent communication skills (i.e., verbal, written, and digital). h. Exhibit high-quality habits of work (i.e., professionalism), including integrity, work ethic, and dependability.

Mississippi Career Connections
Mississippi's advanced manufacturing sector is a cornerstone of the state's economy, offering high-demand, high-wage careers that span industries such as aerospace, automotive, polymers, and precision machining. This unit prepares students to enter these growing fields by developing essential workforce readiness skills such as résumé building, interviewing, financial literacy, and professional communication that reflect real employer expectations. Through connections with Mississippi-based manufacturers and workforce partners, such as AccelerateMS, Ingalls Shipbuilding, Toyota Mississippi, Nissan, and PACCAR, students gain insight into what it means to be job-ready in today's competitive manufacturing environment. Emphasizing professionalism, adaptability, and integrity, this unit helps learners bridge classroom learning to meaningful careers in Mississippi's advanced manufacturing ecosystem.

Student Competency Profile

Student's Name: _____

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 it can serve as a cumulative record of competencies achieved in the course.

In the blank before each competency, place the date (MM/DD/YY) on which the student mastered the competency.

Unit 1: Orientation and Program Overview		
	1.	Describe and apply local program and center expectations, policies, and procedures.
	2.	Research and discuss work-based learning (WBL) opportunities related to advanced manufacturing.
Unit 2: Safety in Advanced Manufacturing		
	1.	Apply workplace safety and health regulations related to the manufacturing industry.
	2.	Discuss and display appropriate safety precautions around common job site hazards.
	3.	Demonstrate the appropriate use and care of personal protective equipment (PPE).
	4.	Identify and apply safety practices around welding operations.
	5.	Explain fall protection, ladder, and stair procedures and requirements.
	6.	Explain the safety data sheet (SDS).
	7.	Discuss and display appropriate safety procedures related to fires.
	8.	Explain safety in and around electrical situations.
	9.	Identify and understand the safe handling and storing of hazardous materials (HAZMAT).
	10.	Describe the purpose and steps of a lockout/tagout (LOTO) safety procedure.
Unit 3: Employability Skills		
	1.	Describe employment opportunities in the manufacturing industry.
	2.	Examine the Mississippi Department of Employment Security (MDES) website and its applications relating to employment opportunities.
	3.	Demonstrate the ability to follow verbal and written instructions and communicate effectively in workplace situations.
	4.	Apply leadership and 21st-century skills to class- and work-related situations.
	5.	Utilize teambuilding skills in class- and work-related situations.
Unit 4: Fundamentals of Student Organizations		
	1.	Discuss the history, mission, and purpose of career and technical student organizations (CTSO).
	2.	Explore the advantages of membership in student organizations.
	3.	Discuss the organization's brand resources.
	4.	Describe the importance of effective communication skills.
	5.	Apply leadership skills and 21st century skills to class- and work-related situations.

	6.	Utilize teambuilding skills in class- and work-related situations.
	7.	Discuss the various competitions offered through the program area's CTSOs.
Unit 5: Math in the Manufacturing Industry		
	1.	Apply the four basic math skills using whole numbers, fractions, decimals, and percentages, both with and without a calculator.
	2.	Apply concepts of unit measurement in the workplace.
Unit 6: Hand Tools		
	1.	Demonstrate the use and maintenance of hand tools.
	2.	Demonstrate proper use of screwdrivers to assemble, disassemble, and tighten components.
	3.	Demonstrate proper use of wrenches to assemble, disassemble, and tighten components.
	4.	Demonstrate proper use of a torque wrench to tighten a fastener.
Unit 7: Power Tools		
	1.	Demonstrate the use and maintenance of power tools.
Unit 8: Technical Drawings		
	1.	Read, analyze, and interpret the basic components of a technical drawing.
Unit 9: Fabrication		
	1.	Demonstrate proper safety procedures used in fabrication and fabrication tools.
	2.	Demonstrate various shop math skills and the proper use of measurement tools in a fabrication scenario or project.
	3.	Analyze and use print plans to perform fabrication skills.
Unit 10: Welding and Cutting		
	1.	Identify basic welding concepts and demonstrate safety procedures and proper welding techniques.
	2.	Demonstrate safe and proper procedures when welding and cutting.
	3.	Demonstrate functional shop math in a welding and cutting project or scenario.
	4.	Use and read print specifications to demonstrate various welding and cutting skills in a project or scenario.
	5.	Demonstrate proper logistics procedures in a welding and cutting project or scenario.
	6.	Demonstrate budget planning and accounting in a welding and cutting project scenario, ensuring the consideration and application of component and labor costs.
	7.	Explore various careers in welding and cutting.
	8.	Demonstrate appropriate habits of work in a welding and cutting project or scenario.
Unit 11: Basic Assembly		
	1.	Identify safety concerns associated with assembly and demonstrate proper procedures to ensure safety during assembly.
	2.	Identify, describe, and practice standardized work in advanced manufacturing.
	3.	Demonstrate various shop math skills and the proper use of measurement tools in an assembly scenario or project.
	4.	Identify and describe basic elements of print plans for assembly.
	5.	Demonstrate appropriate, efficient teamwork and team problem-solving skills during the assembly project scenario according to the associated rubric.

	6.	Explore various careers in assembly.
Unit 12: Advanced Manufacturing Program Overview		
	1.	Review local program and center expectations, policies, and procedures.
	2.	Explore leadership skills and personal development opportunities necessary for careers in the manufacturing industry.
	3.	Participate in an advanced manufacturing orientation.
Unit 13: Machine and Tool Safety Overview		
	1.	Review general safety rules for working in a shop/lab and industry.
	2.	Locate and interpret machine reference documents, such as start-up and shut-down procedures, operation, machine performance, settings, and adjustments.
	3.	Demonstrate proper start-up and shut-down of a computer-controlled machine.
	4.	Apply machine operation safety procedures.
	5.	Demonstrate the operation and application of oils and grease.
	6.	Perform basic preventative machine maintenance.
Unit 14: Precision Measurement		
	1.	Demonstrate proper procedures to ensure safety during precision measurement.
	2.	Demonstrate functional shop math skills in a precision measurement scenario.
	3.	Demonstrate proper use of various precision measurement tools in a project or industry simulation scenario.
	4.	Demonstrate appropriate, efficient teamwork and team critical thinking skills during the precision measurement project scenario.
	5.	Read, interpret, and create print plans to assemble and communicate information about a specific part.
	6.	Explore various careers that utilize precision measurement.
	7.	Demonstrate appropriate habits of work throughout precision measurement projects or scenarios.
Unit 15: Machine Operation		
	1.	Demonstrate the use of a Human-Machine Interface (HMI) panel to test machine operation manually.
	2.	Demonstrate monitoring and operation procedures of a computer-controlled machine.
	3.	Interpret machine fault conditions and restart operations.
Unit 16: Circuits and Electronics		
	1.	Demonstrate proper procedures to ensure safety when working with circuits and electronics.
	2.	Demonstrate functional shop math skills in a project/scenario(s) involving circuits and/or electronics.
	3.	Read, interpret, and use print plans in a project or scenario to demonstrate print reading skills with circuits and electronics, including component identification, placement, and current paths.
	4.	Demonstrate knowledge and skills associated with circuit, electronic, and basic electrical theory and applications.
	5.	Explore *Ohm's law* in a project or scenario, specifically investigating power, voltage, current, resistance, and *Kirchhoff's law* of current flow.
	6.	Explore relays and logic.
	7.	Discuss basic aspects of motor controls.

	8.	Explore various careers that utilize electronic systems as part of their day-to-day operations (e.g. maintenance, design, hazards, etc.).
	9.	Demonstrate professional habits of work, including proper attendance, punctuality, conformance to rules, and teamwork.
Unit 17: Hydraulics and Pneumatics		
	1.	Demonstrate proper procedures to ensure safety when working with hydraulics and pneumatics.
	2.	Research and discuss basic aspects of hydraulics and pneumatics in advanced manufacturing.
	3.	Operate and adjust basic hydraulic and pneumatic components.
Unit 18: Programmable Logic Controllers (PLCs)		
	1.	Examine the purpose and function of programmable logic controllers (PLCs) in automated systems.
	2.	Interpret basic PLC ladder logic programs.
	3.	Interpret PLC I/O and power diagrams.
	4.	Analyze basic PLC operations in an automated scenario.
Unit 19: Robotics and Automation		
	1.	Identify basic robot elements.
	2.	Research and discuss the use of robotics in advanced manufacturing.
	3.	Demonstrate functional shop math skills in a project/scenario(s) involving robotics and automation.
	4.	Examine robotic tool handling/motion control.
Unit 20: Additive and Subtractive Manufacturing Systems		
	1.	Maintain manufacturing process reliability and quality.
	2.	Identify components and operations of computer numerical control (CNC) and additive manufacturing machines.
	3.	Interpret CNC machine coordinates.
	4.	Interpret a basic CNC G&M code program.
Unit 21: Advanced Manufacturing Systems		
	1.	Implement lean manufacturing principles and practices.
	2.	Interpret common manufacturing performance metrics.
	3.	Identify functional elements of advanced manufacturing.
	4.	Describe how to adjust a basic production line to meet business needs.
	5.	Identify applications of manufacturing materials.
	6.	Identify advanced manufacturing processes.
	7.	Investigate cloud-based maintenance through a Supervisory Control and Data Acquisition (SCADA) system.
Unit 22: Workforce Readiness		
	1.	Research and demonstrate workforce readiness for advanced manufacturing jobs.

Appendix A: 21st Century Standards

	Units																				
Standards	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**
CS1																						
CS2			X																			X
CS3																						
CS4		X																				
CS5		X																			X	
CS6			X						X	X												
CS7			X											X				X		X		
CS8			X	X							X			X								X
CS9			X											X		X						
CS10																						
CS11																X		X				
CS12			X																			X
CS13			X																			X
CS14			X	X							X			X								X
CS15			X							X				X								X
CS16			X	X								X										X

CSS1-21st Century Themes

CS1 Global Awareness

1. Using 21st century skills to understand and address global issues
2. Learning from and working collaboratively with individuals representing diverse cultures, religions, and lifestyles in a spirit of mutual respect and open dialogue in personal, work, and community contexts
3. Understanding other nations and cultures, including the use of non-English languages

CS2 Financial, Economic, Business, and Entrepreneurial Literacy

1. Knowing how to make appropriate personal economic choices
2. Understanding the role of the economy in society
3. Using entrepreneurial skills to enhance workplace productivity and career options

CS3 Civic Literacy

1. Participating effectively in civic life through knowing how to stay informed and understanding governmental processes
2. Exercising the rights and obligations of citizenship at local, state, national, and global levels
3. Understanding the local and global implications of civic decisions

CS4 Health Literacy

1. Obtaining, interpreting, and understanding basic health information and services and using such information and services in ways that enhance health
2. Understanding preventive physical and mental health measures, including proper diet, nutrition, exercise, risk avoidance, and stress reduction

3. Using available information to make appropriate health-related decisions
4. Establishing and monitoring personal and family health goals
5. Understanding national and international public health and safety issues

CS5 Environmental Literacy

1. Demonstrating knowledge and understanding of the environment and the circumstances and conditions affecting it, particularly as relates to air, climate, land, food, energy, water, and ecosystems
2. Demonstrating knowledge and understanding of society's impact on the natural world (e.g., population growth, population development, resource consumption rate, etc.)
3. Investigating and analyzing environmental issues and make accurate conclusions about effective solutions
4. Taking individual and collective action toward addressing environmental challenges (e.g., participating in global actions, designing solutions that inspire action on environmental issues)

CSS2-Learning and Innovation Skills

CS6 Creativity and Innovation

1. Think creatively
2. Work creatively with others
3. Implement innovations

CS7 Critical Thinking and Problem Solving

1. Reason effectively
2. Use systems thinking
3. Make judgments and decisions
4. Solve problems

CS8 Communication and Collaboration

1. Communicate clearly
2. Collaborate with others

CSS3-Information, Media and Technology Skills

CS9 Information Literacy

1. Access and evaluate information
2. Use and manage information

CS10 Media Literacy

1. Analyze media
2. Create media products

CS11 ICT Literacy

1. Apply technology effectively

CSS4-Life and Career Skills

CS12 Flexibility and Adaptability

1. Adapt to change
2. Be flexible

CS13 Initiative and Self-Direction

1. Manage goals and time
2. Work independently
3. Be self-directed learners

CS14 Social and Cross-Cultural Skills

1. Interact effectively with others
2. Work effectively in diverse teams

CS15 Productivity and Accountability

1. Manage projects
2. Produce results

CS16 Leadership and Responsibility

1. Guide and lead others
2. Be responsible to others

Appendix B: Advance CTE Manufacturing Standards

	Units																					
Standards	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**
MNC05.01	X	X						X														X
MNC05.02								X					X									X
MNC06.01			X								X											
MNC06.02			X								X											
MNC06.03			X																			
MNC06.04			X								X											
MNC06.05			X								X											
MNC10.01				X	X	X			X	X	X		X	X	X	X	X		X		X	X
MNPA01.01		X						X	X	X	X		X						X	X	X	
MNPA03.01							X									X	X				X	
MNPA04.01			X									X									X	
MNPA05.01													X								X	
MNPA06.01	X																				X	
MNPA07.01				X										X	X			X			X	
MNPA08.01																						
MNPA09.01					X	X																

MNC01 Academic Foundations

Achieve additional academic knowledge and skills required to pursue the full range of career and postsecondary education opportunities within a Career Cluster. No additional statements in this topic beyond those found in the Essential Knowledge and Skills Chart.

MNC02 Communications

Use oral and written communication skills in creating, expressing and interpreting information and ideas including technical terminology and information. No additional statements in this topic beyond those found in the Essential Knowledge and Skills Chart.

MNC03 Problem-Solving and Critical Thinking

Solve problems using critical thinking skills (analyze, synthesize, and evaluate) independently and in teams. Solve problems using creativity and innovation. No additional statements in this topic beyond those found in the Essential Knowledge and Skills Chart.

MNC04 Information Technology Applications

Use information technology tools specific to the career cluster to access, manage, integrate, and create information. No additional statements in this topic beyond those found in the Essential Knowledge and Skills Chart.

MNC05 Systems

Understand roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment. Identify how key organizational systems affect organizational performance and the quality of products and services. Understand global context of industries and careers.

MNC05.01 Summarize and explain how manufacturing businesses operate to demonstrate an understanding of key functions within organizations in the industry.

1. Performance Element - Identify the role and major functions of manufacturing businesses.
   Sample Indicators:
   a. Explain the importance of manufacturing to society.
   b. Identify the mission, major internal functions and structure of manufacturing businesses.
   c. Identify the customers, suppliers, and stakeholders of manufacturing businesses, their roles, and how they relate.
   d. Explain the major competitive challenges faced by the manufacturing businesses.
   e. Identify and describe types of manufacturing systems.
   f. Analyze current trends in manufacturing systems.
2. Performance Element - Describe how manufacturing businesses manage performance.
   Sample Indicators:
   a. Explain how financial performance is measured.
   b. Explain how market performance is gauged.
   c. Explain how service and internal operations performance is determined.
   d. Explain how compliance and performance related to health, safety, and environment are evaluated.
3. Performance Element - Describe how changes outside the manufacturing business impact the manufacturing business.
   Sample Indicators:
   a. Explain the impact of economic changes.
   b. Explain the impact of social changes.
   c. Explain the impact of technological changes.
4. Performance Element - Explain the role of risk management in reducing risks and improving performance in manufacturing businesses.
   Sample Indicators:
   a. Explain the objectives of risk management programs.
   b. Explain the major types of loss exposure for manufacturing businesses.
   c. Explain the approaches for managing organizational risks.
5. Performance Element - Identify the roles and functions of government in regulating and supporting manufacturing businesses.
   Sample Indicators:
   a. Explain the roles in regulating domestic operations.
   b. Explain the roles in regulating international operations.
   c. Explain the roles in managing the infrastructures of manufacturing businesses.
   d. Explain the roles in health, safety, and environmental management.

MNC05.02 Analyze and summarize how manufacturing businesses improve performance to demonstrate an understanding of various methods for enhancing production.

1. Performance Element - Describe how manufacturing businesses manage customer relationships.
   Sample Indicators:
   a. Identify needs and requirements of internal and external customers.
   b. Describe customer satisfaction and fulfillment of customer requirements.
   c. Explain how manufacturing businesses respond to customer problems and complaints.
2. Performance Element - Describe how planning and budgeting are used to accomplish organizational goals and objectives.
   Sample Indicators:
   a. Explain how work plans and budgets are used to allocate people and resources.
   b. Identify reports used to track performance and resource and explain how they are used.
   c. Explain how plans and budgets are revised to meet goals and objectives.
3. Performance Element - Explain how planning is used to improve overall business performance.
   Sample Indicators:
   a. Identify and describe the most critical performance problems that manufacturing businesses typically face.
   b. Describe how improvements are identified.

MNC06 Safety, Health and Environmental

Understand the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance. Follow organizational policies and procedures and contribute to continuous improvement in performance and compliance.

MNC06.01 Maintain safe and healthy working conditions and environment to ensure employee safety.

1. Performance Element - Assess workplace conditions according to specified safety and health requirements.
   Sample Indicators:
   a. Identify the types of risk of injury/illness at work.
   b. Identify those who are susceptible to risk of injury/illness at work.
   c. Describe ways to positively impact occupational safety and health.

MNC06.02 Understand employee rights and responsibilities and employer obligations concerning occupational safety and health.

1. Performance Element - Demonstrate knowledge of rules and laws designed to promote safety and health and their rationale.
   Sample Indicators:
   a. Identify key rights of employees related to occupational safety and health.
   b. Identify the responsibilities of employers related to occupational safety and health.
   c. Explain the role of government agencies in providing a safe workplace.

MNC06.03 Assess types and sources of workplace hazards in order to maintain safe working conditions in a manufacturing business environment.

1. Performance Element - Demonstrate methods to correct common hazards following appropriate safety procedures.
   Sample Indicators:
   a. Identify and describe common hazards in the workplace.
   b. Identify and describe major sources of information about hazards in the workplace (e.g., MSDS, work procedures, exposure control plans, training materials, labels, and signage).
   c. Identify sources of combustible/flammable materials, fire and emergencies to establish a fire safe environment.
   d. Interpret safety signs and symbols.

MNC06.04 Control workplace hazards in order to maintain safe working conditions in a manufacturing business environment.

1. Performance Element - Demonstrate safe workplace practices that promote personal and group health.
   Sample Indicators:
   a. Identify procedures necessary for maintaining a safe work area.
   b. Identify methods to correct common hazards.
   c. Identify methods for disposing of hazardous materials.
   d. Demonstrate principles of safe physical movement to avoid slips, trips, and spills.
   e. Inspect and use protective equipment (PPE).

MNC06.05 Summarize safety, health, and environmental management systems to build an understanding of compliance with governmental policies and procedures for manufacturing businesses.

1. Performance Element - Identify the major federal and state regulatory areas.
   Sample Indicators:
   a. Identify specific health and safety laws and regulations that impact manufacturing and the major topics they address.
   b. Identify specific environmental management laws and regulations and the major topics they address.
2. Performance Element - Explain how government agencies ensure compliance with environmental regulations and promote improved performance.
   Sample Indicators:
   a. Provide examples of the major regulations and types of data used by government to measure and monitor performance.
   b. Provide examples of how manufacturing organizations ensure their compliance.
   c. Provide examples of consequences that manufacturing organizations suffer when they fail to comply.
3. Performance Element - Demonstrate workplace activities that comply with safety, health, and environmental policies and procedures.

Sample Indicators:

a. Promote and maintain knowledge of organizational safety, health, and environmental management policies and procedures.
b. Follow organizational policies and procedures.
c. Educate and orient other workers.
d. Maintain a safe work area.
e. Identify, describe, and report workplace hazards.
f. Perform and participate in regular audits and inspections.
g. Provide and maintain documentation needed for compliance.
h. Conduct and participate in accident/incident investigations.

4. Performance Element - Develop plans to improve safety performance.
   Sample Indicator:
   a. Use a structured problem-solving process to develop improvement plans.

MNC07 Leadership and Teamwork

Use leadership and teamwork skills in collaborating with others to accomplish organizational goals and objectives. No additional statements in this topic beyond those found in the Essential Knowledge and Skills Chart.

MNC08 Ethics and Legal Responsibilities

Know and understand the importance of professional ethics and legal responsibilities. No additional statements in this topic beyond those found in the Essential Knowledge and Skills Chart.

MNC09 Employability and Career Development

Know and understand the importance of employability skills. Explore, plan, and effectively manage careers. Know and understand the importance of entrepreneurship skills. No additional statements in this topic beyond those found in the Essential Knowledge and Skills Chart.

MNC10 Technical Skills

Use the technical knowledge and skills required to pursue the targeted careers for all pathways in the career cluster, including knowledge of design, operation, and maintenance of technological systems critical to the career cluster.

MNC10.01 Describe and employ technical skills and knowledge required for careers in manufacturing in order to perform basic workplace activities common to manufacturing.

1. Performance Element - Demonstrate the planning and layout processes (e.g., designing, print reading, measuring) used in manufacturing.
   Sample Indicator:
   a. Read prints and use the information to play, lay out, and produce parts or products.
2. Performance Element - Summarize how materials can be processed using tools and machines.
   Sample Indicator:
   a. Use tools and the processes of cutting, shaping, combining, forming, etc. of materials to manufacture a part or product.
3. Performance Element - Describe various types of assembling processes (e.g., mechanical fastening, mechanical force, joining, fusion bonding, adhesive bonding) used in manufacturing.
   Sample Indicator:
   a. Apply appropriate fastening or joining procedure to the design and production of a manufactured part or product.
4. Performance Element - Explain finishing processes (e.g., types of finishing materials, surface preparation, methods of application) used in manufacturing.
   Sample Indicators:
   a. Select a finishing process for a product appropriate to the job it must perform environment in which it functions, and its aesthetic appeal.
5. Performance Element - Explain the processes of inspection and quality control used in manufacturing.
   Sample Indicators:
   a. Perform continuous on line inspections to ensure that parts or products meet design specifications.

Mississippi College- and Career-Readiness Standards (MS CCRS)
Algebra I

	Units																					
Standards	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**
N-RN.3																						
N-Q.1		X		X																		
N-Q.2		X		X																		
N-Q.3		X		X																		
A-SSE.1					X	X																
A-SSE.2					X	X																
A-SSE.3													X									
A-APR.1											X											
A-APR.3											X											
A-CED.1							X															
A-CED.2							X															
A-CED.3																						
A-CED.4																						
A-REI.1											X											
A-REI.3			X								X											
A-REI.4											X											
A-REI.5																						
A-REI.6																						
A-REI.10																						
A-REI.11																						
A-REI.12																						
F-IF.1	X												X									
F-IF.2	X												X									
F-IF.3	X																					
F-IF.4							X							X	X							
F-IF.5														X							X	
F-IF.6							X								X	X						
F-IF.7																	X					
F-IF.8																						
F-IF.9																						
F-BF.1																	X					
F-BF.3																					X	
F-LE.1																		X			X	
F-LE.2																					X	
F-LE.5																						
S-ID.1																			X			
S-ID.2																			X			
S-ID.3																			X			
S-ID.5																						
S-ID.6																						
S-ID.7																						
S-ID.8																					X	
S-ID.9																						

Number and Quantity

The Real Number System (N-RN)

N-RN.3 Explain why the sum or product of two rational numbers is rational; the sum of a rational number and an irrational number is irrational; and the product of a nonzero rational number and an irrational number is irrational.

Quantities (N-Q)

N-Q.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

N-Q.2 Define appropriate quantities for the purpose of descriptive modeling.

N-Q.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

Algebra

Seeing Structure in Expressions (A-SSE)

A-SSE.1 Interpret expressions that represent a quantity in terms of its context.

A-SSE.2 Use the structure of an expression to identify ways to rewrite it.

A-SSE.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

Arithmetic with Polynomials and Rational Expressions (A-APR)

A-APR.1 Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.

A-APR.3 Identify zeros of polynomials when suitable factorizations are available and use the zeros to construct a rough graph of the function defined by the polynomial (limit to 1st- and 2nd-degree polynomials).

Creating Equations (A-CED)

A-CED.1 Create equations and inequalities in one variable and use them to solve problems.

A-CED.2 Create equations in two variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

A-CED.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context.

A-CED.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

Reasoning with Equations and Inequalities (A-REI)

A-REI.1 Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

A-REI.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

A-REI.4 Solve quadratic equations in one variable.

A-REI.5 Given a system of two equations in two variables, show and explain why the sum of equivalent forms of the equations produces the same solution as the original system.

A-REI.6 Solve systems of linear equations algebraically, exactly, and graphically while focusing on pairs of linear equations in two variables.

A-REI.10 Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

A-REI.11 Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, quadratic, absolute value, and exponential functions.

A-REI.12 Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

Functions

Interpreting Functions (F-IF)

F-IF.1 Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).

F-IF.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

F-IF.3 Recognize that sequences are functions whose domain is a subset of the integers.

F-IF.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.

F-IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.

F-IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

F-IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

F-IF.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

F-IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions.)

Building Functions (F-BF)

F-BF.1 Write a function that describes a relationship between two quantities.

F-BF.3 Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs.

Linear, Quadratic, and Exponential Models (F-LE)

F-LE.1 Distinguish between situations that can be modeled with linear functions and with exponential functions.

F-LE.2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

F-LE.5 Interpret the parameters in a linear or exponential function in terms of a context.

Functions Statistics and Probability

Interpreting Categorical and Quantitative Data (S-ID)

S-ID.1 Represent and analyze data with plots on the real number line (dot plots, histograms, and box plots).

S-ID.2 Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.

S-ID.3 Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

S-ID.5 Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.

S-ID.6 Represent data on two quantitative variables on a scatter plot and describe how the variables are related.

S-ID.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.

S-ID.8 Compute (using technology) and interpret the correlation coefficient of a linear fit.

S-ID.9 Distinguish between correlation and causation.

Appendix D: SkillsUSA Competition Crosswalk

	Units																				
SkillsUSA Competitions	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**
Additive Manufacturing					X			X	X					X						X	X	
Architectural Drafting								X						X							X	
Automated Manufacturing Technology								X						X	X			X	X	X	X	X
Cabinetmaking		X			X	X	X		X		X											
Career Pathways – Industrial & Engineering Tech			X	X								X									X	X
Carpentry		X				X	X	X	X		X											
CNC 2–Axis Turning Programmer								X						X	X					X		
CNC 3–Axis Milling Programmer								X						X	X					X		
CNC 5–Axis Milling Programmer								X						X	X					X		
CNC Programmer								X						X	X					X		
Computer Programming															X			X	X		X	
Customer Service			X																			X
Electrical Construction Wiring		X							X				X	X		X						
Electronics Technology														X	X		X					
Employment Application Process			X																			X
Engineering Technology – Design					X			X						X						X	X	
Extemporaneous Speaking			X	X																		X
Industrial Motor Control													X		X		X	X				
Information Technology Services															X			X	X		X	
Internet of Things (IOT) Smart Home															X			X	X		X	
Job Interview			X																			X
Job Skill Demonstration A						X	X		X	X	X			X			X			X		
Job Skill Demonstration A/Open						X	X		X	X	X			X			X			X		
Job Skill Demonstration Open														X	X		X	X	X		X	

Mechatronics					X																
Mobile Robotics Technology		X		X									X							X	
Occupational Health and Safety		X		X									X								
Occupational Health and Safety – Multiple/Single			X	X																	
Opening and Closing Ceremonies						X	X		X				X	X							
Sheet Metal		X							X	X			X	X						X	
Welding									X	X			X	X						X	
Welding Fabrication				X					X	X										X	
Welding Sculpture					X			X	X					X					X	X	

National SkillsUSA Conferences High School Competitive Events: 2025-2026

1. **Additive Manufacturing** (includes Middle School)**:** Additive manufacturing, also known as 3D Printing, embraces a wide range of materials and derivative processes to build parts suitable for end-use service. The virtually unlimited design freedom enabled by additive manufacturing allows for the creation of shapes and the integration of feature and function that previously required sub-assemblies. Employment opportunities for design engineers are growing as the industry adopts additive manufacturing methods and applies the practice to various parts of their business from prototyping to end use parts.
2. **Architectural Drafting:** Competitors will use their drafting skills to solve an architectural problem. The competition includes a written test, a hand sketch, and drawings that are either computer-generated or board drafted. The competition evaluates the competitors' problem-solving abilities, not simply CAD skills.
3. **Automated Manufacturing Technology:** This competition assesses teams on their readiness for employment in automated manufacturing environments, emphasizing their approach to design, manufacturing, and problem-solving within a realistic production workflow. Each team will complete a full cycle of production involving Computer-Aided Design (CAD), Computer-Aided Manufacturing (CAM), and Computer Numerical Control (CNC) precision machining of a component. The CAD operator is responsible for creating the part geometry, the CAM operator develops the tool paths, and the machinist sets up and operates the CNC machine to produce the part. Teams are evaluated on the entire design-to-production process, including documentation, work efficiency, accuracy, and adherence to industry standards and practices.
4. **Cabinetmaking:** Competitors build a small cabinet or piece of furniture from the supplied materials and drawings. Competitors are expected to read the drawings, lay out, create a cut list, and cut the parts using a variety of tools including, but not limited to, the following: table saw, miter saw, drill, hinge boring machine, and various hand tools. The parts must be accurately assembled, sanded, and adjusted to tolerances specified by the judges.
5. **Career Pathways – Industrial and Engineering Technology:** Student teams use their course of study as the basis of a project that will benefit their class, school, community or industry. The project must highlight an aspect of their Career Cluster training. Upon completion of the project, the students will develop a display and use it within the community to explain their training and project. This competition will judge mastery of their training, its application, the project's benefit to their community, and display and presentation techniques. Teams must be entered in the appropriate Career Pathways - Industrial and Engineering Technology based on the course enrollment of the students (not on the content of the project). The following career clusters are represented in this competition: Architecture and Construction; Manufacturing; Science, Technology, Engineering, and Mathematics; and Transportation Distribution and Logistics.
6. **Carpentry:** Competitors frame walls using wood and/or steel studs, cut and install rafters, gable end overhangs, fascia board and soffit installation, install sheathing and/or exterior siding and trim. Demonstration of knowledge of stair construction is required. Competitors will be judged on accuracy, ability to read and interpret blueprints, workmanship, safety, and the proper use of tools, equipment, and materials.
7. **CNC 2–Axis Turning Programmer:** This competition evaluates each competitor's ability to independently plan and program jobs for CNC (Computer Numerical Control) turning centers and provide instructions for operators to execute. Competitors program part features and generate NC code using CAM software, troubleshoot G-code programming errors, interpret prints (including geometric dimensioning and tolerancing or GD&T), measure/gauge parts, and demonstrate their theoretical knowledge of CNC turning center configuration, setup, and operation.
8. **CNC 3–Axis Milling Programmer:** This competition evaluates each competitor's ability to independently plan and program jobs for CNC (Computer Numerical Control) milling machines and provide instructions for operators to execute. Competitors program part features and generate NC code using CAM software, troubleshoot G-code programming errors,

interpret prints (including geometric dimensioning and tolerancing or GD&T), measure/gauge parts, and demonstrate their theoretical knowledge of CNC milling machine configuration, setup, and operation.

9. **CNC 5–Axis Milling Programmer:** This competition evaluates each competitor's ability to independently plan and program jobs for 5-Axis CNC (Computer Numerical Control) milling machines and provide instructions for operators to execute. Competitors program part features and generate NC code using CAM software, troubleshoot G-code programming errors, interpret prints (including geometric dimensioning and tolerancing or GD&T), measure/gauge parts, and demonstrate their theoretical knowledge of 5-Axis CNC milling machine configuration, setup, and operation.
10. **CNC Programmer:** This competition evaluates each competitor's ability to independently plan and program jobs for 2-Axis CNC (Computer Numerical Control) turning centers and 3-Axis CNC milling machines and provide instructions for operators to execute. Competitors program part features and generate NC code using CAM software, troubleshoot G-code programming errors, interpret prints (including geometric dimensioning and tolerancing or GD&T), measure/gauge parts, and demonstrate their theoretical knowledge of CNC turning center and milling machine configuration, setup, and operation.
11. **Computer Programming:** Competitors demonstrate knowledge of computer programming, describe how programs and programming languages work, and describe the purposes and practices of structured programming. The competition may include a computer programming problem consisting of background information and program specifications. An appropriate (successfully executable) computer program from design notes and instructions will be developed.
12. **Customer Service:** The competition evaluates students' proficiency in providing customer service. The competition involves live role-playing situations. Competitors demonstrate their ability to perform customer service in both written and oral forms including telephone and computer skills, communications, problem solving, conflict resolution, and business etiquette.
13. **Electrical Construction Wiring:** Competitors are required to complete a written test of questions formulated from the latest edition of the National Electric Code (NEC), a practical conduit bending exercise, and hands-on installation of a conduit system, cabling system, and wiring devices. Working from drawings and specification sheets, competitors are required to install an electrical system common in most residential and light commercial projects. Judging is based on general workmanship, accuracy of layout and installation, and adherence to the current NEC and standard industry safe practices.
14. **Electronics Technology:** The competition is divided into sections: customer service exam, written exam, soldering, breadboarding, and troubleshooting. Competitors demonstrate their knowledge of analog and digital circuitry; ability to troubleshoot electronic circuits; ability to construct and test experimental circuits; and ability to design and select circuit components. All aspects of the competition test competitors' abilities to use and calibrate electronic equipment, record and organize data, and demonstrate proper safety practices.
15. **Employment Application Process:** This competition tests the competitor's readiness in applying for employment and their understanding of the process. The competition includes completing an application and interviewing with the judges. Their resume and portfolio are used during their interviews. The competition is available to students who are classified under the provisions of Public Law 105-17, Individuals with Disabilities Education Act, 1997.
16. **Engineering Technology – Design** (includes Middle School)**:** (Team of 3) Students demonstrate their ability to design an innovative engineering project and present those ideas along with a display and live model. During the presentation, students are judged on their performance as a professional team, presentation of their project to a panel of judges from the engineering field, their storyboard presentation model, and the overall effect of the presentation.
17. **Extemporaneous Speaking** (includes Middle School)**:** The competition requires competitors to give a three- to five-minute speech on an assigned topic with five minutes of advance preparation. Competitors enter the preparation area one at a time, where they are given a speech topic. They are judged on voice, mechanics, platform deportment, organization, and effectiveness.
18. **Industrial Motor Control:** Students demonstrate their knowledge of electrical principles, equipment, and industry codes and standards as it relates to the design and installation of motor control systems. Students demonstrate their skills and abilities in applying that knowledge by properly installing motor control equipment and associated enclosures, raceways, pilot devices, and circuitry in accordance with accepted industry practice and National Electric Code requirements.
19. **Information Technology Services:** Competitors demonstrate their skills with hands-on modules designed to test their knowledge as an IT service professional. The competition challenges competitors to correct end-user computing issues, configure and secure networks, manage virtual machines, navigate and modify operating system internals, deploy operating systems, leverage troubleshooting software and tools, identify virus and malware origins, work with mobile devices, and proficiently use command line interfaces. The operating systems used in the competition include Windows, Macintosh, and Linux. Additionally, competitors are evaluated on their interpersonal skills (such as communication, teamwork, and professionalism). Competitors will take a written exam which is aligned with CompTIA A+; the industry standard certification for Information Technology.
20. **Internet of Things (IOT) Smart Home:** The competition tests each competitor's preparation for employment and recognizes outstanding students for excellence and professionalism in the field of home technology integration. The competitors will complete both a written test and hands on demonstration of the installation of smart home residential products including bulbs; thermostats; locks; alarms; sensors; cameras; speakers; home theater systems; computer

networking; and video security equipment. Construction of the various interconnecting cables such as cat 6/networking cables, coax cables and low and high voltage residential wiring will also be necessary. The competition will challenge competitors to configure and secure networks, update firmware/software and configure operating system settings. Troubleshooting skills will also be tested. Finally, the competition requires a demonstration of all hardware software set up, completed in an easy-to-understand manner fit for the typical customer.

21. **Job Interview:** Competitors are evaluated on their understanding of employment procedures faced in applying for positions in the occupational areas in which they are training. The competition is divided into phases, including the following: completion of employment application; introduction scenario with a receptionist; and an in-depth interview(s).
22. **Job Skill Demonstration A** (includes Middle School)**:** Competitors demonstrate and explain an entry-level skill used in the occupational area for which they are training. The competition requires a demonstration performing an occupational skill accompanied by a clear explanation of the topic using experiments, displays or practical operations.
23. **Job Skill Demonstration Open** (includes Middle School)**:** Competitors demonstrate and explain an entry-level technical skill used either in the occupational area for which he or she is training or outside the training area. The competition requires a demonstration performing an occupational skill accompanied by a clear explanation of the topic using experiments, displays or practical operations.
24. **Mechatronics:** The competition requires competitors to have the ability to understand complex systems that integrate various elements in the mechanical, fluid power and controls domain, combined with the ability to work in a team environment with people with different areas of expertise. Mechatronic specialists must have well developed skills in pneumatic technology, electrical and electronics systems, mechanical systems, and general automation techniques and practices, including systematic troubleshooting methods. This competition consists of events designed to measure the skills required in the modern automated manufacturing environment. Competitors are required to assemble, adjust and test an automated machine system, troubleshoot and repair a faulty machine system, and take a comprehensive written test. The competition elements have been designed to be as realistic as possible, closely resembling the tasks and activities of modern automation professionals. In addition, there is an individual oral interview. Teams are required to provide their own PLC that will be used in the construction phase.
25. **Mobile Robotics Technology** (includes Middle School)**:** (Team of 2) The competition includes activities that simulate situations encountered by robotic programmers and support professionals. Teams are given a task to solve using a mobile robotic system that is built ahead of time and brought to the competition. Teams will have two scored chances to solve the mobile robotic challenge and will be given a design and programming interview. Once a team has performed the required task or set of tasks, a design change may be introduced. Competitors are required to adhere to industry safety standards using the hardware and software they have selected.
26. **Occupational Health and Safety – Multiple:** Competitors demonstrate the safety and health endeavors of their respective career and technical education programs by assembling a scrapbook that highlights important programs, activities and events related to their school's health and safety program. The competition encourages chapters to be active in all aspects of SkillsUSA. The health and safety activities of the chapters will be evaluated on the planning, organization and outcome of four projects. Students are interviewed and portfolios are scored by a panel of judges based on the quality and content of the books and on the candidates' presentation during the interview process. Multiple refers to a SkillsUSA chapter entry that represents more than one occupational program. There must be at least one member from each program on the Health and Safety Committee.
27. **Occupational Health and Safety – Single:** Competitors demonstrate the safety and health endeavors of their respective career and technical education programs by assembling a scrapbook that highlights important programs, activities and events related to their school's health and safety program. The competition encourages chapters to be active in all aspects of SkillsUSA. The health and safety activities of the chapters will be evaluated on the planning, organization and outcome of four projects. Students are interviewed and portfolios are scored by a panel of judges based on the quality and content of the books and on the candidates' presentation during the interview process. Single refers to a SkillsUSA chapter that represents one occupational area.
28. **Opening and Closing Ceremonies** (includes Middle School)**:** (Team of 7) This teamwork and oral presentation competition evaluates a team's understanding of the symbolic representation of the colors and assembled parts of the SkillsUSA emblem. Each team includes seven registered members in the roles of president, vice president, parliamentarian, reporter, treasurer, secretary and historian.
29. **Sheet Metal:** Competitors are evaluated on their ability to perform such jobs as connecting sheet metal pieces with drive cleats, spot welding and riveting. Skills tested may include, but are not limited to, straight duct, transition fitting and 45-degree entry tap fitting. Professional sheet metal workers judge competitors on the use of hand tools, correctness of layout and shop safety procedures. Competitors are judged on accuracy, completeness and craftsmanship.
30. **Welding:** Competitors receive competition drawings and a set of welding procedure specifications that conform to the latest edition of the American Welding Society standards. At a series of stations, competitors are tested on various aspects of welding: measuring weld replicas, using weld measuring gauges; laying out a plate and using oxy-acetylene equipment to cut several holes that are checked for accuracy and quality; gas metal arc welding (GMAW) on steel making welds in

various positions using short circuiting transfers; flux cored arc welding (FCAW) using a shielding gas, making welds in various positions and, using a combination machine capable of providing the correct welding current for shielded metal arc (SMAW) and gas tungsten arc welding (GTAW). Competitors complete the steel project and weld an aluminum project in various positions using a variety of filler metals.

31. **Welding Fabrication:** This competition requires a team of three students to use their welding and fabrication skills to build a designed project from the provided material. The project is constructed by the competitors based on provided prints. Teams should be skilled in the following welding and cutting processes: SMAW, GTAW, GMAW, FCAW / OFC and PAC. The students are also required to be proficient in using common tools of a workshop.
32. **Welding Sculpture:** Competitors demonstrate their ability to design and produce a welded sculpture and to describe all aspects of the creation of their design. Welded sculptures are displayed for the national competition along with a professional portfolio documenting evidence of creating the original work. Each participant is interviewed regarding the design and creation of the piece. The introduction of an onsite welding component will be demonstrated in the 2023 competition and scored in 2024.

Appendix E: Technology Student Associations (TSA) Competition Crosswalk

	Units																				
Standards	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**
Architectural Design								X						X						X	X	
Animatronics								X						X		X		X	X			
Audio Podcasting			X	X																		X
Biotechnology Design					X						X										X	
Board Game Design			X		X			X														
Chapter Team			X	X																		X
Coding															X	X		X	X			
CAD, Architecture								X					X							X		
CAD, Engineering								X						X						X		
Data Science & Analytics			X		X																X	
Debating Technological Issues			X	X																		X
Dragster Design					X			X						X						X		
Drone Challenge (UAV)								X								X		X	X	X		
Engineering Design					X			X						X						X	X	
Extemporaneous Speech			X	X																		X
Fashion Design & Technology					X			X												X		
Flight Endurance					X			X						X						X		
Future Technology Teacher			X	X				X														X
Manufacturing Prototype								X	X					X						X	X	
Robotics								X							X	X		X	X			
Senior Solar Sprint					X									X		X				X	X	
Software Development								X										X				
Structural Design & Engineering					X			X						X						X	X	

System Control Technology															X	X		X	X	X		
Technology Bowl			X	X	X			X								X					X	
Technology Problem Solving					X			X	X					X						X	X	
Transportation Modeling					X			X						X						X		
Virtual Reality Simulation (VR)			X					X	X											X	X	

National Technology Student Association (TSA) Conferences
High School Competitive Events: 2025-2026

1. **Architectural Design:** In response to the annual design challenge, participants develop a set of architectural plans and related materials, and construct both a physical and computer-generated model to accurately depict their design. Semifinalists deliver a presentation and participate in an interview.
2. **Animatronics:** To address the annual design challenge, participants exhibit and demonstrate their knowledge of mechanical and control systems by creating an animatronic device with a specific purpose (i.e., communicate an idea, entertain, demonstrate a concept, etc.) that includes sound, lights, and an appropriate surrounding environment (a display).
3. **Architectural Design:** In response to the annual design challenge, participants develop a set of architectural plans and related materials, and construct both a physical and computer-generated model to accurately depict their design. Semifinalists deliver a presentation and participate in an interview.
4. **Audio Podcasting:** Participants use digital audio technology to create original content for a podcast piece that addresses the annual theme. The podcast must feature high level storytelling techniques, voice acting, and folly sound effects; the full entry must include documentation of the podcast development process and elements. Semifinalists participate in an interview.
5. **Biotechnology Design:** Participants select a contemporary biotechnology problem that addresses the annual theme and demonstrates understanding of the topic through documented research, the development of a solution, a display (including an optional model or prototype), and an effective multimedia presentation. Semifinalists deliver a presentation and participate in an interview.
6. **Board Game Design:** Participants develop, build, and package a board game that focuses on a subject of their choice. Creative packaging, and the instructions, pieces, and cards associated with the pilot game will be evaluated. Semifinalists set up the game, demonstrate how the game is played, explain the game's features, and discuss the design process.
7. **Chapter Team:** Participants take a parliamentary procedure test to qualify for the semifinal round of competition. Semifinalists conduct an opening ceremony, items of business, parliamentary actions, and a closing ceremony.
8. **Coding:** Participants take a test, which concentrates on aspects of coding, to qualify for the semifinal round of competition. Semifinalists develop a software program – in a designated amount of time – that accurately addresses an onsite problem.
9. **Computer-Aided Design (CAD), Architecture:** Participants use complex computer graphic skills, tools, and processes to respond to a design challenge in which they develop representations of architectural subjects, such as foundation and/or floor plans, and/or elevation drawings, and/or details of architectural ornamentation or cabinetry. The solution to the design challenge and participant answers in an interview are evaluated.
10. **Computer-Aided Design (CAD), Engineering:** Participants use complex computer graphic skills, tools, and processes to respond to a design challenge in which they develop three-dimensional representations of engineering subjects, such as a machine part, tool, device, or manufactured product. The solution to the design challenge and participant answers in an interview are evaluated.
11. **Data Science and Analytics:** Participants identify a societal issue, collect or compile data from various sources about the issue, and then produce documentation and a digital scientific poster about their findings. Semifinalists create a synopsis and digital visual representation of a data set provided in an onsite challenge.
12. **Debating Technological Issues:** Participants research the annual topic and subtopics and prepare for a debate against a team from another chapter. Teams are instructed to take either the pro or con side of a selected subtopic, submit a summary of references, and use their research to support their assigned position. The quality of a team's debate determines semifinalists and finalists.

13. **Dragster Design:** Participants design, draw, and construct a CO2-powered dragster that adheres to specifications, design and documentation requirements, and the annual theme. Semifinalists compete in a double-elimination race and participate in an interview.
14. **Drone Challenge (UAV) :** Participants design, build, assemble, document, and test fly an open-source Unmanned Aerial Vehicle (UAV) according to the stated annual theme/problem specifications. The required documentation portfolio must include elements such as a photographic log, wiring schematics, and a description of the programming software used. Semifinalists participate in an interview.
15. **Engineering Design:** Participants develop a solution to an annual theme that is based on a specific challenge noted by the National Academy of Engineering (NAE) in its compilation of the grand challenges for engineering in the 21st century. The solution will include a documentation portfolio, a display, and a model/prototype. Semifinalists deliver a presentation and participate in an interview.
16. **Extemporaneous Speech:** Participants select a technology-related or TSA topic from among three topic cards and prepare and give a three-to-five-minute speech that communicates their knowledge of the chosen topic. The quality of the speech determines advancement to the semifinalist level of competition, for which an identical competition procedure is followed to determine finalists.
17. **Fashion Design and Technology:** To address the annual theme, participants demonstrate expertise in fashion design principles by creating a wearable garment, garment patterns, and a documentation portfolio. Semifinalist teams present their garment designs (worn by team models), discuss the design process with evaluators, and respond to interview questions.
18. **Flight Endurance:** Participants design, build, fly, and adjust (trim) a rubber-band powered model aircraft to make long endurance flights inside a contained airspace. Documentation (including elements such as attributes of the model design, drawings, and an analysis of the trim modifications), an inspection of the model and the required model flight box, and official times for two flights are aspects of the evaluation.
19. **Future Technology Teacher:** Participants research a developing technology, prepare a video showing an application of the technology in the classroom, and create a lesson plan/activity that features the application and connects to the Standards for Technological and Engineering Literacy (STEL), as well as STEM initiatives and integration. Semifinalists demonstrate the lesson plan and answer questions about their presentation.
20. **Manufacturing Prototype:** Participants design, fabricate, and use Computer Integrated Manufacturing (CIM) to create a product that addresses the annual theme. A documentation portfolio and the completed product prototype are submitted for evaluation. Semifinalists give a product "sales pitch" and demonstration.
21. **Robotics:** Participants design, build, document, and test a robot assembled using open-sourced parts according to stated specifications and to meet the challenge of the yearly theme/problem.
22. **Senior Solar Sprint:** The Senior Solar Sprint (SSS) competition is managed by TSA. Students apply scientific understanding, creativity, experimentation, and teamwork to design, build, and race a model solar vehicle that carries a payload; documentation of the process is required. Students must register via an Army Educational Outreach Program (AEOP) portal to participate and begin the SSS journey.
23. **Software Development:** Participants use their knowledge of cutting-edge technologies, algorithm design, problem-solving principles, effective communication, and collaboration to design, implement, test, document, and present a software development project of educational or social value. Both semifinalists and finalists are determined based on the quality of the presentation and project.
24. **Structural Design and Engineering:** Participants apply the principles of structural engineering to design and construct a structure that complies with the annual challenge. An assessment of the required documentation and the destructive testing of the structure (to determine its design efficiency) determine both semifinalists and finalists.
25. **System Control Technology:** Participants develop a solution to a problem (typically one from an industrial setting) presented onsite at the conference. They analyze the problem, build a computer-controlled mechanical model, program the model, demonstrate the programming and mechanical features of the model-solution in an interview, and provide instructions for evaluators to operate the model.
26. **Technology Bowl:** Participants demonstrate their knowledge of TSA and concepts addressed in technology content standards by completing an objective test. Semifinalist teams participate in a question/response, head-to-head, team competition.
27. **Technology Problem Solving:** Participants use problem-solving skills to design and construct a finite solution to a challenge provided onsite at the conference. Solutions are evaluated at the end of 90 minutes using measures appropriate to the challenge, such as elapsed time, horizontal or vertical distance, and/or strength.
28. **Transportation Modeling:** Participants research, design, and produce a scale model of a vehicle that complies with the annual design problem. A display for the model and a documentation portfolio – containing elements such as a description of the vehicle, photographs and commentary detailing the vehicle production, and technical illustrations – are required. Semifinalists participate in an interview.

29. **Virtual Reality Simulation (VR) :** Participants use video and 3D computer graphics tools and design processes to create a two-to-three-minute VR visualization (accompanied by supporting documentation) that addresses the annual theme. Semifinalists deliver a presentation about their visualization and participate in an interview.

Appendix F: SACA C-101 Certified Industry 4.0 Associate-Basic Operations Skill Standards

	Units																					
Standards	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
101.1.1	X											X			X	X		X	X	X	X	
101.1.2	X											X			X			X	X	X		
101.1.3	X											X			X			X	X		X	
101.1.4	X			X	X				X		X	X									X	X
101.1.5																			X			
101.2.1	X	X		X		X	X		X	X		X	X			X	X		X			X
101.2.2		X				X	X		X	X			X			X	X		X			
101.2.3		X								X			X									
101.2.4		X	X			X	X		X	X			X			X	X					X
101.2.5		X							X	X												
101.2.6		X							X	X												
101.2.7		X					X						X			X						
101.2.8	X	X	X				X					X	X									X
101.3.1					X				X		X			X								
101.3.2					X				X					X						X		
101.3.3					X				X		X			X								
101.3.4					X				X					X								
101.3.5	X				X			X	X			X		X						X		X
101.3.6				X	X	X	X		X		X			X								
101.4.1								X	X		X			X								
101.4.2								X	X					X								
101.4.3								X	X					X						X		
101.4.4								X						X								
101.4.5	X			X				X	X		X	X										X
101.4.6								X						X						X		
101.4.7								X	X		X											
101.5.1					X								X		X					X		
101.5.2					X								X		X							
101.5.3					X		X						X		X					X		
101.5.4					X										X			X	X	X		
101.5.5	X			X	X							X			X				X	X	X	X
101.5.6															X			X		X		
101.6.1				X		X	X				X											X
101.6.2				X		X	X				X											X
101.6.3				X		X	X				X			X								X
101.7.1													X							X	X	
101.7.2	X		X	X		X	X					X	X							X	X	X
101.7.3					X								X			X						X
101.7.4						X	X									X		X		X		
101.7.5																X		X	X			
101.7.6													X				X					
101.7.7					X												X					

101.1 INDUSTRY 4.0 CONCEPTS 1

1. Identify Industry 4.0 components and their functions
   a. Performance Indicators:
      - Identify Industry 4.0 machine components and their functions
   b. Knowledge Indicators:
      - Define advanced manufacturing
      - Define Industry 4.0 and explain its impact
      - Describe the major elements of Industry 4.0 and IIoT
      - Describe emerging technologies in advanced manufacturing (additive, nano, and lightweight)
2. Identify types of automation and their functions
   a. Performance Indicators:
      - Identify machine automation systems and their functions
   b. Knowledge Indicators:
      - Describe types of automation and software used in Industry 4.0
      - Describe the basic functions and applications of PLC, Robots, CNC
      - Describe types of robots and their applications
3. Use a cloud-based maintenance notification and SCADA system
   a. Performance Indicators:
      - Respond to a maintenance notification using a mobile device
      - Use a cloud-based notification system to request maintenance
      - View production data using a mobile device
   b. Knowledge Indicators:
      - Describe basic cloud-based maintenance system functions
      - Describe basic cloud-based SCADA functions
4. Perform basic lean manufacturing functions
   a. Performance Indicators:
      - Identify types of manufacturing waste in an advanced manufacturing plant
      - Perform a 5S process
   b. Knowledge Indicators:
      - Define Lean Manufacturing
      - Describe the core elements of Lean Manufacturing
      - Define value-added and non-value-added activities
      - Describe the eight deadly wastes
      - Describe the steps of 5S
5. Identify basic robot elements
   a. Performance Indicators:
      - Identify the basic parts of a robot
      - Apply robot safety procedures
   b. Knowledge Indicators:
      - Describe the basic operation of a robot and simulation software
      - Describe the operation of a basic robot program
      - Describe two methods of programming robot points
      - Describe types of robot safety devices
      - Describe the function of collaborative robots

101.2 SAFETY

1. Apply workplace safety, health, and environmental regulations
   a. Performance Indicators:
      - Locate company safety regulations and policies

b. Knowledge Indicators:
   - Describe the safety roles and responsibilities of these organizations: OSHA, NIOSH, EPCRA, EPA, state safety agencies
   - Describe the safety responsibilities within a company
   - Describe how to create a culture of safety in the workplace

2. Identify and correct common workplace hazards
   a. Performance Indicators:
      - Identify types of workplace hazards for welding, NFPA 70E arc flash, electrical, fire, hazardous materials, steam and compressed air, hydraulics, general machines, sheet metal, combustibles, confined spaces, walkway, work area, ergonomics, material handling, hand tools, ladders, and platform
      - Apply hazard prevention guidelines to correct common hazards
   b. Knowledge Indicators:
      - Describe the basic process of a Job Safety Analysis (JSA)
3. Select and use a fire extinguisher
   a. Performance Indicators:
      - Select and use a fire extinguisher for a given fire type
   b. Knowledge Indicators:
      - Describe the elements of fire and four types of fires
      - Describe the operation of fire extinguisher types
4. Select and use personal protective equipment (PPE) for workplace functions
   a. Performance Indicators:
      - Select and use types of PPE for a given workplace task
   b. Knowledge Indicators:
      - Describe types of PPE
5. Locate and interpret safety data sheets (SDS)
   a. Performance Indicators:
      - Locate SDS sheets for a given material
      - Interpret the sections of a SDS
   b. Knowledge Indicators:
      - Describe the purpose of a SDS and its sections
6. Identify and safely handle and store hazardous materials
   a. Performance Indicators:
      - Interpret the HAZCOM labeling system
      - Interpret the NFPA and HMIS hazardous material ID systems
      - Interpret the DOT hazardous material ID system
   b. Knowledge Indicators:
      - Define three categories of hazardous materials
      - Describe handling and storing HAZMAT guidelines
      - Describe how to dispose of hazardous materials
      - Describe hazardous materials shipping guidelines
7. Perform a lockout tagout
   a. Performance Indicators:
      - Perform an electrical lockout tagout
      - Perform a pneumatic lockout tagout
   b. Knowledge Indicators:
      - Describe the purpose and steps of a lockout tagout (LOTO)
      - Describe how to test for a zero energy state
8. Respond to a workplace accident or emergency
   a. Performance Indicators:
      - Use an eyewash station
      - Respond/report to a workplace accident

- Locate a company emergency action plan

b. Knowledge Indicators:

- Describe types of workplace accidents
- Describe the categories of emergencies
- Describe the elements of an emergency action plan
- Describe how to respond to an emergency

101.3 QUALITY

1. Use a tape measure to measure dimensions
   a. Performance Indicators:
      - Position a tape measure to measure linear dimensions
      - Read a tape measure
   b. Knowledge Indicators:
      - Describe the operation/ construction of a tape measure
2. Use a machinist's rule to measure part dimensions
   a. Performance Indicators:
      - Position a machinist's rule to measure inside, outside, circular dimensions
      - Read an SI (metric), fraction inch, and decimal machinist's rule
   b. Knowledge Indicators:
      - Describe the units of measure found on an SI (metric), fraction inch, and decimal inch machinist's rule
3. Use dial and digital calipers to measure part dimensions
   a. Performance Indicators:
      - Zero and Read a dial caliper in SI and US Customary units
      - Zero and Read a digital caliper in SI and US Customary units
      - Position a caliper to measure inside, outside, circular dimensions
   b. Knowledge Indicators:
      - Describe the operation/ construction of a digital caliper
      - Describe the operation/ construction of a dial caliper
4. Use digital and Vernier micrometers to measure part dimensions
   a. Performance Indicators:
      - Read a Vernier micrometer in SI and US Customary units
      - Read a digital micrometer in SI and US Customary units
      - Check zero of an outside micrometer
      - Position an outside micrometer to measure rectangular and circular dimensions
      - Check calibration documentation of a measurement instrument
   b. Knowledge Indicators:
      - Describe the operation/ construction of a Vernier micrometer
      - Describe the operation/ construction of a digital micrometer
5. Determine if measured part dimensions meet specifications
   a. Performance Indicators:
      - Convert between SI fraction inch, and decimal US Systems
      - Convert conventional tolerances of circular and linear dimensions into part specification limits
      - Compare measured part dimensions of circular and linear part features to upper and lower limits on technical drawing
   b. Knowledge Indicators:
      - Define conventional tolerance system
      - Define linear measurement systems conversion factor
6. Select the best measurement tool for an application
   a. Performance Indicators:
      - Select a measurement tool for a given task
   b. Knowledge Indicators:

- Define accuracy, resolution, and repeatability
- Describe accuracy/ resolution of rules, calipers and micrometers
- Describe factors that affect measurement tool repeatability

101.4 TECHNICAL DRAWINGS

1. Interpret features in technical drawings
   a. Performance Indicators:
      - Interpret first angle and third angle multi-view drawings
      - Interpret views of a multi-view drawing
      - Interpret sectional and auxiliary views
      - Interpret exploded view assembly drawings
   b. Knowledge Indicators:
      - Define multi-view, assembly, and isometric technical drawings
      - Define the alphabet of lines and line precedence
2. Interpret multi-view drawing dimensions
   a. Performance Indicators:
      - Interpret part dimensions in multi-view drawings for linear, circular, angular, arcs and holes in SI and US Customary units
      - Determine measurement units from notes and title blocks
   b. Knowledge Indicators:
      - Describe guidelines for dimensioning drawings
3. Interpret conventional drawing tolerances
   a. Performance Indicators:
      - Interpret a conventional tolerance on a drawing of circular, angular, arc, and linear part dimensions in SI and US Customary units
      - Interpret a tolerance note in SI and US Customary Units
      - Determine the type of fit two parts have based on tolerances
   b. Knowledge Indicators:
      - Define types of fits, clearance, and allowance
      - Define baseline dimensioning and explain its benefit
      - Define maximum and minimum material conditions
4. Interpret a drawing scale
   a. Performance Indicators:
      - Determine actual part dimensions using a drawing and a rule
      - Determine scale of a drawing given actual part
   b. Knowledge Indicators:
      - Describe the formats of drawing scales and list common scales
5. Interpret drawing notes and information blocks
   a. Performance Indicators:
      - Interpret drawing notes
      - Interpret change, material and title blocks
      - Interpret surface finish symbols
   b. Knowledge Indicators:
      - Describe types of information found in title blocks, change blocks, material blocks, and tolerance blocks
6. Interpret basic geometric and dimensioning drawing tolerances
   a. Performance Indicators:
      - Interpret a basic feature control frame
   b. Knowledge Indicators:
      - Define types of basic geometric features and their symbols
      - Define geometric dimensioning and tolerancing
      - Define a datum

7. Interpret fastener drawings and specifications
    a. Performance Indicators:
        - Interpret UNS and SI thread specifications on drawings
    b. Knowledge Indicators:
        - Describe types and applications of threaded fasteners

101.5 MACHINE OPERATION

1. Locate and interpret machine reference documents
    a. Performance Indicators:
        - Locate and use a machine operation manual to perform standard startup/shutdown procedures, operating procedures, safety procedures, machine performance and setting specifications, and machine adjustment
        - Locate and use machine documentation to determine the recommended preventive maintenance schedule and lubrication.
    b. Knowledge Indicators:
        - Read and interpret machine reference documents
2. Apply machine operation safety procedures
    a. Performance Indicators
        - Identify and correct machine operation safety hazards
        - Install a machine guard
        - Locate machine safety devices
        - Interpret machine safety documentation
    b. Knowledge Indicators
        - Describe machine operation clothing safety
        - Describe machine operation safety guidelines
        - Describe types of machine guards
        - Describe machine interlock and emergency control operation
        - Describe pneumatic system safety guidelines
        - Describe hand tool safety guidelines
3. Start up and shut down a computer-controlled machine
    a. Performance Indicators:
        - Perform pre-startup inspection and safety check of machine
        - Connect an air hose and adjust air pressure to specified setting
        - Perform normal machine startup and planned shutdown
        - Perform machine halt, cycle stop, and emergency stop
    b. Knowledge Indicators:
        - Describe types of machine stop functions
4. Use an HMI panel to manually test machine operation
    a. Performance Indicators:
        - Use HMI panel to manually operate machine actuators
        - Use HMI panel to single-step a machine sequence
    b. Knowledge Indicators:
        - Describe the operation of an HMI panel
5. Operate and monitor a computer-controlled machine
    a. Performance Indicators:
        - Operate machine in automatic cycle, single cycle and continuous
        - Monitor HMI for correct machine operation
        - Monitor pressure, voltage, current, and temperature indicators
    b. Knowledge Indicators:
        - Define common production statistics of machine or system, including quantity produced, rejects, and cycle times
6. Interpret machine fault conditions and restart operation
    a. Performance Indicators:

- Clear faults and reset machine operation in response to alarm conditions on HMI
- Locate and interpret fault history on HMI menus

b. Knowledge Indicators:

- Describe types of machine alarm conditions

101.6 HAND TOOLS

1. Standard101.6.1 Use screwdrivers to assemble/disassemble/ tighten components
   a. Performance Indicators:
      - Select and use slotted screwdriver to tighten fasteners
      - Select and use Phillips screwdriver to tighten fasteners
   b. Knowledge Indicators:
      - Describe types of screwdrivers and their applications
      - Define screws and bolts and their applications
2. Use wrenches to assemble/disassemble/tighten components
   a. Performance Indicators:
      - Select and use hex key wrench to tighten fasteners
      - Select and use combination wrench to tighten fasteners
      - Select and use ratchet wrench to tighten fasteners
      - Select and use backup wrench to tighten fasteners
   b. Knowledge Indicators:
      - Describe common wrench types and their applications
3. Use a torque wrench to tighten a fastener
   a. Performance Indicators:
      - Use a click-type torque wrench to tighten a fastener to specified torque in N-M and foot-pounds
   b. Knowledge Indicators:
      - Describe the operation of a click-type torque wrench
      - Describe the operation of a threaded fastener
      - Define torque and explain its importance with fasteners

101.7 MACHINE MAINTENANCE

1. Determine correct oil or grease machine lubrication
   a. Performance Indicators:
      - Interpret oil and grease label specifications
      - Use reference manuals to determine correct oil/ grease
   b. Knowledge Indicators:
      - Describe the operation and application of oils and grease
2. Perform basic preventive machine maintenance
   a. Performance Indicators:
      - Check and refill oil and grease in reservoir levels
      - Drain pneumatic filters
      - Check and refill pneumatic lubricator levels
      - Clean machine surfaces
   b. Knowledge Indicators:
      - Describe elements of a preventive maintenance schedule
3. Verify AC and DC power
   a. Performance Indicators:
      - Use a digital multimeter to measure AC/ DC supply voltage
      - Verify that machine voltage readings match specifications
      - Reset a circuit breaker
      - Identify a fuse
   b. Knowledge Indicators:

- Define voltage, resistance, current, and power and give units
- Describe the relationship of power, resistance, current, and voltage
- Describe the operation of fuses and circuit breakers
- Define overload and overcurrent conditions

4. Interpret basic electrical power and control schematics
   a. Performance Indicators:
      - Interpret basic electrical power schematics
      - Interpret basic electrical ladder control schematics
   b. Knowledge Indicators:
      - Describe the operation of basic electrical circuits, motors, pushbutton switches, selector switches, resistors, relays, motor contactors, indicators, instrumentation, power supplies, series and parallel circuits.
      - Describe the schematic symbols for components for basic electrical power and control circuits
      - Describe the operation of basic control logic
      - Describe basic electrical power and ladder schematic guidelines
5. Adjust machine limit switches, inductive and capacitive sensors
   a. Performance Indicators:
      - Adjust and test trip point of a limit switch
      - Adjust and test trip point of an inductive and capacitive sensors
   b. Knowledge Indicators:
      - Describe the operation of limit switches, inductive and capacitive sensors
6. Interpret pneumatic schematics
   a. Performance Indicators:
      - Interpret a basic pneumatic schematic in NFPA/ISO symbols
   b. Knowledge Indicators:
      - Describe the guidelines for drawing pneumatic schematics
      - Describe the operation of basic pneumatic circuits, directional valves, conductors, actuators, gauges, regulators, filters, and lubricators.
      - Describe the NFPA/ISO pneumatic component schematic symbols
7. Operate and adjust basic machine pneumatic components
   a. Performance Indicators:
      - Operate a basic pneumatic valve circuit with manual operator
      - Use pneumatic valve manual overrides to test actuators
      - Adjust the stroke length of a pneumatic cylinder
      - Connect and disconnect pneumatic hoses using push-lok fittings
   b. Knowledge Indicators:
      - Describe how compressed air is generated and its characteristics
      - Calculate pneumatic pressure given force and area
      - Define pneumatic pressure