Georgia CTAE

# CTEA Architecture & Construction (2021)

Adopted 2021

## Carpentry I (46.55)

**AC-C1-1. Demonstrate employability skills required by business and industry.** AC-C1-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. AC-C1-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. AC-C1-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. AC-C1-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. AC-C1-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply teamwork skills. AC-C1-1.5
6. Present a professional image through appearance, behavior and language. AC-C1-1.6

**AC-C1-2. Read, interpret, apply information, and estimate costs from a variety of architectural and construction working drawings.** AC-C1-2

1. Demonstrate knowledge of reading and interpreting plans, elevations, schedules, sections, and details contained in basic construction drawings as related to site layout, floors and walls. AC-C1-2.1
2. Estimate materials for use in site layout, floors and walls. AC-C1-2.2

**AC-C1-3. Demonstrate an understanding of the materials, processes, and safety related to all cement and concrete products** AC-C1-3

1. Demonstrate knowledge of the safety procedures associated with construction and use of concrete products. AC-C1-3.1
2. Demonstrate knowledge of properties and composition of concrete products. AC-C1-3.2

**AC-C1-4. Demonstrate an understanding of the concepts, materials and practices of basic site layout and footings.** AC-C1-4

1. Demonstrate knowledge of the proper selection of materials for site layout, floors and walls. AC-C1-4.1
2. Demonstrate knowledge of site layout. AC-C1-4.2
3. Demonstrate knowledge of individual components used in footings. AC-C1-4.3

**AC-C1-5. Demonstrate knowledge of proper and necessary carpentry tasks and materials that enable a team to construct floor and wall systems.** AC-C1-5

1. Demonstrate the proper selection of materials for floors and walls. AC-C1-5.1
2. Demonstrate knowledge of constructing floor systems. AC-C1-5.2
3. Demonstrate knowledge of constructing wall systems. AC-C1-5.3

**AC-C1-6. Demonstrate an understanding of proper and necessary carpentry tasks that enable a team to construct ceiling and roof systems** AC-C1-6

1. Demonstrate measuring, laying-out, and cutting all types of ceiling framing members. AC-C1-6.1
2. Demonstrate measuring, laying-out, and cutting all types of roof framing members. AC-C1-6.2
3. Demonstrate a basic knowledge of truss systems. AC-C1-6.3

**AC-C1-7. Demonstrate an understanding of the proper and necessary carpentry tasks that enable a team to install doors, windows, and stairs.** AC-C1-7

1. Demonstrate knowledge of the installation of door and window jambs. AC-C1-7.1
2. Demonstrate how to install doors and windows and associated components. AC-C1-7.2
3. Demonstrate how to lay-out, cut, and install stairs. AC-C1-7.3

**AC-C1-8. Demonstrate an understanding of installation and application procedures for exterior finishes.** AC-C1-8

1. Demonstrate knowledge of products and materials used in exterior finishes. AC-C1-8.1
2. Demonstrate measuring, laying-out, cutting, and installing exterior finishes. AC-C1-8.2

AC-C1-9. Examine how SkillsUSA is a co-curricular part of career and technical education through leadership development, school and community service projects, and competitive events. AC-C1-9

1. **Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA.** AC-C1-9.1

2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. AC-C1-9.2
3. Explore the impact and opportunities that SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. AC-C1-9.3
4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA, including but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. AC-C1-9.4

**Architectural Drawing and Design I (48.545)**

**AC-ADDI-1. Demonstrate employability skills required by business and industry.** AC-ADDI-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities AC-ADDI-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. AC-ADDI-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. AC-ADDI-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management and respect for diversity. AC-ADDI-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply teamwork skills. AC-ADDI-1.5
6. Present a professional image through appearance, behavior and language. AC-ADDI-1.6

**AC-ADDI-2. Identify components related to the architectural design process.** AC-ADDI-2

1. Describe the elements and principles of design. AC-ADDI-2.1
2. Research historical architectural styles. AC-ADDI-2.2
3. Explain the steps in the design process. AC-ADDI-2.3
4. Analyze building sites. AC-ADDI-2.4
5. Identify and summarize elements of sustainable design. AC-ADDI-2.5
6. Interpret considerations of universal design. AC-ADDI-2.6

**AC-ADDI-3. Demonstrate architectural drafting skills.** AC-ADDI-3

1. Read and interpret existing architectural drawings. AC-ADDI-3.1
2. Measure using an architect's and an engineer's scale. AC-ADDI-3.2
3. Calculate volume and area related to architectural drafting. AC-ADDI-3.3

**AC-ADDI-4. Prepare residential floor plans.** AC-ADDI-4

1. Research and describe general codes related to floor plans. AC-ADDI-4.1
2. Sketch to scale residential floor plans. AC-ADDI-4.2
3. Draw dimensioned floor plans using appropriate symbols. AC-ADDI-4.3
4. Apply appropriate dimensioning rules. AC-ADDI-4.4
5. Incorporate aspects of sustainable and universal design. AC-ADDI-4.5
6. Demonstrate the use of the Computer-Aided Design (CAD) software.4.6 related to residential floor plans problem solving. AC-ADDI-4.6

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**AC-ADDI-5. Research roof systems, styles and terminology.** AC-ADDI-5

1. Recognize and compile various styles and constructions of roof systems, including hip, gable, mansard, gambrel, shed, and flat. AC-ADDI-5.1
2. Identify and explain basic roofing terminology, including: rise, run, slope, pitch, overhang, eave line and ridge line. AC-ADDI-5.2
3. Research and compare environmental and sustainability issues in relation to roof design. AC-ADDI-5.3
4. Assess aesthetics of roofs. AC-ADDI-5.4
5. Demonstrate the use of Computer-Aided Design (CAD) software related to problem solving roof systems. AC-ADDI-5.5

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**AC-ADDI-6. Prepare elevations for residential drawings.** AC-ADDI-6

1. Explain the purpose of elevations. AC-ADDI-6.1
2. Sketch elevations. AC-ADDI-6.2
3. Create elevation drawings with labels and dimensions to include: roof slope and overhang, type of roofing, door and window location, and porches. AC-ADDI-6.3
4. Demonstrate the use of Computer-Aided Design (CAD) software related to preparing elevations for residential drawings. AC-ADDI-6.4

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**AC-ADDI-7. Demonstrate preparing schedules.** AC-ADDI-7

1. Explain the purpose of schedules on a set of architectural drawings. AC-ADDI-7.1
2. Generate the following schedules: window, door, and finish. AC-ADDI-7.2
3. Demonstrate the use of Computer-Aided Design (CAD) software related to preparing schedules. AC-ADDI-7.3

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**AC-ADDI-8. Demonstrate preparing foundation plans.** AC-ADDI-8

1. Explain the purpose of foundation plans. AC-ADDI-8.1
2. Identify different foundation systems and terminology, including: slab, crawl space, and basement. AC-ADDI-8.2
3. Draw dimensioned foundation plans. AC-ADDI-8.3

4. Demonstrate the use of Computer-Aided Design (CAD) software related to preparing foundation plans. AC-ADDI-8.4

**AC-ADDI-9. Maintain a course portfolio.** AC-ADDI-9

1. Complete a set of residential house plans incorporating course standards (ongoing). AC-ADDI-9.1
2. Report summary reflections on the design processes utilized throughout the course. AC-ADDI-9.2
3. Include ancillary assignments created throughout the course necessary to demonstrate AC-ADDI-9.3

**AC-ADDI-10. Examine SkillsUSA is a co-curricular part of career and technical education.** AC-ADDI-10

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. AC-ADDI-10.1
2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. AC-ADDI-10.2
3. Explore the impact and opportunities that SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. AC-ADDI-10.3
4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA, including but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. AC-ADDI-10.4

**Architectural Drawing and Design II (48.546)**

**AC-ADDII-1. Demonstrate employability skills required by business and industry.** AC-ADDII-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities AC-ADDII-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. AC-ADDII-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. AC-ADDII-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management and respect for diversity. AC-ADDII-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply teamwork skills. AC-ADDII-1.5

6. Present a professional image through appearance, behavior and language. AC-ADDII-1.6

**AC-ADDII-2. Demonstrate and explain the preparation of site plans.** AC-ADDII-2

1. Research and describe general codes related to site planning. AC-ADDII-2.1
2. Identify and restate topology and pertinent information on an existing site plan, including meridian arrow, contour lines, property lines, and utility mains. AC-ADDII-2.2
3. Create a site plan for a building using correct symbols, including contour lines, property lines, utility mains, topographical features, and meridian arrow. AC-ADDII-2.3
4. Demonstrate the use of Computer-Aided Design (CAD) software related to preparing site plans. AC-ADDII-2.4

**AC-ADDII-3. Demonstrate and describe the preparation of electrical plans.** AC-ADDII-3

1. Interpret and explain basic codes and symbols related to electrical plans, including: single-pole switches, three-way switches. duplex receptacle outlets, recessed and fluorescent lights, weatherproof switches and outlets, lighting distribution panels, service panels, and junction boxes. AC-ADDII-3.1
2. Create an electrical plan. AC-ADDII-3.2
3. Demonstrate using Computer-Aided Design (CAD) software related to preparing electrical plans. AC-ADDII-3.3

**AC-ADDII-4. Read and interpret plumbing plans.** AC-ADDII-4

1. Read and interpret basic codes and symbols related to plumbing plans. AC-ADDII-4.1
2. Apply plumbing symbols to a floor plan AC-ADDII-4.2
3. Demonstrate using Computer-Aided Design (CAD) software related to plumbing plans AC-ADDII-4.3

**AC-ADDII-5. Demonstrate preparing sections and details.** AC-ADDII-5

1. Describe the purpose of sections and details AC-ADDII-5.1
2. Create a wall section to scale, including labeling and dimensions AC-ADDII-5.2
3. Generate cabinet sections. Include labeling and dimensions. AC-ADDII-5.3
4. Generate building sections to include labeling and dimensions. AC-ADDII-5.4
5. Demonstrate the use of Computer-Aided Design (CAD) software related to preparing sections and details. AC-ADDII-5.5

**AC-ADDII-6. Create a project presentation for a building** AC-ADDII-6

1. Research architectural presentations. AC-ADDII-6.1
2. Prepare one-point and two-point perspectives of a building. AC-ADDII-6.2
3. Create a rendering of a building AC-ADDII-6.3
4. Draw a set of plans to demonstrate comprehension of residential drawing and design standards. AC-ADDII-6.4
5. Build a physical three-dimensional (3D) model based on researched architectural plans. AC-ADDII-6.5
6. Generate a presentation using a virtual walk-through on a house (optional dependent upon software capabilities). AC-ADDII-6.6
7. Demonstrate the use of Computer-Aided Design (CAD) software related to creating project presentations. AC-ADDII-6.7

**AC-ADDII-7. Maintain a course portfolio.** AC-ADDII-7

2. Report summary reflections on the design processes utilized throughout the course. AC-ADDII-7.2
3. Report ancillary assignments created throughout the course necessary to demonstrate mastery of standards. AC-ADDII-7.3
1. Complete a set of residential house plans incorporating course standards. AC-ADDII-7.1

**AC-ADDII-8. Examine SkillsUSA is a co-curricular part of career and technical education.** AC-ADDII-8

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. AC-ADDII-8.1
2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. AC-ADDII-8.2
3. Explore the impact and opportunities that SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. AC-ADDII-8.3
4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA, including but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. AC-ADDII-8.4

**Introduction to Financial Technology (7.427)**

**AC-E1-1. Demonstrate employability skills required by business and industry.** AC-E1-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. AC-E1-1.1

2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. AC-E1-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. AC-E1-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. AC-E1-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply teamwork skills. AC-E1-1.5
6. Present a professional image through appearance, behavior and language. AC-E1-1.6

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**AC-E1-2. Use tools, instruments, and equipment in a professional and safe manner.** AC-E1-2

1. Demonstrate the use of a hand bender to make 90-degree bends, back-to-back bends, offsets, kicks, and saddle bends. AC-E1-2.1
2. Demonstrate the correct application of fasteners and anchors AC-E1-2.2
3. Demonstrate the proper use of a multi-meter, clamp-on ammeter, and megohmmeter. AC-E1-2.3
4. Demonstrate testing of ground fault circuit interrupters (GFCIs). AC-E1-2.4

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**AC-E1-3. Demonstrate an understanding of the selection, handling, storage, and proper use of electrical materials.** AC-E1-3

1. Demonstrate recognition and use of correct fasteners and anchors. AC-E1-3.1
2. Demonstrate the proper handling and storing of capacitors, motors, transformers, and other electrical equipment. AC-E1-3.2

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**AC-E1-4. Demonstrate an understanding of electrical circuitry including raceways, boxes, and conduit.** AC-E1-4

1. Demonstrate the proper sizing of electrical devices and boxes AC-E1-4.1
2. Demonstrate the proper sizing of electrical conduits. AC-E1-4.2
3. Accurately compute loads for various circuits. AC-E1-4.3

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**AC-E1-5. Demonstrate knowledge of the current National Electrical Code (NEC), National Electrical Manufacturers Association Code (NEMA), National Fire Protection Association Code (NFPA), and Underwriters Laboratories (UL) Standards** AC-E1-5

1. Demonstrate the use of electrical codes and specifications. AC-E1-5.1
2. Demonstrate applying codes to calculating loads AC-E1-5.2

**AC-E1-6. Demonstrate an understanding of the identification and installation of conductors according to National Electrical Code (NEC).** AC-E1-6

1. Demonstrate the knowledge of National Electric code (NEC) related to conductors. AC-E1-6.1
2. Accurately select proper conductors for a specified application. AC-E1-6.2
3. Demonstrate the proper installation of selected conductors. AC-E1-6.3

**AC-E1-7. Demonstrate an understanding of installing a variety of fixtures.** AC-E1-7

1. Demonstrate the selection of proper fixtures for the specified application. AC-E1-7.1
2. Demonstrate the proper installation of various fixtures. AC-E1-7.2

**AC-E1-8. Demonstrate an understanding of voltage, resistance and current and how they relate.** AC-E1-8

1. Demonstrate a working knowledge of Ohm's Law, Kirchhoff's Law and how they work in a circuit. AC-E1-8.1
2. Demonstrate an understanding of the math needed to calculate voltage, wattage, amps, and resistance. AC-E1-8.2

**AC-E1-9. Examine how SkillsUSA is a co-curricular part of career and technical education through leadership development, school and community service projects, and competitive events.** AC-E1-9

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. AC-E1-9.1
2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. AC-E1-9.2
3. Explore the impact and opportunities that SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. AC-E1-9.3
4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA, including but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. AC-E1-9.4

**Electrical Motor Control (46.43)**

**AC-EMC-1. Demonstrate employability skills required by business and industry.** AC-EMC-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. AC-EMC-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. AC-EMC-1.2

3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. AC-EMC-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. AC-EMC-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. AC-EMC-1.5
6. Present a professional image through appearance, behavior and language. AC-EMC-1.6

**AC-EMC-2. Demonstrate appropriate safety procedures in an Industrial Environment.** AC-EMC-2

1. Wear approved PPE (shoes, eye wear, gloves, hard hats, etc.). AC-EMC-2.1
2. Understand the importance of lockout/tag-out procedures to control various energy types (i.e. electrical, thermal (steam), hydraulic, pneumatic, or gravitational). Practice correct lockout/tag-out procedures using a padlock and tag as described under OSHA's 29 CFR 1910.147 standard, the Control of Hazardous Energy (Lockout/Tag-out). AC-EMC-2.2
3. Discuss the Material Safety Data Sheets (MSDS) Right-to-Know Law. AC-EMC-2.3
4. Identify types of fires, types of fire extinguishers, and types of protective clothing. AC-EMC-2.4
5. Identify the appropriate action for reporting fires and appropriate firefighting procedures. AC-EMC-2.5
6. Demonstrate Use of Lab Emergency Power Disconnect ("Kill Switch"). AC-EMC-2.6
7. Demonstrate an understanding of safety precautions and procedures. AC-EMC-2.7
8. Demonstrate the safe use of test equipment. AC-EMC-2.8
9. Understand safety rules to follow when working with mechanical and electrical systems. AC-EMC-2.9
10. Identify and discuss the potential safety hazards and precautions of working with mechanical and electrical systems. AC-EMC-2.10

**AC-EMC-3. Demonstrate an understanding of motor theory and operating principles.** AC-EMC-3

1. Describe the laws of magnetism and their application to AC and DC motors. AC-EMC-3.1
2. Compare the operating principles of AC motors with those of DC motors. AC-EMC-3.2

3. Compare the characteristics of AC motors with those of DC motors. AC-EMC-3.3
4. Define terms associated with electric motors. AC-EMC-3.4
5. Identify the component parts of an electric motor. AC-EMC-3.5
6. Name different types of AC and DC motors. AC-EMC-3.6
7. Determine voltage, amperage, speed, horsepower, NEMA class, and environmental requirements of electric motors using data from the motor name plate. AC-EMC-3.7

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**AC-EMC-4. Demonstrate an understanding of the differences between AC and DC of motor controls.** AC-EMC-4

1. Describe the operating characteristics of the three classes of DC motors. AC-EMC-4.1
2. State the function of starter devices in DC motors. AC-EMC-4.2
3. Name the types of manual DC motor starters. AC-EMC-4.3
4. Identify the components used in DC motor control. AC-EMC-4.4
5. Name the types of automatic DC motor starters. AC-EMC-4.5
6. Describe the methods of controlling the speed of DC motors. AC-EMC-4.6
7. Describe the operating characteristics of the three classes of AC motors. AC-EMC-4.7
8. State the purpose of controllers in AC motor circuits. AC-EMC-4.8
9. Name the types of AC motor controllers. AC-EMC-4.9
10. Identify the components used in AC motor controls. AC-EMC-4.10
11. Describe the methods used to provide circuit protection in AC motor control applications. AC-EMC-4.11

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**AC-EMC-5. Demonstrate an understanding of the purpose of control devices.** AC-EMC-5

1. Identify and describe various devices used for sensing temperature, pressure, level, motion, and position. AC-EMC-5.1
2. Identify and describe the devices used in switching circuits. AC-EMC-5.2
3. Identify and describe the devices used for motor overload protection. AC-EMC-5.3
4. Identify and describe the devices used for ground fault and short circuit protection. AC-EMC-5.4
5. Identify and describe various other devices used in motor control circuits. AC-EMC-5.5

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**AC-EMC-6. Read and interpret symbols and schematic diagrams.** AC-EMC-6

1. Identify and draw the various symbols for components and conditional state of devices used in motor control circuits. AC-EMC-6.1

2. Describe a typical motor control schematic diagram. AC-EMC-6.2
3. Draw a schematic diagram of a motor control circuit. AC-EMC-6.3
4. Interpret schematic diagrams of various motor control circuits. AC-EMC-6.4

**AC-EMC-7. Demonstrate an understanding of magnetic starters and braking.** AC-EMC-7

1. Wire control transformers for the various 24V, 120V, and 230V secondary control voltages used in the industry. AC-EMC-7.1
2. Wire an across-the-line motor starter using a start-stop switch. AC-EMC-7.2
3. Wire a forward/reverse motor starter using a stop/forward/reverse switch. AC-EMC-7.3
4. Wire a magnetic starter for a motor control using a run/jog/stop switch without a control relay. AC-EMC-7.4
5. Wire a magnetic starter for a motor control using a control relay and a run/jog/stop switch. AC-EMC-7.5
6. Identify and describe the different dynamic, plugging, electronic, electric, and manual types of motor braking devices used in the industry. AC-EMC-7.6
7. Install a braking system on a motor. AC-EMC-7.7

**AC-EMC-8. Apply concepts of the NEMA (National Electrical Manufacturers Association) and NFPA (National Fire Protection Agency) Standards.** AC-EMC-8

1. Identify and explain the purpose of NEMA standards for electric motors. AC-EMC-8.1
2. Interpret NEMA design codes to operating characteristics of electric motors. AC-EMC-8.2
3. Differentiate between types of electric motor enclosures as outlined in NEMA standards. AC-EMC-8.3
4. Interpret NFPA (National Fire Protection Agency) 70E standards. AC-EMC-8.4

**AC-EMC-9. Apply concepts from article 430 of the NEC (National Electrical Code).** AC-EMC-9

1. Calculate the size for branch circuit conductors covered by NEC selection 430-22. AC-EMC-9.1
2. Calculate the size for feeder circuit protection covered by NEC section 430-22. AC-EMC-9.2
3. Calculate the size for ground fault/short circuit protection (fuses and circuit breakers) using locked motor current, Table 430-152, and Article 430-52 of the NEC. AC-EMC-9.3

4. Calculate the size of overload protection according to sections 430-74 and 430-34 of the NEC. AC-EMC-9.4
5. Size equipment grounds according to Table 250-95 of the NEC. AC-EMC-9.5
6. Size and locate the motor disconnects according to NEC Part H, Article 430. AC-EMC-9.6
7. Size controllers according the NEMA standards. AC-EMC-9.7
8. Calculate the size of control conductors according to Article 430-72 of the NEC. AC-EMC-9.8
9. Size raceways for motor circuits using Chapter 9: Table 3A, 3B, 3C, 4, and 5 of the NEC. AC-EMC-9.9

**AC-EMC-10. Demonstrate knowledge of preventative maintenance and troubleshooting.** AC-EMC-10

1. Perform a visual inspection using procedures described in the manufacturer's service manual. AC-EMC-10.1
2. Lubricate a motor according to procedures described in the manufacturer's service manual. AC-EMC-10.2
3. Clean a motor according to procedures outlined in the manufacturer's service manual. AC-EMC-10.3
4. Discuss techniques for troubleshooting electric motors. AC-EMC-10.4

**AC-EMC-11. Examine how related student organizations are integral parts of career and technology education courses through leadership development, school and community service projects, and competitive events.** AC-EMC-11

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. AC-EMC-11.1
2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. AC-EMC-11.2
3. Explore the impact and opportunities SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. AC-EMC-11.3
4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA including but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. AC-EMC-11.4

**Fine Furniture/Cabinetmaking I (46.454)**

**AC-FFCI-1. Demonstrate employability skills required by business and industry.** AC-FFCI-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. AC-FFCI-1.1

2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. AC-FFCI-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. AC-FFCI-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. AC-FFCI-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. AC-FFCI-1.5
6. Present a professional image through appearance, behavior and language. AC-FFCI-1.6

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**AC-FFCI-2. Demonstrate knowledge and application of fine furniture/cabinetmaking terminology.** AC-FFCI-2

1. Recognize and identify basic terms used in the fine furniture/cabinetmaking industry. AC-FFCI-2.1
2. Recognize and describe basic drawing terms, components, and symbols. AC-FFCI-2.2
3. Interpret and describe different wood joint names. AC-FFCI-2.3
4. Interpret and describe the parts of a board. AC-FFCI-2.4
5. Identify and explain the different types of warps. AC-FFCI-2.5
6. Identify and be able to explain the classifications of trees. AC-FFCI-2.6

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**AC-FFCI-3. Identify and describe the types of hardwoods and softwoods and other materials used in the fine furniture and cabinetmaking profession** AC-FFCI-3

1. Identify and explain the variety of softwoods and hardwoods, plywood and other materials used in the fine furniture and cabinetmaking profession. AC-FFCI-3.1

2. Identify different types of resistors and explain how the resistance values are determined for the following: AC-FFCI-3.2
    A. Solid hardwoods AC-FFCI-3.2.A
        1. Cherry AC-FFCI-3.2.A.1
        2. Black Walnut AC-FFCI-3.2.A.2
        3. Red Oak AC-FFCI-3.2.A.3
        4. Mahogany AC-FFCI-3.2.A.4
        5. Poplar AC-FFCI-3.2.A.5
        6. Basswood AC-FFCI-3.2.A.6
        7. Maple AC-FFCI-3.2.A.7
        8. Poplar AC-FFCI-3.2.A.8
    B. Plywood AC-FFCI-3.2.B
        1. Soft wood plywood AC-FFCI-3.2.B.1
        2. Hardwood plywood AC-FFCI-3.2.B.2
    C. Particle board and medium-density fiberboard (MDF) AC-FFCI-3.2.C
    D. Lauan AC-FFCI-3.2.D

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**AC-FFCI-4. Demonstrate mathematic knowledge and skills relevant to the fine furniture/cabinetmaking field.** AC-FFCI-4

1. Demonstrate reading a ruler to solve problems related to the fine furniture/cabinetmaking field. AC-FFCI-4.1
2. Apply general math, geometry, and algebra skills to solve problems related to the fine furniture/cabinetmaking with and without a calculator. AC-FFCI-4.2
3. Demonstrate and apply math skills to make and fill out a bill of materials sheet. AC-FFCI-4.3
4. Interpret and use drawing dimensions and scales. AC-FFCI-4.4
5. Calculate board feet in order to solve problems related to the fine furniture/cabinetmaking field. AC-FFCI-4.5

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**AC-FFCI-5. Identify and utilize general shop safety rules.** AC-FFCI-5

1. Identify and describe general shop safety rules. AC-FFCI-5.1
2. Demonstrate how to act and work safely around other people in a shop area. AC-FFCI-5.2
3. Demonstrate maintaining a clean, orderly, and safe working area. AC-FFCI-5.3
4. Demonstrate the use and care of personal protective equipment (PPE). AC-FFCI-5.4
5. Identify and operate different types of fire extinguishers. AC-FFCI-5.5

6. Identify and describe general shop safety hazards. AC-FFCI-5.6
7. Demonstrate safely transporting, handling, and storing of materials. AC-FFCI-5.7

**AC-FFCI-6. Demonstrate the use of hand and portable power tools relevant to the fine furniture/cabinetmaking profession.** AC-FFCI-6

1. Demonstrate reading and use of measuring instruments. AC-FFCI-6.1
2. Identify and describe various hand and portable power tools. AC-FFCI-6.2
3. Demonstrate selecting the correct tools for specific jobs. AC-FFCI-6.3
4. Demonstrate cleaning and maintenance of hand and portable power tools. AC-FFCI-6.4
5. Demonstrate proficiency in the safe use of hand and portable power tools. AC-FFCI-6.5
6. State and explain the application of all hand and portable power tool safety rules. AC-FFCI-6.6

**AC-FFCI-7. Demonstrate and utilize equipment/machines relevant to the fine furniture/cabinetmaking profession.** AC-FFCI-7

1. Identify and be able to describe the various types of machines and related parts relevant to the fine furniture/cabinetmaking profession. AC-FFCI-7.1
2. State and apply the safety rules for operating all machines, regardless of type in the fine furniture/cabinetmaking profession. AC-FFCI-7.2
3. Demonstrate the special operation and procedures required for each piece of equipment/machine. AC-FFCI-7.3
4. Identify and describe different types of wood joints and which machine or machines are used to make each joint. AC-FFCI-7.4

**AC-FFCI-8. Demonstrate the making and assembling of basic wood joints used in the fine furniture/cabinetmaking profession.** AC-FFCI-8

1. Recognize and identify the basic wood joint used in the fine furniture/cabinetmaking industry. AC-FFCI-8.1
2. Demonstrate how to cut and assemble the various types of wood joints. AC-FFCI-8.2
3. Demonstrate gluing, clamping and fastening the different types of wood joints. AC-FFCI-8.3

4. Identify and describe common wood joints, such as the following: AC-FFCI-8.4
    a. Dado AC-FFCI-8.4.A
    b. Blind Dado AC-FFCI-8.4.B
    c. Groove AC-FFCI-8.4.C
    d. Edge rabbet AC-FFCI-8.4.D
    e. Pocket AC-FFCI-8.4.E
    f. Dovetail AC-FFCI-8.4.F
    g. Butt joints: Edge to Edge; Face to Face; and Edge to Face AC-FFCI-8.4.G

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**AC-FFCI-9. Identify and demonstrate how to fasten stock and wood joints.** AC-FFCI-9

1. Identify and describe types of glue and fasteners. AC-FFCI-9.1
2. Demonstrate fastening stock with glue and clamps. AC-FFCI-9.2
3. Demonstrate gluing and clamping stock using various techniques. AC-FFCI-9.3
4. Demonstrate fastening stock and wood joints with appropriate fasteners, such as: AC-FFCI-9.4
    a. Nails AC-FFCI-9.4.A
    b. Staples AC-FFCI-9.4.B
    c. Screws AC-FFCI-9.4.C
    d. Bolts AC-FFCI-9.4.D

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**AC-FFCI-10. Demonstrate selecting and using appropriate woods, fasteners, and hardware to construct a single piece of fine furniture or cabinet in a small group setting.** AC-FFCI-10

1. Demonstrate working together in small groups (3 or 4 persons) to construct a single piece of fine furniture or cabinet. AC-FFCI-10.1
2. Demonstrate constructing a simple project (approved by the teacher). AC-FFCI-10.2
3. Demonstrate making (3 view) drawings of project using pencil and paper. AC-FFCI-10.3
4. Create a bill of materials sheet. AC-FFCI-10.4
5. Demonstrate determining and selecting the type of wood joints and fasteners to be used in a project. AC-FFCI-10.5

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**AC-FFCI-11. Prepare fine furniture, cabinets for finish.** AC-FFCI-11

1. Demonstrate sanding all wood surfaces for finishing. AC-FFCI-11.1
2. Demonstrate selecting and applying proper wood fillers. AC-FFCI-11.2

3. Identify and demonstrate the use of different types of sand paper. AC-FFCI-11.3
4. Demonstrate how to sand and select the proper grits to be used on the project. AC-FFCI-11.4
5. Identify wood defects and describe how to repair properly. AC-FFCI-11.5
6. Observe and describe safety precautions when sanding wood. AC-FFCI-11.6

**AC-FFCI-12. Apply stains and finishing.** AC-FFCI-12

1. Demonstrate selecting and applying stain to the surface, as necessary. AC-FFCI-12.1
2. Demonstrate and describe the use of retarders before staining. AC-FFCI-12.2
3. Demonstrate knowledge of ventilation systems when using finishes and stains. AC-FFCI-12.3
4. Demonstrate the proper procedure for disposing of oil rags. AC-FFCI-12.4
5. Identify and describe the types of wood finishes, such as the following: AC-FFCI-12.5
    a. Oil based AC-FFCI-12.5.A
    b. Lacquer based AC-FFCI-12.5.B
    c. Water based AC-FFCI-12.5.C
    d. Polyurethane AC-FFCI-12.5.D
    e. Enamels AC-FFCI-12.5.E

**AC-FFCI-13. Create a student portfolio.** AC-FFCI-13

1. Demonstrate maintaining a student portfolio. AC-FFCI-13.1
2. Demonstrate taking proper notes in class. AC-FFCI-13.2
3. Demonstrate writing and keeping all handouts and machine pictures for future use. AC-FFCI-13.3
4. Demonstrate keeping all hand tool and machine-safety notes for future use. AC-FFCI-13.4
5. Demonstrate making a portfolio cover sheet with required data displayed. AC-FFCI-13.5

**Fine Furniture/Cabinetmaking II (46.455)**

**AC-FFCII-1. Demonstrate employability skills required by business and industry.** AC-FFCII-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. AC-FFCII-1.1

2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. AC-FFCII-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. AC-FFCII-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. AC-FFCII-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. AC-FFCII-1.5
6. Present a professional image through appearance, behavior and language. AC-FFCII-1.6

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**AC-FFCII-2. Demonstrate and apply occupational safety skills used in the Fine Furniture/Cabinetmaking profession.** AC-FFCII-2

1. Demonstrate knowledge and application of the general safety rules used in a lab or shop setting. AC-FFCII-2.1
2. Demonstrate the knowledge of personal safety equipment. AC-FFCII-2.2
3. Demonstrate maintaining a clean, orderly, and safe working area. AC-FFCII-2.3
4. Demonstrate the use and care of personal protective equipment (PPE). AC-FFCII-2.4
5. Demonstrate the proper operation of a fire extinguisher. AC-FFCII-2.5
6. Identify and describe safety hazards. AC-FFCII-2.6
7. Demonstrate safely transporting, handling, and storing of materials. AC-FFCII-2.7

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**AC-FFCII-3. Demonstrate creating and designing a complete set of working drawings.** AC-FFCII-3

1. Draw a multi-view drawing (top, front, right, side) of a cabinet or piece of furniture. AC-FFCII-3.1
2. Demonstrate the proper layout measurement and dimensions of multi-view drawings. AC-FFCII-3.2
3. Demonstrate making a bill of materials list for cost of wood, hardware, and finishes. AC-FFCII-3.3
4. Demonstrate creating a furniture drawing using a Computer-Aided Design (CAD) program. AC-FFCII-3.4

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**AC-FFCII-4. Demonstrate designing, cutting, and assembling a drawer.** AC-FFCII-4

1. Measure and layout (list) all the parts of a drawer. AC-FFCII-4.1

2. Identify and describe the different types of drawers used in cabinetry and fine furniture. AC-FFCII-4.2
3. Identify and demonstrate the use of all types of wood joints required in making drawers. AC-FFCII-4.3
4. Demonstrate gluing, clamping, and assembling all parts of a drawer. AC-FFCII-4.4
5. Demonstrate the measurement, the layout, and the mounting of all hardware used with a drawer. AC-FFCII-4.5

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**AC-FFCII-5. Demonstrate designing, cutting, assembling, and gluing the different types of doors used in the profession.** AC-FFCII-5

1. Demonstrate designing the various types of doors, such as: AC-FFCII-5.1
   a. Over lays doors AC-FFCII-5.1.A
   b. Inset or flush mount doors AC-FFCII-5.1.B
   c. Lipped doors AC-FFCII-5.1.C
2. Demonstrate assembling the various types of doors using the following items: AC-FFCII-5.2
   a. Tongue and groove joints AC-FFCII-5.2.A
   b. Pocket joints AC-FFCII-5.2.B
   c. Dowel joints AC-FFCII-5.2.C
3. Demonstrate installing types of doors, as follows: AC-FFCII-5.3
   a. Raised panel door AC-FFCII-5.3.A
   b. Flat panel door AC-FFCII-5.3.B
   c. Glass panel and metal grills AC-FFCII-5.3.C
   d. Solid doors AC-FFCII-5.3.D
4. Demonstrate installing fasteners. AC-FFCII-5.4
5. Demonstrate installing hardware, including the following: AC-FFCII-5.5
   a. Hinges AC-FFCII-5.5.A
   b. Handles AC-FFCII-5.5.B
   c. Drawer slides AC-FFCII-5.5.C
   d. Locks AC-FFCII-5.5.D

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**AC-FFCII-6. Demonstrate preparing projects for finishing.** AC-FFCII-6

1. Demonstrate sanding the complete project and all wood joints. AC-FFCII-6.1
2. Demonstrate removing all mill marks, scratches, and dents. AC-FFCII-6.2
3. Demonstrate using wood filler, where needed. AC-FFCII-6.3

4. Demonstrate proper stain application. AC-FFCII-6.4

**AC-FFCII-7. Demonstrate applying finishes to project.** AC-FFCII-7

1. Demonstrate applying different methods of applying finishes, such as hand-rubbed, spray, and brush. AC-FFCII-7.1
2. Demonstrate applying types of finishes, such as oil. AC-FFCII-7.2
3. Demonstrate sanding in between coats of finish. AC-FFCII-7.3
4. Demonstrate use of safety precautions needed when applying finish. AC-FFCII-7.4
5. Demonstrate and apply long-term project care. AC-FFCII-7.5

**AC-FFCII-8. Demonstrate the skills and craftsmanship used in building a cabinet on a piece of fine furniture.** AC-FFCII-8

1. Demonstrate designing and drawing the project. AC-FFCII-8.1
2. Demonstrate measuring, cutting, and assembling the project. AC-FFCII-8.2
3. Demonstrate applying stains and finish to the project. AC-FFCII-8.3

**AC-FFCII-9. Create a student portfolio.** AC-FFCII-9

1. Create and keep a class portfolio. AC-FFCII-9.1
2. Demonstrate taking and printing weekly project pictures. AC-FFCII-9.2
3. Demonstrate taking and keeping notes, handouts, and bill of materials lists for the portfolio. AC-FFCII-9.3
4. Demonstrate keeping and maintaining the portfolio for future jobs and completing the pathway. AC-FFCII-9.4

## Fine Furniture/Cabinetmaking III (46.456)

**AC-FFCIII-1. Demonstrate employability skills required by business and industry.** AC-FFCIII-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. AC-FFCIII-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. AC-FFCIII-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. AC-FFCIII-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. AC-FFCIII-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. AC-FFCIII-1.5

6. Present a professional image through appearance, behavior and language. AC-FFCIII-1.6

**AC-FFCIII-2. Demonstrate installing various types of materials used for tops on cabinets and fine furniture.** AC-FFCIII-2

1. Identify and describe the different types of materials, such as the following: AC-FFCIII-2.1
   a. Laminates AC-FFCIII-2.1.A
   b. Solid surfaces AC-FFCIII-2.1.B
   c. Granite AC-FFCIII-2.1.C
   d. Ceramic Tile AC-FFCIII-2.1.D
2. Demonstrate preparing of layout materials. AC-FFCIII-2.2
3. Demonstrate applying adhesive. AC-FFCIII-2.3
4. Demonstrate cleaning of various types of materials. AC-FFCIII-2.4

**AC-FFCIII-3. Demonstrate the use of information technology tools.** AC-FFCIII-3

1. Demonstrate applying technological tools to make bill of materials sheets, spreadsheets, and CAD drawings. AC-FFCIII-3.1
2. Demonstrate maintaining project timeline sheets. AC-FFCIII-3.2
3. Demonstrate taking digital pictures of project and mounting the prints in the portfolio. AC-FFCIII-3.3
4. Research and describe special hardware, such as the following: AC-FFCIII-3.4
   a. Handles AC-FFCIII-3.4.A
   b. Hinges AC-FFCIII-3.4.B
   c. Locks AC-FFCIII-3.4.C
   d. Drawer slides AC-FFCIII-3.4.D
   e. Fasteners AC-FFCIII-3.4.E

**AC-FFCIII-4. Demonstrate designing, making, and mounting various types of molding and trim.** AC-FFCIII-4

1. Demonstrate safely cutting the molding and trim using a miter saw. AC-FFCIII-4.1
2. Demonstrate mounting molding and trim using different methods, such as: AC-FFCIII-4.2
   a. Gluing and clamping AC-FFCIII-4.2.A
   b. Nails AC-FFCIII-4.2.B
   c. Staples AC-FFCIII-4.2.C
   d. Screws AC-FFCIII-4.2.D

3. Demonstrate sanding and filling voids with wood fillers. AC-FFCIII-4.3

**AC-FFCIII-5. Construct a wood project.** AC-FFCIII-5

1. Design and draw a set of plans for a wood project. AC-FFCIII-5.1
2. Demonstrate safely measuring, cutting, and assembling a wood project. AC-FFCIII-5.2
3. Design at least one type of door for a wood project. AC-FFCIII-5.3
4. Design at least one type of drawer for a wood project. AC-FFCIII-5.4

**AC-FFCIII-6. Demonstrate project preparation and finish.** AC-FFCIII-6

1. Demonstrate sanding all parts and joints for a wood project. AC-FFCIII-6.1
2. Demonstrate filling holes and voids with filler for a wood project. AC-FFCIII-6.2
3. Demonstrate applying finish to a wood project. AC-FFCIII-6.3
4. Demonstrate mounting all hardware to a wood project. AC-FFCIII-6.4
5. Demonstrate adjusting all drawers and doors for a wood project. AC-FFCIII-6.5
6. Demonstrate proper application of a hand-rubbed finish for a wood project. AC-FFCIII-6.6

**AC-FFCIII-7. Create a project portfolio.** AC-FFCIII-7

1. Demonstrate maintaining a student portfolio. AC-FFCIII-7.1
2. Demonstrate maintaining weekly timelines for a student portfolio. AC-FFCIII-7.2
3. Demonstrate taking and mounting of pictures in the student portfolio. AC-FFCIII-7.3
4. Demonstrate maintaining a set of project plans in the student portfolio. AC-FFCIII-7.4

**Fluid Power and Piping Systems (46.42)**

**AC-FPPS-1. Demonstrate employability skills required by business and industry.** AC-FPPS-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. AC-FPPS-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. AC-FPPS-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. AC-FPPS-1.3

4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. AC-FPPS-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. AC-FPPS-1.5
6. Present a professional image through appearance, behavior and language. AC-FPPS-1.6

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**AC-FPPS-2. Demonstrate appropriate safety procedures in an Industrial Environment.** AC-FPPS-2

1. Wear approved PPE (shoes, eye wear, gloves, hard hats, etc.). AC-FPPS-2.1
2. Understand the importance of lockout/tag-out procedures to control various energy types (i.e. electrical, thermal (steam), hydraulic, pneumatic, or gravitational). Practice correct lockout/tag-out procedures using a padlock and tag as described under OSHA's 29 CFR 1910.147 standard, the Control of Hazardous Energy (Lockout/Tag-out). AC-FPPS-2.2
3. Discuss the Material Safety Data Sheets (MSDS) Right-to-Know Law. AC-FPPS-2.3
4. Identify types of fires, types of fire extinguishers, and types of protective clothing. AC-FPPS-2.4
5. Identify the appropriate action for reporting fires and appropriate firefighting procedures. AC-FPPS-2.5
6. Demonstrate Use of Lab Emergency Power Disconnect ("Kill Switch"). AC-FPPS-2.6
7. Demonstrate an understanding of safety precautions and procedures. AC-FPPS-2.7
8. Demonstrate the safe use of test equipment. AC-FPPS-2.8
9. Understand safety rules to follow when working with mechanical and electrical systems. AC-FPPS-2.9
10. Identify and discuss the potential safety hazards and precautions of working with mechanical and electrical systems. AC-FPPS-2.10

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**AC-FPPS-3. Explain hydraulic system principles.** AC-FPPS-3

1. Define and discuss the following basic hydraulic terms; hydraulic, force, weight, mass, work, and pressure. AC-FPPS-3.1
2. Explain how hydraulic power is transmitted. AC-FPPS-3.2
3. Discuss conservation of energy as it applies to a hydraulic system. AC-FPPS-3.3

4. State the laws of physics that relate to hydraulic applications. AC-FPPS-3.4
5. Explain how force, weight, mass, and pressure are used in the operation of hydraulic devices. AC-FPPS-3.5
6. Use formulas to compute solutions for single variable problems relating to hydraulic systems where force, weight, mass, pressure, and work are the unknowns. AC-FPPS-3.6
7. Identify the advantages of hydraulic power when compared to other methods of power transmission. AC-FPPS-3.7
8. Identify the symbols used to represent components in a hydraulic system. AC-FPPS-3.8
9. Identify the purpose of a hydraulic system using circuit diagrams. AC-FPPS-3.9
10. Draw a complete hydraulic system schematic using the appropriate symbols. AC-FPPS-3.10
11. Read and interpret a hydraulic system schematic. AC-FPPS-3.11

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**AC-FPPS-4. Demonstrate proper operation of hydraulic system components.** AC-FPPS-4

1. Check for symptoms of binding rods and pistons. AC-FPPS-4.1
2. Align a piston in a hydraulic cylinder. AC-FPPS-4.2
3. Discuss the purpose and use of servo-proportional valves (SPV). AC-FPPS-4.3
4. Discuss troubleshooting procedures for actuators in a hydraulic system. AC-FPPS-4.4
5. Inspect a pressure control relief valve. AC-FPPS-4.5
6. Measure the pressure in a hydraulic system. AC-FPPS-4.6
7. Measure the flow of fluid in a hydraulic system. AC-FPPS-4.7
8. Null a hydraulic servo valve. AC-FPPS-4.8
9. Replace valves in hydraulic system. AC-FPPS-4.9
10. Adjust the hydraulic pressure at a valve. AC-FPPS-4.10
11. Test the accumulator charge in a hydraulic system. AC-FPPS-4.11
12. Recharge an accumulator. AC-FPPS-4.12
13. Replace a defective accumulator. AC-FPPS-4.13
14. Explain how hydraulic fluid is manufactured. AC-FPPS-4.14
15. Identify types of hydraulic fluids and discuss their characteristics. AC-FPPS-4.15
16. Explain viscosity ratings. AC-FPPS-4.16

17. Select hydraulic fluids appropriate to the types of seals used in the system. AC-FPPS-4.17
18. Check the fluid level in a hydraulic system. AC-FPPS-4.18
19. Replace and clean hydraulic filters and strainers. AC-FPPS-4.19
20. Drain and refill a hydraulic system with the correct fluid. AC-FPPS-4.20
21. Discuss the types and purposes of reservoirs in a hydraulic system. AC-FPPS-4.21
22. Identify the various pumps used in industry. AC-FPPS-4.22
23. Discuss gear, vane, and piston pump principles of operations. AC-FPPS-4.23
24. Discuss the operation of various pumps used in industry. AC-FPPS-4.24
25. Discuss cavitation in a hydraulic system. AC-FPPS-4.25
26. Discuss pseudo cavitation in a hydraulic system. AC-FPPS-4.26
27. Discuss the effects of atmospheric pressure of the suction side of the pump. AC-FPPS-4.27
28. Inspect a hydraulic pump for proper operation before and after an installation. AC-FPPS-4.28
29. Determine the type of pump required for a specific operation. AC-FPPS-4.29
30. Install, maintain and trouble shoot an industrial pump. AC-FPPS-4.30

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**AC-FPPS-5. Explain pneumatic system principles.** AC-FPPS-5

1. Define the terms force, weight, mass, pressure, volume, work, PSI, PSIA, PSIG, compressibility pneumatic energy, and kinetic energy as they relate to pneumatic systems. AC-FPPS-5.1
2. Describe the relationship between the following: force and area, work and time, volume and pressure, temperature and pressure, and temperature, volume, and pressure. AC-FPPS-5.2
3. Describe the effects of air viscosity on velocity. AC-FPPS-5.3
4. Explain Bernoulli's Principle. AC-FPPS-5.4
5. Describe the relationship between pneumatic leverage and travel. AC-FPPS-5.5
6. Use formulas to compute pneumatic output force when given input force and cylinder areas. AC-FPPS-5.6
7. Use formulas to compute work when given cylinder bore, stroke, and air pressure. AC-FPPS-5.7
8. Use formulas to compute output cylinder travel when given input cylinder travel and leverage increase ratio. AC-FPPS-5.8
9. Identify the symbols used to represent components of pneumatic systems. AC-FPPS-5.9

10. Describe the operation of pneumatic systems when supplied with a system schematic. AC-FPPS-5.10
11. Verify air logic with a pneumatic system diagram. AC-FPPS-5.11
12. Explain the principles of vacuum physics. AC-FPPS-5.12

**AC-FPPS-6. Demonstrate proper operation of pneumatic system components.** AC-FPPS-6

1. Describe the various types of compressors. AC-FPPS-6.1
2. Analyze the functions of compressors. AC-FPPS-6.2
3. Service pneumatic system compressors. AC-FPPS-6.3
4. Disassemble and reassemble a pneumatic system compressor. AC-FPPS-6.4
5. Describe the various types of valves used in pneumatic systems. AC-FPPS-6.5
6. Analyze the function of commonly used types of pneumatic valves. AC-FPPS-6.6
7. Verify pneumatic valve operation. AC-FPPS-6.7
8. Identify commonly used types of actuators. AC-FPPS-6.8
9. Describe the operation of commonly used types of actuators. AC-FPPS-6.9
10. Verify the proper operation of an air motor. AC-FPPS-6.10

**AC-FPPS-7. Identify basic fundamentals of pumps and piping systems.** AC-FPPS-7

1. Discuss and identify the various materials used in piping systems. AC-FPPS-7.1
2. Identify various fittings used in piping systems. AC-FPPS-7.2
3. Discuss and Calculate fitting allowances and pipe measurements. AC-FPPS-7.3
4. Cut, ream, and thread steel pipe. AC-FPPS-7.4
5. Prepare tubing for installation by flaring, brazing and using compression fittings. AC-FPPS-7.5
6. Identify and discuss the types of valves used in piping systems. AC-FPPS-7.6
7. Install various valves used in piping systems. AC-FPPS-7.7
8. Refer to the proper section of the ASME Codes for information on code requirements for industrial pumps. AC-FPPS-7.8

**AC-FPPS-8. Demonstrate how to correctly rebuild hydraulic and pneumatic components.** AC-FPPS-8

1. Use systematic trouble shooting techniques to determine cylinder operation. AC-FPPS-8.1
2. Demonstrate proper procedures to bring the system to a zero energy state. AC-FPPS-8.2
3. Demonstrate proper removal of component to be replaced. AC-FPPS-8.3
4. Properly rebuild component to industry standards. AC-FPPS-8.4
5. Test component to insure proper operation. AC-FPPS-8.5
6. Explain the proper process to reinstall hydraulic and pneumatic components. AC-FPPS-8.6

**AC-FPPS-9. Examine how related student organizations are integral parts of career and technology education courses through leadership development, school and community service projects, and competitive events.** AC-FPPS-9

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. AC-FPPS-9.1
2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. AC-FPPS-9.2
3. Explore the impact and opportunities SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. AC-FPPS-9.3
4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA including but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. AC-FPPS-9.4

**Heating, Ventilation, Air-Conditioning, and Refrigeration (47.415)**

**AC-HVACR1-1. Demonstrate employability skills required by business and industry.** AC-HVACR1-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. AC-HVACR1-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. AC-HVACR1-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. AC-HVACR1-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. AC-HVACR1-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. AC-HVACR1-1.5

6. Present a professional image through appearance, behavior and language. AC-HVACR1-1.6

**AC-HVACR1-2. Apply mathematical concepts related to HVACR.** AC-HVACR1-2

1. Solve algebraic equations that relate to the HVACR trade. AC-HVACR1-2.1
2. Calculate volume, weight, pressure, vacuum, and temperature related to the HVACR trade. AC-HVACR1-2.2

**AC-HVACR1-3. Demonstrate using hand and power tools associated with the HVACR trade in a professional and safe manner.** AC-HVACR1-3

1. Demonstrate the ability to correctly use the following: pipe wrenches, torque wrenches, hammers and mallets, tin snips, hand and power hacksaws, drills, and measuring instruments. AC-HVACR1-3.1

**AC-HVACR1-4. Demonstrate the proper selection, handling, and methods of joining, installing and supporting of HVACR pipe and tubing.** AC-HVACR1-4

1. Describe procedures and precautions that must be taken when preparing and installing HVACR piping. AC-HVACR1-4.1
2. Braze and solder copper tubing and fittings in a safe and professional manner. AC-HVACR1-4.2
3. Demonstrate correct preparation and installation of Poly(vinyl chloride) or PVC and Ferrous Metal Piping. AC-HVACR1-4.3

**AC-HVACR1-5. Describe how an HVACR system conditions and cools the air within a specified space.** AC-HVACR1-5

1. Demonstrate an understanding of the basic refrigeration cycle. AC-HVACR1-5.1
2. Recognize the major components of a cooling system and explain how they operate. AC-HVACR1-5.2
3. Identify and describe refrigerants and demonstrate procedures for safe handling of them. AC-HVACR1-5.3
4. Use temperature and pressure measuring instruments to evaluate the condition of the system. AC-HVACR1-5.4

**AC-HVACR1-6. Describe how an HVACR system conditions and heats the air within a specified space.** AC-HVACR1-6

1. Explain the three methods of heat transfer. AC-HVACR1-6.1
2. Recognize the major components of a forced air furnace (gas and electric) and explain their function. AC-HVACR1-6.2
3. State the factors that must be considered when installing a furnace. AC-HVACR1-6.3
4. Demonstrate performing preventive maintenance procedures such as cleaning and filter replacement. AC-HVACR1-6.4

5. Demonstrate an understanding of the sequence of operation of a gas furnace. AC-HVACR1-6.5
6. Demonstrate an understanding of how to adjust a gas valve. AC-HVACR1-6.6

**AC-HVACR1-7. Describe how compressors operate.** AC-HVACR1-7

1. Identify and explain the operation of the different kinds of compressors. AC-HVACR1-7.1
2. Demonstrate the common procedures for servicing and maintenance of both hermetic and semi-hermetic compressors. AC-HVACR1-7.2

**AC-HVACR1-8. Demonstrate how to operate the equipment used in the HVAC field.** AC-HVACR1-8

1. Demonstrate proper operation of manifold gages. AC-HVACR1-8.1
2. Demonstrate proper operation of recovery machines, vacuum pumps, micron gages, charging scales, and leak detectors. AC-HVACR1-8.2
3. Demonstrate the ability to check superheat and sub cooling. AC-HVACR1-8.3
4. Demonstrate recovering refrigerant, evacuating a system, and charging a system. AC-HVACR1-8.4

**AC-HVACR1-9. Demonstrate proper assembly of ductwork.** AC-HVACR1-9

1. Demonstrate the ability to assemble pre-made sections of ductwork. AC-HVACR1-9.1
2. Demonstrate how to make S Cleats, Drive Cleats, and Pittsburg seams, and explain how they are installed. AC-HVACR1-9.2
3. Demonstrate how to install Flex duct, take offs, boots, and registers. AC-HVACR1-9.3

**AC-HVACR1-10. Examine how SkillsUSA is a co-curricular part of career and technical education through leadership development, school and community service projects, and competitive events.** AC-HVACR1-10

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. AC-HVACR1-10.1
2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. AC-HVACR1-10.2
3. Explore the impact and opportunities that SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. AC-HVACR1-10.3

4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA, including but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. AC-HVACR1-10.4

**Industrial Mechanics (46.41)**

**AC-IM-1. Demonstrate employability skills required by business and industry.** AC-IM-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. AC-IM-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. AC-IM-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. AC-IM-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. AC-IM-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. AC-IM-1.5
6. Present a professional image through appearance, behavior and language. AC-IM-1.6

**AC-IM-2. Demonstrate appropriate safety procedures in an Industrial Environment.** AC-IM-2

1. Wear approved PPE (shoes, eye wear, gloves, hard hats, etc.). AC-IM-2.1
2. Understand the importance of lockout/tag-out procedures to control various energy types (i.e. electrical, thermal (steam), hydraulic, pneumatic, or gravitational). Practice correct lockout/tag-out procedures using a padlock and tag as described under OSHA's 29 CFR 1910.147 standard, the Control of Hazardous Energy (Lockout/Tag-out). AC-IM-2.2
3. Discuss the Material Safety Data Sheets (MSDS) Right-to-Know Law. AC-IM-2.3
4. Identify types of fires, types of fire extinguishers, and types of protective clothing. AC-IM-2.4
5. Identify the appropriate action for reporting fires and appropriate firefighting procedures. AC-IM-2.5
6. Demonstrate Use of Lab Emergency Power Disconnect ("Kill Switch"). AC-IM-2.6
7. Demonstrate an understanding of safety precautions and procedures. AC-IM-2.7
8. Demonstrate the safe use of test equipment. AC-IM-2.8

9. Understand safety rules to follow when working with mechanical and electrical systems. AC-IM-2.9
10. Identify and discuss the potential safety hazards and precautions of working with mechanical and electrical systems. AC-IM-2.10

**AC-IM-3. Understand and apply mathematic concepts and measurements as relevant to maintenance installation and repair.** AC-IM-3

1. Compare and contrast standards and metric measuring systems. AC-IM-3.1
2. Use formulas to determine areas and volumes. AC-IM-3.2
3. Determine drive ratios for belt drives, chain drives, and gear drives. AC-IM-3.3
4. Identify and use common tools of measurement. AC-IM-3.4
5. Identify and use various precision measurement instruments. AC-IM-3.5

**AC-IM-4. Demonstrate proper use of maintenance tools and materials in industrial systems.** AC-IM-4

1. Identify various mechanical tools used in industrial maintenance systems. AC-IM-4.1
2. Demonstrate the use of the mechanical tools used in industrial systems. AC-IM-4.2
3. Identify and discuss the types and characteristics of common metals used in maintenance. AC-IM-4.3
4. Identify and discuss the types and characteristics of common non-metals used in maintenance. AC-IM-4.4
5. Define the terminology applied to fasteners. AC-IM-4.5
6. Identify common fasteners used in mechanical maintenance. AC-IM-4.6
7. Demonstrate safe use of appropriate shop equipment. AC-IM-4.7
8. Demonstrate the ability to use layout and measurement tools to transfer print dimensions to a part. AC-IM-4.8
9. Demonstrate the safe use of equipment to drill, cut, ream, and tap in accordance with print specifications. AC-IM-4.9
10. Demonstrate safe and proper use of files, grinders, and other hand and power tools in accordance with good shop practices. AC-IM-4.10

**AC-IM-5. Demonstrate an understanding and identify components of power transmission systems.** AC-IM-5

1. Identify common belts and the belt codes used in mechanical systems. AC-IM-5.1
2. Define the common terms used in belt drive systems. AC-IM-5.2
3. Align pulleys used in belt drive systems. AC-IM-5.3
4. Install and tension a belt. AC-IM-5.4

5. Define the common terms used in chain drive systems. AC-IM-5.5
6. Identify common chains and chain codes used in chain drive systems. AC-IM-5.6
7. Align a sprocket used in a chain drive system. AC-IM-5.7
8. Install and tension a chain. AC-IM-5.8
9. Define common terms used in gear drive systems. AC-IM-5.9
10. Identify common gears used in gear drive systems. AC-IM-5.10
11. Demonstrate the ability to properly use a gear gauge. AC-IM-5.11
12. Remove and install gears used in a gear drive system. AC-IM-5.12

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**AC-IM-6. Examine and explain basic system principles and components for mechanical systems.** AC-IM-6

1. Identify the different types of bearings. AC-IM-6.1
2. Explain the use and applications of the different types of bearings. AC-IM-6.2
3. Remove and install bearings in bore. AC-IM-6.3
4. Remove and install bearings on a shaft. AC-IM-6.4
5. Identify the causes of bearing failure. AC-IM-6.5
6. Inspect a bearing used in mechanical systems. AC-IM-6.6
7. Explain the function of packing and seals in industrial production equipment. AC-IM-6.7
8. Remove and install packings and seals. AC-IM-6.8
9. Identify commonly used couplings in mechanical systems. AC-IM-6.9
10. Align couplings using a straight edge, feeler gauge and dial indicators. AC-IM-6.10
11. Install and remove couplings in a mechanical system. AC-IM-6.11
12. Define the common terms used in the lubrication process. AC-IM-6.12
13. Identify the types of liquid and solid lubricants for various applications. AC-IM-6.13
14. Diagnose symptoms of lubricant failure. AC-IM-6.14
15. Properly and safely apply lubricants to drive components. AC-IM-6.15
16. Identify and demonstrate the proper and safe use of lubricating equipment. AC-IM-6.16

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**AC-IM-7. Demonstrate the ability to properly set up and use a pedestal grinder.** AC-IM-7

1. Inspect and clean a pedestal grinder. AC-IM-7.1
2. Inspect and position eye shields and tool rests. AC-IM-7.2

3. Demonstrate the proper dressing of grinding wheels. AC-IM-7.3
4. Demonstrate the proper sharpening of center punches and chisels. AC-IM-7.4
5. Demonstrate the proper sharpening of drill bits. AC-IM-7.5

**AC-IM-8. Demonstrate the ability to properly set up and use a drill press.** AC-IM-8

1. Demonstrate the proper inspecting and cleaning of a drill press. AC-IM-8.1
2. Demonstrate the proper mounting and securing of a work piece. AC-IM-8.2
3. Accurately calculate proper revolutions per minute (RPMs) on a drill press. AC-IM-8.3
4. Demonstrate center drilling. AC-IM-8.4
5. Demonstrate the proper drilling of pilot holes. AC-IM-8.5
6. Demonstrate the proper drilling of blind holes. AC-IM-8.6
7. Demonstrate the proper method of drilling through holes. AC-IM-8.7

**AC-IM-9. Perform necessary operations in order to use a lathe.** AC-IM-9

1. Identify and explain the parts of an engine lathe. AC-IM-9.1
2. Demonstrate checking oil reservoirs and cutting fluid levels. AC-IM-9.2
3. Accurately calculate feeds and speeds for various materials and material diameters. AC-IM-9.3
4. Demonstrate the set-up of a lathe for various feeds and speeds. AC-IM-9.4
5. Demonstrate grinding general lathe cutting tools with a pedestal grinder. AC-IM-9.5
6. Demonstrate the set-up and alignment of the tool post. AC-IM-9.6
7. Demonstrate the set-up of the three-jaw chuck. AC-IM-9.7
8. Perform facing operations. AC-IM-9.8
9. Perform center drilling operations. AC-IM-9.9

**AC-IM-10. Perform the necessary operations to use a milling machine.** AC-IM-10

1. Identify and explain the parts of a milling machine. AC-IM-10.1
2. Accurately check oil reservoirs and cutting fluid levels. AC-IM-10.2
3. Accurately calculate feeds and speeds for various materials and material diameters. AC-IM-10.3
4. Demonstrate the set up a mill for various feeds and speeds. AC-IM-10.4
5. Demonstrate the use an edge finder to find the edge of a part. AC-IM-10.5
6. Perform center drilling operations. AC-IM-10.6
7. Perform countersinking operations. AC-IM-10.7
8. Perform drilling operations. AC-IM-10.8

9. Perform taping operations. AC-IM-10.9

**AC-IM-11. Demonstrate safe operating procedures for the use of Oxyacetylene welding and cutting equipment.** AC-IM-11

1. Explain some common hazards in oxyfuel cutting. AC-IM-11.1
2. Demonstrate proficiency in use of proper personal protection equipment. AC-IM-11.2
3. Demonstrate proficiency in the proper use of safety data sheets. AC-IM-11.3
4. Demonstrate proficiency in the proper material handling methods. AC-IM-11.4
5. Explain and demonstrate proper oxyfuel cutting safety. AC-IM-11.5
6. Demonstrate setting up and disassembling oxyfuel equipment. AC-IM-11.6
7. Demonstrate lighting, adjusting, and making cuts with acetylene gas. AC-IM-11.7

**AC-IM-12. Demonstrate knowledge of basic shielded gas metal arc welding (GMAW).** AC-IM-12

1. Demonstrate setting up of equipment for gas metal arc welding (GMAW). AC-IM-12.1
2. Demonstrate preparation of base metal for welding. AC-IM-12.2
3. Identify and explain the American Welding Society (AWS) classification of wire. AC-IM-12.3
4. Identify and explain the proper AWS codes for fillet weld quality. AC-IM-12.4
5. Demonstrate performing fillet welds in the flat, horizontal, vertical, overhead positions to AWS code. AC-IM-12.5

**AC-IM-13. Examine how related student organizations are integral parts of career and technology education courses through leadership development, school and community service projects, and competitive events.** AC-IM-13

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. AC-IM-13.1
2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. AC-IM-13.2
3. Explore the impact and opportunities SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. AC-IM-13.3
4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA including but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. AC-IM-13.4

**Industry Fundamentals and Occupational Safety (46.545)**

**AC-IFOS-1. Demonstrate employability skills required by business and industry.** AC-IFOS-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. AC-IFOS-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. AC-IFOS-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. AC-IFOS-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. AC-IFOS-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. AC-IFOS-1.5
6. Present a professional image through appearance, behavior and language. AC-IFOS-1.6

**AC-IFOS-2. Understand and practice construction safety.** AC-IFOS-2

1. Demonstrate knowledge of use and care of PPE. AC-IFOS-2.1
2. Demonstrate a basic knowledge of OSHA and its regulations. AC-IFOS-2.2
3. Demonstrate a basic knowledge of safety as related as relates to personal safety, aerial work, electricity, and fire. AC-IFOS-2.3

**AC-IFOS-3. Understand and apply math concepts as applied to construction.** AC-IFOS-3

1. Demonstrate knowledge and application of measuring. AC-IFOS-3.1
2. Apply basic math computations to construction settings. AC-IFOS-3.2
3. Apply basic geometric calculations including the 3-4-5 rule. AC-IFOS-3.3
4. Demonstrate knowledge and application of area and volume calculations. AC-IFOS-3.4

**AC-IFOS-4. Utilize basic hand and power tools in a professional and safe manner.** AC-IFOS-4

1. Demonstrate knowledge of rules and regulations regarding the safe use of hand and power tools. AC-IFOS-4.1
2. Demonstrate knowledge of the care and maintenance of hand and power tools. AC-IFOS-4.2
3. Demonstrate knowledge of proper usage techniques of hand and power tools. AC-IFOS-4.3

**AC-IFOS-5. Demonstrate knowledge of construction drawings terms, components, and symbols.** AC-IFOS-5

1. Demonstrate knowledge of construction drawings terms. AC-IFOS-5.1
2. Demonstrate knowledge of construction drawings components. AC-IFOS-5.2
3. Demonstrate knowledge of construction drawings symbols. AC-IFOS-5.3

**AC-IFOS-6. Explain and implement safe rigging procedures.** AC-IFOS-6

1. Demonstrate the knowledge of basic rigging equipment. AC-IFOS-6.1
2. Demonstrate the knowledge of basic rigging communication. AC-IFOS-6.2
3. Demonstrate the knowledge of basic rigging safety. AC-IFOS-6.3

**AC-IFOS-7. Understand hazards associated with materials handling.** AC-IFOS-7

1. Demonstrate knowledge of the importance of proper materials handling. AC-IFOS-7.1
2. Demonstrate the ability to develop a pre-task plan. AC-IFOS-7.2
3. Demonstrate the ability to use proper materials handling techniques. AC-IFOS-7.3
4. Demonstrate the ability to choose appropriate materials handling equipment for a given task. AC-IFOS-7.4
5. Demonstrate the ability to recognize hazards and follow appropriate safety procedures associated with materials handling. AC-IFOS-7.5

**AC-IFOS-8. Demonstrate knowledge of the different forms of communication used in the construction industry.** AC-IFOS-8

1. Demonstrate knowledge of interpreting written and verbal instructions. AC-IFOS-8.1
2. Demonstrate the ability to effectively communicate using verbal and written skills. AC-IFOS-8.2
3. Demonstrate the ability to effectively communicate using electronic communication devices. AC-IFOS-8.3

**AC-IFOS-9. Develop an understanding of construction careers and describe the principal fields of specializations (i.e. Carpentry, masonry, plumbing, electrical, welding, precision machining) and identify associated career opportunities.** AC-IFOS-9

1. Identify education requirements for construction occupations and locations where programs of study are available. AC-IFOS-9.1
2. Match construction job titles with qualifications and responsibilities. AC-IFOS-9.2
3. Participate in activities related to career interests. AC-IFOS-9.3

**AC-IFOS-10. Examine how SkillsUSA is a co-curricular part of career and technical education through leadership development, school and community service projects, and competitive events.** AC-IFOS-10

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. AC-IFOS-10.1
2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. AC-IFOS-10.2
3. Explore the impact and opportunities that SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. AC-IFOS-10.3
4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA, including but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. AC-IFOS-10.4

**Introduction to Construction (46.546)**

**AC-IC-1. Demonstrate employability skills required by business and industry.** AC-IC-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. AC-IC-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. AC-IC-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. AC-IC-1.3

4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. AC-IC-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. AC-IC-1.5
6. Present a professional image through appearance, behavior and language. AC-IC-1.6

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**AC-IC-2. Demonstrate and explain knowledge of the history and traditions of the building trades.** AC-IC-2

1. Describe and explain the history of carpentry, masonry, plumbing, electrical and HVAC. AC-IC-2.1
2. Describe and explain the association of the history of the trades with other events in history. AC-IC-2.2
3. Demonstrate a basic understanding of the history of the tools related to each craft. AC-IC-2.3

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**AC-IC-3. Demonstrate knowledge and application of general construction and specific OSHA and EPA safety concepts and practices.** AC-IC-3

1. Demonstrate an understanding of the applications of Occupational Safety and Health Administration (OSHA) and Environmental Protection Agency (EPA) regulations concerning Personal Protective Equipment (PPE). AC-IC-3.1
2. Demonstrate an understanding of the applications of OSHA and EPA regulations concerning environmental issues on the construction site. AC-IC-3.2
3. Describe and explain the importance of building codes. AC-IC-3.3
4. Evaluate sustainable building practices. AC-IC-3.4

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**AC-IC-4. Demonstrate the professional and safe use of basic tools used in the building trades.** AC-IC-4

1. Demonstrate safe use of basic tools of the trade areas. AC-IC-4.1
2. Demonstrate proper care and maintenance of the basic tools. AC-IC-4.2
3. Demonstrate the use of proper tools for specific building procedures. AC-IC-4.3
4. Demonstrate knowledge of specific regulations related to specific tools. AC-IC-4.4

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**AC-IC-5. Differentiate between the different building trades' plans and specifications.** AC-IC-5

1. Demonstrate evaluating specific types of plans and drawings. AC-IC-5.1
2. Compare differences in symbols between the building trades. AC-IC-5.2

3. Accurately explain terms and abbreviations for each building trade area. AC-IC-5.3
4. Accurately estimate materials needed based on the provided blueprints. AC-IC-5.4

**AC-IC-6. Examine how SkillsUSA is a co-curricular part of career and technical education through leadership development, school and community service projects, and competitive events.** AC-IC-6

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. AC-IC-6.1
2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. AC-IC-6.2
3. Explore the impact and opportunities that SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. AC-IC-6.3
4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA, including but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. AC-IC-6.4

**Introduction to Drafting and Design (48.541)**

**AC-IDD-1. Demonstrate employability skills required by business and industry.** AC-IDD-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. AC-IDD-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. AC-IDD-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. AC-IDD-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. AC-IDD-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. AC-IDD-1.5
6. Present a professional image through appearance, behavior and language. AC-IDD-1.6

**AC-IDD-2. Identify the disciplines related to architectural and engineering professions.** AC-IDD-2

1. Identify the professional and/or trade associations related to the architectural and engineering professions. AC-IDD-2.1

2. Identify related occupations within the architectural and engineering professions. AC-IDD-2.2
3. Identify the employment opportunities in the architectural and engineering professions. AC-IDD-2.3
4. Match architectural and engineering occupational job titles with qualifications and responsibilities. AC-IDD-2.4
5. Identify education and training required to work in the various architectural and engineering professions. AC-IDD-2.5
6. Participate in activities related to career interests. AC-IDD-2.6

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**AC-IDD-3. Demonstrate the knowledge and skills to properly use the tools and equipment safely in the drafting lab.** AC-IDD-3

1. Maintain workstation and storage area. AC-IDD-3.1
2. Demonstrate and incorporate proper use of ergonomics in the drawing lab. AC-IDD-3.2
3. Follow class and lab rules. AC-IDD-3.3

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**AC-IDD-4. Demonstrate the correct use and management of all drafting tools and supplies.** AC-IDD-4

1. Identify and demonstrate the correct operation and maintenance of manual drafting equipment. AC-IDD-4.1
2. Use correct lead selection to produce drawings. AC-IDD-4.2
3. Identify and use the proper type of media. AC-IDD-4.3
4. Promote responsible use of drafting supplies. AC-IDD-4.4

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**AC-IDD-5. Create technical freehand sketches.** AC-IDD-5

1. Demonstrate orthographic sketches. AC-IDD-5.1
2. Demonstrate pictorial sketches. AC-IDD-5.2

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**AC-IDD-6. Demonstrate proper lettering techniques.** AC-IDD-6

1. Demonstrate vertical and/or inclined manual lettering. AC-IDD-6.1
2. Create text using appropriate annotation commands, orientation, style, size, and placement in CAD. AC-IDD-6.2

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**AC-IDD-7. Demonstrate the use of proper line types.** AC-IDD-7

1. Demonstrate the ability to perform a drawing setup, e.g., sheet size, border, and title block. AC-IDD-7.1
2. Control entity properties by layer, color, and line type. AC-IDD-7.2
3. Demonstrate the use of the alphabet of lines. AC-IDD-7.3

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**AC-IDD-8. Demonstrate the ability to read and draw using the proper scale.** AC-IDD-8

1. Demonstrate the ability to measure using the architect's scale, engineer's scale, and metric scale. AC-IDD-8.1
2. Select proper drawing scale. AC-IDD-8.2

**AC-IDD-9. Demonstrate the knowledge and skills of computer operations.** AC-IDD-9

1. Demonstrate definitions and procedures for file management techniques: copying, deleting, finding, saving, and renaming, based on operating/applications systems. AC-IDD-9.1
2. Use an on-line help tutorial based on the application system. AC-IDD-9.2
3. Demonstrate the ability to open a drawing file and create a drawing. AC-IDD-9.3
4. Identify and use all major components of hardware associated with a CAD system. AC-IDD-9.4

**AC-IDD-10. Create and dimension single view drawings while applying geometric construction.** AC-IDD-10

1. Produce geometric shapes such as straight lines, geometric angles, plane figures, circles and arcs, and irregular geometric figures. AC-IDD-10.1
2. Demonstrate geometric construction techniques given size, orientation, and location specifications. AC-IDD-10.2
3. Apply center lines to drawings in correct size and location. AC-IDD-10.3
4. Apply correct dimensioning procedures. AC-IDD-10.4

**AC-IDD-11. Utilize orthographic projection to create and dimension multi-view drawings manually and using CADD.** AC-IDD-11

1. Draw an object that is described with two views. AC-IDD-11.1
2. Draw an object that is described with three views. AC-IDD-11.2
3. Select proper drawing scale, views, and layout. AC-IDD-11.3
4. Draw an object that has an inclined surface. AC-IDD-11.4
5. Draw an object containing circles and arcs. AC-IDD-11.5
6. Correctly identify views of an object. AC-IDD-11.6
7. Create orthographic projections utilizing the necessary views. AC-IDD-11.7

**Introduction to HVACR Systems (47.414)**

**AC-IHVACR-1. Demonstrate employability skills required by business and industry.** AC-IHVACR-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. AC-IHVACR-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. AC-IHVACR-1.2

3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. AC-IHVACR-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. AC-IHVACR-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. AC-IHVACR-1.5
6. Present a professional image through appearance, behavior and language. AC-IHVACR-1.6

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**AC-IHVACR-2.** **Demonstrate a thorough understanding of electrical concepts, theories, laws, and simple circuits.** AC-IHVACR-2

1. Explain atomic theory, Ohm's law, and Kirchoff's law in relation to electrical circuits. AC-IHVACR-2.1
2. Demonstrate a working knowledge of the math needed to calculate amperage, voltage, wattage, and resistance. AC-IHVACR-2.2
3. Distinguish between series, parallel, and series parallel circuits. AC-IHVACR-2.3
4. Demonstrate proper use of a multi meter and ammeter. AC-IHVACR-2.4

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**AC-IHVACR-3.** **Identify and describe electrical circuitry associated with the HVACR trade.** AC-IHVACR-3

1. Recognize and describe the purpose and operation of the various electrical components used in HVACR equipment. AC-IHVACR-3.1
2. Identify different types of resistors and explain how their resistance values can be determined. AC-IHVACR-3.2

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**AC-IHVACR-4.** **Compare components to schematic symbols.** AC-IHVACR-4

1. Compare components to the schematic symbol. AC-IHVACR-4.1
2. Read and interpret schematic diagrams. AC-IHVACR-4.2
3. Identify and explain the sequence of operation for a basic HVACR schematic diagram. AC-IHVACR-4.3

**AC-IHVACR-5. Describe and illustrate alternating current.** AC-IHVACR-5

1. Explain how alternating current is developed and draw a sine wave. AC-IHVACR-5.1
2. Describe the operation of types of single-phase transformers. AC-IHVACR-5.2
3. Describe the types and applications of capacitors. AC-IHVACR-5.3
4. Identify and describe applications of single-phase motors. AC-IHVACR-5.4

**AC-IHVACR-6. Demonstrate the ability to test various electrical components in a HVAC system.** AC-IHVACR-6

1. Explain how magnetism works in various electrical components in an HVAC system. AC-IHVACR-6.1
2. Demonstrate testing contractors, relays, transformers, bi-metal thermostats, electrical heating elements, capacitors, and solenoids. AC-IHVACR-6.2
3. Demonstrate checking a compressor electrically using resistance readings. AC-IHVACR-6.3
4. Demonstrate starting and running common terminals on a compressor. AC-IHVACR-6.4

**AC-IHVACR-7. Demonstrate installing and troubleshooting thermostats.** AC-IHVACR-7

1. Identify and explain the types and operation of thermostats. AC-IHVACR-7.1
2. Identify and explain the low voltage side of the HVAC system. AC-IHVACR-7.2
3. Demonstrate correct thermostat installation procedures. AC-IHVACR-7.3
4. Explain and demonstrate troubleshooting procedures on the low voltage side of the HVAC system. AC-IHVACR-7.4

**AC-IHVACR-8. Examine how SkillsUSA is a co-curricular part of career and technical education through leadership development, school and community service projects, and competitive events.** AC-IHVACR-8

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. AC-IHVACR-8.1
2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. AC-IHVACR-8.2
3. Explore the impact and opportunities that SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. AC-IHVACR-8.3

4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA, including but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. AC-IHVACR-8.4

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**Introduction to Metals (48.581)**

**AC-IM-1. Demonstrate employability skills required by business and industry.** AC-IM-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. AC-IM-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. AC-IM-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. AC-IM-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. AC-IM-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. AC-IM-1.5
6. Present a professional image through appearance, behavior and language. AC-IM-1.6

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**AC-IM-2. Explore the history of the machining, welding, and sheet-metal trade.** AC-IM-2

1. Research and describe the history of the machining, welding, and sheet metal trade by utilizing technology, collaboration, and other sources. AC-IM-2.1
2. Describe the history of the machining, welding, and sheet-metal trade through group discussions and written summary or presentation. AC-IM-2.2

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**AC-IM-3. Demonstrate knowledge and practice of metals safety.** AC-IM-3

1. Identify and explain the common hazards in machining, sheet metal, and welding. AC-IM-3.1
2. Demonstrate basic knowledge of Occupational Safety and Health Administration (OSHA), and the regulations related to preventive measures for personal safety. AC-IM-3.2
3. Demonstrate the proper use and care of Personal Protection Equipment (PPE) used in machining, sheet metal, and welding. AC-IM-3.3
4. Demonstrate the safe use of equipment in the metals laboratory. AC-IM-3.4

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**AC-IM-4. Demonstrate proficiency in the use of hand and power tools specific to the trade.** AC-IM-4

1. Demonstrate knowledge of proper care, maintenance, and safe use of hand and power tools specific to the metals trade. AC-IM-4.1
2. Demonstrate proficiency in the techniques of power and hand tools specific to the metals trade. AC-IM-4.2

**AC-IM-5. Demonstrate the ability to use measuring instruments specific to the metals trade.** AC-IM-5

1. Demonstrate proficiency in measuring work pieces with the English and metric system scales. AC-IM-5.1
2. Demonstrate proficiency in the use of measuring tools used in the metals trade including but not limited to fillet weld gauge, caliper, micrometer, tape measure, divider, protractor, angle finder, etc. AC-IM-5.2
3. Demonstrate proficiency in the proper care, cleaning, and storage of measuring instruments. AC-IM-5.3

**AC-IM-6. Demonstrate and explain the ability to safely set up and operate basic equipment for welding and cutting specific to the metal trade.** AC-IM-6

1. Identify and explain the use of oxyfuel cutting equipment. AC-IM-6.1
2. Properly set up oxyfuel equipment for acetylene and alternate fuel gases (i.e. propane). AC-IM-6.2
3. Safely perform basic cuts, straight lines, arches, and piercing holes using oxyfuel equipment. AC-IM-6.3
4. Identify and explain the Shielded Metal Arc Welding (SMAW) process. AC-IM-6.4
5. Demonstrate proficiency in safely setting up SMAW equipment and welding continuous beads. AC-IM-6.5
6. Identify and explain the Gas Metal Arc Welding (GMAW) process. AC-IM-6.6
7. Demonstrate proficiency in safely setting up GMAW equipment and welding continuous beads. AC-IM-6.7

**AC-IM-7. Demonstrate the ability to perform basic layout for parallel line development.** AC-IM-7

1. Demonstrate proficiency in the selection and use of layout tools for parallel line development. AC-IM-7.1
2. Demonstrate proficiency in the selection and use of hand tools and equipment for parallel line development. AC-IM-7.2

**AC-IM-8. Demonstrate and explain the ability to perform basic layout for machined projects.** AC-IM-8

1. Identify and explain the use of a conventional and Computer-Controlled Shaping Machine (CNC) machining equipment used in current manufacturing. AC-IM-8.1

2. Demonstrate proficiency in the selection and use of basic layout tools used in the machining trade. AC-IM-8.2
3. Demonstrate proficiency in the selection and use of machine shop equipment to produce basic layout projects. AC-IM-8.3

**AC-IM-9. Examine how SkillsUSA is a co-curricular part of career and technical education through leadership development, school and community service projects, and competitive events.** AC-IM-9

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. AC-IM-9.1
2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. AC-IM-9.2
3. Explore the impact and opportunities that SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. AC-IM-9.3
4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA, including but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. AC-IM-9.4

**Low Voltage Electrical (47.416)**

**AC-LVE-1. Demonstrate employability skills required by business and industry.** AC-LVE-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. AC-LVE-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. AC-LVE-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. AC-LVE-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. AC-LVE-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. AC-LVE-1.5
6. Present a professional image through appearance, behavior and language. AC-LVE-1.6

**AC-LVE-2. Apply general construction and specific Occupational Safety and Health Administration (OSHA) and Environmental Protection Agency (EPA) safety concepts and practices.** AC-LVE-2

1. Demonstrate safe working procedures in the electrical/electronic environment. AC-LVE-2.1

2. Identify and explain electrical hazards and how to minimize them in the workplace. AC-LVE-2.2
3. Explain safety issue concerning lockout, tag out, personal protective equipment (PPE), assured grounding and isolation programs, confined spaces, breathing and fall protection. AC-LVE-2.3

**AC-LVE-3. Demonstrate proper use of tools, instruments, and equipment in a professional and safe manner.** AC-LVE-3

1. Demonstrate 90-degree bends, back-to-back bends, offsets, kicks, and saddle bends using a hand bender. AC-LVE-3.1
2. Demonstrate correct application of fasteners and anchors. AC-LVE-3.2
3. Demonstrate proper use of a multi-meter, clamp-on ammeter, and megohm-meter. AC-LVE-3.3
4. Demonstrate knowledge of testing a ground fault circuit interrupter (GFCI). AC-LVE-3.4

**AC-LVE-4. Demonstrate proper selection, handling, storage, and use of electrical/electronic materials.** AC-LVE-4

1. Identify and describe correct fasteners and anchors. AC-LVE-4.1
2. Demonstrate proper handling and storage of capacitors, motors, transformers and other electronic and electrical equipment. AC-LVE-4.2
3. Demonstrate proper handling of electronic circuitry. AC-LVE-4.3

**AC-LVE-5. Read, interpret, apply information and estimate costs from a variety of architectural and construction working drawings.** AC-LVE-5

1. Read and interpret electrical blueprints. AC-LVE-5.1
2. Read and interpret electrical diagrams. AC-LVE-5.2
3. Estimate materials based on provided blueprints. AC-LVE-5.3

**AC-LVE-6. Identify and apply information regarding electrical circuitry, including raceways, boxes, and conduit.** AC-LVE-6

1. Identify and select various sizes of electrical devices and boxes. AC-LVE-6.1
2. Identify and select various sizes of electrical conduit. AC-LVE-6.2
3. Demonstrate correct computing of loads for various circuits. AC-LVE-6.3
4. Demonstrate how to properly connect HVACR equipment to power supplies. AC-LVE-6.4

**AC-LVE-7. Examine how SkillsUSA is a co-curricular part of career and technical education through leadership development, school and community service projects, and competitive events.** AC-LVE-7

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. AC-LVE-7.1

2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. AC-LVE-7.2
3. Explore the impact and opportunities that SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. AC-LVE-7.3
4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA, including but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. AC-LVE-7.4

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**Machining Operations I (48.59)**

**AC-MO1-1. The following standard is included in all CTAE courses adopted for the Career Cluster/Pathways.** AC-MO1-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. AC-MO1-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. AC-MO1-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. AC-MO1-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. AC-MO1-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. AC-MO1-1.5
6. Present a professional image through appearance, behavior and language. AC-MO1-1.6

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**AC-MO1-2. Demonstrate safety in the machining lab and classroom.** AC-MO1-2

1. List and explain general safety rules for the machining laboratory. AC-MO1-2.1
2. Identify and explain the location of the following: fire extinguisher(s), eye wash station, first aid kit, and emergency electrical shutoff. AC-MO1-2.2
3. Describe the types of fires possible in a machining environment and identify the appropriate fire extinguisher for each type of fire. AC-MO1-2.3
4. Demonstrate the use of a fire extinguisher. AC-MO1-2.4
5. Demonstrate basic first aid needed to stop bleeding and prevent shock. AC-MO1-2.5
6. Describe the procedure for obtaining outside emergency medical response. AC-MO1-2.6
7. Demonstrate using emergency shutoff procedures. AC-MO1-2.7

8. Demonstrate proper shop evacuation procedures. AC-MO1-2.8
9. Identify and describe the location of Material Safety and Data Sheets (MSDS). AC-MO1-2.9

**AC-MO1-3. Accurately measure to specific tolerances.** AC-MO1-3

1. Accurately measure work pieces with a 6 inch Standard rule. AC-MO1-3.1
2. Accurately measure work pieces with a 12 inch Standard rule. AC-MO1-3.2
3. Accurately measure work pieces 0-1" Micrometer. AC-MO1-3.3
4. Accurately measure work pieces with dial and vernier calipers. AC-MO1-3.4
5. Demonstrate the accurate use a dial indicator. AC-MO1-3.5

**AC-MO1-4. Identify and describe blueprint information.** AC-MO1-4

1. Identify and describe title block. AC-MO1-4.1
2. Identify and describe basic blueprint symbols and lines. AC-MO1-4.2

**AC-MO1-5. Demonstrate the ability to properly set up and use a pedestal grinder.** AC-MO1-5

1. Inspect and clean a pedestal grinder. AC-MO1-5.1
2. Inspect and position eye shields and tool rests. AC-MO1-5.2
3. Demonstrate the proper dressing of grinding wheels. AC-MO1-5.3
4. Demonstrate the proper sharpening of center punches and chisels. AC-MO1-5.4
5. Demonstrate the proper sharpening of drill bits. AC-MO1-5.5

**AC-MO1-6. Demonstrate the ability to properly set up and use a drill press.** AC-MO1-6

1. Demonstrate the proper inspecting and cleaning of a drill press. AC-MO1-6.1
2. Demonstrate the proper mounting and securing of a work piece. AC-MO1-6.2
3. Accurately calculate proper revolutions per minute (RPMs) on a drill press. AC-MO1-6.3
4. Demonstrate center drilling. AC-MO1-6.4
5. Demonstrate the proper drilling of pilot holes. AC-MO1-6.5
6. Demonstrate the proper drilling of blind holes. AC-MO1-6.6
7. Demonstrate the proper method of drilling through holes. AC-MO1-6.7

**AC-MO1-7. Perform necessary operations in order to use a lathe.** AC-MO1-7

1. Identify and explain the parts of an engine lathe. AC-MO1-7.1
2. Demonstrate checking oil reservoirs and cutting fluid levels. AC-MO1-7.2

3. Accurately calculate feeds and speeds for various materials and material diameters. AC-MO1-7.3
4. Demonstrate the set-up of a lathe for various feeds and speeds. AC-MO1-7.4
5. Demonstrate grinding general lathe cutting tools with a pedestal grinder. AC-MO1-7.5
6. Demonstrate the set-up and alignment of the tool post. AC-MO1-7.6
7. Demonstrate the set-up of the three-jaw chuck. AC-MO1-7.7
8. Perform facing operations. AC-MO1-7.8
9. Perform center drilling operations. AC-MO1-7.9

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**AC-MO1-8. Perform the necessary operations to use a milling machine.** AC-MO1-8

1. Identify and explain the parts of a milling machine. AC-MO1-8.1
2. Accurately check oil reservoirs and cutting fluid levels. AC-MO1-8.2
3. Accurately calculate feeds and speeds for various materials and material diameters. AC-MO1-8.3
4. Demonstrate the set up a mill for various feeds and speeds. AC-MO1-8.4
5. Demonstrate the use an edge finder to find the edge of a part. AC-MO1-8.5
6. Perform center drilling operations. AC-MO1-8.6
7. Perform countersinking operations. AC-MO1-8.7
8. Perform drilling operations. AC-MO1-8.8
9. Perform taping operations. AC-MO1-8.9

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**AC-MO1-9. Perform maintenance procedures.** AC-MO1-9

1. Perform incidental and preventative maintenance on a milling machine, lathe, pedestal grinder, and drill press. AC-MO1-9.1
2. Demonstrate the proper completion of history forms for tracking maintenance. AC-MO1-9.2
3. Report maintenance problems to the teacher. AC-MO1-9.3

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**AC-MO1-10. Examine how SkillsUSA is a co-curricular part of career and technical education through leadership development, school and community service projects, and competitive events.** AC-MO1-10

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. AC-MO1-10.1
2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. AC-MO1-10.2

3. Explore the impact and opportunities that SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. AC-MO1-10.3
4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA, including but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. AC-MO1-10.4

**Masonry I (46.57)**

**AC-M1-1. Demonstrate employability skills required by business and industry.** AC-M1-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. AC-M1-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. AC-M1-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. AC-M1-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. AC-M1-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. AC-M1-1.5
6. Present a professional image through appearance, behavior and language. AC-M1-1.6

**AC-M1-2. Demonstrate knowledge of the selection, handling, storage, and proper use of masonry materials.** AC-M1-2

1. Demonstrate the proper use of different types of materials used in the masonry trade, including mortar, admixtures, brick and block. AC-M1-2.1
2. Identify and describe the most common types of masonry units. AC-M1-2.2

**AC-M1-3. Demonstrate the ability to read, interpret, apply information, and estimate costs from a variety of architectural and construction working drawings.** AC-M1-3

1. Identify and describe the basic parts of a set of drawings. AC-M1-3.1
2. Demonstrate an understanding of the different types of specifications used in the masonry trade. AC-M1-3.2
3. Accurately estimate materials based on drawings. AC-M1-3.3

**AC-M1-4. Demonstrate an understanding of materials and processes used in masonry construction.** AC-M1-4

1. Demonstrate an understanding of setting up a wall. AC-M1-4.1
2. Demonstrate an understanding of laying a dry bond. AC-M1-4.2
3. Demonstrate and understanding of spreading furrowed bed joint and butter masonry units. AC-M1-4.3
4. Describe different types of masonry bonds. AC-M1-4.4
5. Demonstrate and understanding of accurate cutting of bricks and blocks. AC-M1-4.5
6. Demonstrate and understanding of laying masonry units in a true course. AC-M1-4.6

**AC-M1-5. Demonstrate an understanding of the proper techniques to complete concrete flatwork.** AC-M1-5

1. Demonstrate an understanding of the requirements for construction of various types of residential foundations. AC-M1-5.1
2. Demonstrate the knowledge of the layout and construction of steps, patios, and decks made from masonry units. AC-M1-5.2

**AC-M1-6. Examine how SkillsUSA is a co-curricular part of career and technical education through leadership development, school and community service projects, and competitive events.** AC-M1-6

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. AC-M1-6.1
2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. AC-M1-6.2
3. Explore the impact and opportunities that SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. AC-M1-6.3
4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA, including but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. AC-M1-6.4

**Plumbing I (46.58)**

**AC-PI-1. Demonstrate employability skills required by business and industry.** AC-PI-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. AC-PI-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. AC-PI-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. AC-PI-1.3

4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. AC-PI-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. AC-PI-1.5
6. Present a professional image through appearance, behavior and language. AC-PI-1.6

**AC-PI-2. Demonstrate an understanding of the selection, handling, storage, and proper use of plumbing related construction materials.** AC-PI-2

1. Demonstrate an understanding and proper installation of pipes, fittings and valves, hangers, supports, fixtures, and appliances. AC-PI-2.1

**AC-PI-3. Demonstrate the ability to read, interpret, apply information, and estimate costs from a variety of architectural and construction working drawings.** AC-PI-3

1. Interpret material take-off lists and bill of materials and determine the costs for plumbing materials. AC-PI-3.1
2. Prepare cost estimates for both materials and labor. AC-PI-3.2

**AC-PI-4. Demonstrate how to install drain, waste, and vent systems.** AC-PI-4

1. Demonstrate the proper installation of plastic, steel, iron, and copper pipes and fittings used in Drain, Waste, and Vent (DWV). AC-PI-4.1

**AC-PI-5. Demonstrate installation of water distribution and supply systems.** AC-PI-5

1. Demonstrate installation of piping and fittings used in potable water systems. AC-PI-5.1
2. Demonstrate installation of water and irrigation systems. AC-PI-5.2
3. Demonstrate installation of water meters and water heating appliances. AC-PI-5.3

**AC-PI-6. Demonstrate installation of a variety of fixtures related to plumbing.** AC-PI-6

1. Demonstrate installation of kitchen fixtures. AC-PI-6.1
2. Demonstrate installation of bathroom fixtures. AC-PI-6.2
3. Demonstrate installation of laundry fixtures. AC-PI-6.3
4. Demonstrate installation of utility fixtures. AC-PI-6.4

**AC-PI-7. Demonstrate knowledge of codes applying to plumbing.** AC-PI-7

1. Demonstrate knowledge of Occupational Safety and Health Administration (OSHA) and Environmental Protection Agency (EPA) regulations related to plumbing. AC-PI-7.1

2. Demonstrate knowledge of the International Plumbing Code. AC-PI-7.2
3. Demonstrate knowledge of state and local building codes. AC-PI-7.3

**AC-PI-8. Examine how SkillsUSA is a co-curricular part of career and technical education through leadership development, school and community service projects, and competitive events.** AC-PI-8

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. AC-PI-8.1
2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. AC-PI-8.2
3. Explore the impact and opportunities that SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. AC-PI-8.3
4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA, including but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. AC-PI-8.4

**Sheet Metal I (48.582)**

**AC-SM1-1. Demonstrate employability skills required by business and industry.** AC-SM1-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. AC-SM1-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. AC-SM1-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. AC-SM1-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. AC-SM1-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. AC-SM1-1.5
6. Present a professional image through appearance, behavior and language. AC-SM1-1.6

**AC-SM1-2. Demonstrate proficiency in parallel line development.** AC-SM1-2

1. Demonstrate the proper use of parallel line development as one of the three development methods for laying out sheet metal patterns. AC-SM1-2.1
2. Demonstrate proper use of parallel line development layout procedures. AC-SM1-2.2

3. Demonstrate proper use of laying-out patterns in basic parallel line development. AC-SM1-2.3

**AC-SM1-3. Compute and solve mathematical problems relating to sheet metal.** AC-SM1-3

1. Accurately calculate various rule measurements in English & metric relating to sheet metal. AC-SM1-3.1
2. Accurately calculate appropriate linear, square, weight, and volume measurements relating to sheet metal. AC-SM1-3.2
3. Construct simple geometric figures and solve basic geometry problems related to the sheet metal trade. AC-SM1-3.3

**AC-SM1-4. Demonstrate the ability to use and identify fasteners, hangers, and supports.** AC-SM1-4

1. Identify and explain the various fasteners used in sheet metal work. AC-SM1-4.1
2. Demonstrate the common methods of supporting ducts. AC-SM1-4.2
3. Explain the use of various duct support hangers and supports. AC-SM1-4.3
4. Demonstrate the proper installation of duct fasteners, hangers, and supports. AC-SM1-4.4

**AC-SM1-5. Demonstrate the ability to identify and measure different types of metals used in sheet metal.** AC-SM1-5

1. Identify and demonstrate using various metals in sheet metal, including alloys and pure metals and their properties. AC-SM1-5.1
2. Demonstrate proficiency using sheet metal measuring gauges. AC-SM1-5.2

**AC-SM1-6. Examine how SkillsUSA is a co-curricular part of career and technical education through leadership development, school and community service projects, and competitive events.** AC-SM1-6

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. AC-SM1-6.1
2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. AC-SM1-6.2
3. Explore the impact and opportunities that SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. AC-SM1-6.3
4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA, including but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. AC-SM1-6.4

**Welding I (48.551)**

**AC-WI-1. Demonstrate employability skills required by business and industry.** AC-WI-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. AC-WI-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. AC-WI-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. AC-WI-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. AC-WI-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. AC-WI-1.5
6. Present a professional image through appearance, behavior and language. AC-WI-1.6

**AC-WI-2. Demonstrate proficiency in Arc Welding & Oxyfuel Safety.** AC-WI-2

1. Explain some common hazards in arc welding and oxyfuel cutting. AC-WI-2.1
2. Demonstrate proficiency in use of proper personal protection equipment. AC-WI-2.2
3. Demonstrate proficiency in the proper use of safety data sheets. AC-WI-2.3
4. Demonstrate proficiency in the proper material handling methods. AC-WI-2.4

**AC-WI-3. Identify and use oxyfuel cutting equipment with acetylene and alternate fuels (propane).** AC-WI-3

1. Explain and demonstrate proper oxyfuel cutting safety. AC-WI-3.1
2. Demonstrate setting up and disassembling oxyfuel equipment. AC-WI-3.2
3. Demonstrate lighting, adjusting, and making cuts with acetylene gas. AC-WI-3.3
4. Demonstrate lighting, adjusting, and making cuts with propane gas (alternate fuel). AC-WI-3.4
5. Demonstrate setting up and operating a motorized cutting machine. AC-WI-3.5

**AC-WI-4. Identify and use welding symbols and read detailed drawings.** AC-WI-4

1. Identify and use the parts of welding symbols. AC-WI-4.1
2. Identify and use of basic welding symbols for fillet welds, groove welds, and other basic welds. AC-WI-4.2

3. Identify and demonstrate the use of elements of a detailed drawing. AC-WI-4.3
4. Interpret welding symbols from a detailed drawing. AC-WI-4.4
5. Identify and use the basic weld types, weld joints, and weld positions. AC-WI-4.5

**AC-WI-5. Identify and explain welding procedures and testing.** AC-WI-5

1. Identify and explain common destructive and nondestructive weld test methods. AC-WI-5.1
2. Identify and explain the American Welding Society (AWS) codes for welding. AC-WI-5.2
3. Identify and explain the elements of Welding Procedure Specification (WPS). AC-WI-5.3
4. Identify and explain the requirements for a Welding Performance Qualification Record (WPQR). AC-WI-5.4

**AC-WI-6. Demonstrate knowledge of basic shielded metal arc welding (SMAW).** AC-WI-6

1. Demonstrate setting up equipment for basic shield metal arc welding (SMAW). AC-WI-6.1
2. Demonstrate the preparation of base metal for welding. AC-WI-6.2
3. Identify and explain the American Welding Society (AWS) classification of electrodes. AC-WI-6.3
4. Identify and explain the proper AWS codes for fillet weld quality. AC-WI-6.4
5. Demonstrate performing of fillet welds using E7018 and E6010 electrodes in the flat, horizontal, vertical, and overhead positions to AWS code. AC-WI-6.5

**AC-WI-7. Demonstrate knowledge of basic shielded metal arc welding (SMAW).** AC-WI-7

1. Demonstrate setting up of equipment for gas metal arc welding (GMAW). AC-WI-7.1
2. Demonstrate preparation of base metal for welding. AC-WI-7.2
3. Identify and explain the American Welding Society (AWS) classification of wire. AC-WI-7.3
4. Identify and explain the proper AWS codes for fillet weld quality. AC-WI-7.4
5. Demonstrate performing fillet welds in the flat, horizontal, vertical, and overhead positions to AWS code. AC-WI-7.5

**AC-WI-8. Demonstrate knowledge of plasma arc cutting.** AC-WI-8

1. Identify and explain the proper safety procedures and fume extraction for plasma arc cutting. AC-WI-8.1

2. Identify and explain the use of plasma arc cutting processes. AC-WI-8.2
3. Identify and describe setting up plasma arc cutting equipment. AC-WI-8.3
4. Demonstrate the knowledge required to perform various cuts with plasma arc on various materials, including steel, aluminum, and stainless steel. AC-WI-8.4

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**AC-WI-9. Examine how SkillsUSA is a co-curricular part of career and technical education through leadership development, school and community service projects, and competitive events.** AC-WI-9

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. AC-WI-9.1
2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. AC-WI-9.2
3. Explore the impact and opportunities that SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. AC-WI-9.3
4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA, including but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. AC-WI-9.4