Course Description:
This course introduces and emphasizes the basic skill necessary for mechanical maintenance personnel. Instruction is also provided in the basic physics concepts applicable to the mechanics of industrial production equipment, and the application of mechanical principles with additional emphasis on power transmission and specific mechanical components. There are no prerequisites for this course.

Course Standard 1

AC-IM-1
The following standard is included in all CTAE courses adopted for the Career Cluster/Pathways. Teachers should incorporate the elements of this standard into lesson plans during the course. The topics listed for each element of the standard may be addressed in differentiated instruction matching the content of each course. These elements may also be addressed with specific lessons from a variety of resources. This content is not to be treated as a unit or separate body of knowledge but rather integrated into class activities as applications of the concept.

Standard: Demonstrate employability skills required by business and industry.
The following elements should be integrated throughout the content of this course.

1.1 Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities.

<table>
<thead>
<tr>
<th>Person-to-Person Etiquette</th>
<th>Telephone and Email Etiquette</th>
<th>Cell Phone and Internet Etiquette</th>
<th>Communicating At Work</th>
<th>Listening</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interacting with Your Boss</td>
<td>Telephone Conversations</td>
<td>Using Blogs</td>
<td>Improving Communication Skills</td>
<td>Reasons, Benefits, and Barriers</td>
</tr>
<tr>
<td>Interacting with Subordinates</td>
<td>Barriers to Phone conversations</td>
<td>Using Social Media</td>
<td>Effective Oral Communication</td>
<td>Listening Strategies</td>
</tr>
<tr>
<td>Interacting with Co-workers</td>
<td>Making and Returning Calls</td>
<td></td>
<td>Effective Written Communication</td>
<td>Ways We Filter What We Hear</td>
</tr>
<tr>
<td>Interacting with Suppliers</td>
<td>Making Cold Calls</td>
<td></td>
<td>Effective Nonverbal Skills</td>
<td>Developing a Listening Attitude</td>
</tr>
<tr>
<td></td>
<td>Handling Conference Calls</td>
<td></td>
<td>Effective Word Use</td>
<td>Show You Are Listening</td>
</tr>
<tr>
<td></td>
<td>Handling Unsolicited Calls</td>
<td></td>
<td>Giving and Receiving Feedback</td>
<td>Asking Questions</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nonverbal Communication</th>
<th>Written Communication</th>
<th>Speaking</th>
<th>Applications and Effective Résumés</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communicating Nonverbally</td>
<td>Writing Documents</td>
<td>Using Language Carefully</td>
<td>Completing a Job Application</td>
</tr>
<tr>
<td>Reading Body Language and mixed Messages</td>
<td>Constructive Criticism in Writing</td>
<td>One-on-One Conversations</td>
<td>Writing a Cover Letter</td>
</tr>
<tr>
<td>Matching Verbal and Nonverbal communication</td>
<td>Small Group Communication</td>
<td>Things to Include in a Résumé</td>
<td></td>
</tr>
<tr>
<td>Improving Nonverbal Indicators</td>
<td>Large Group Communication</td>
<td>Selling Yourself in a Résumé</td>
<td></td>
</tr>
</tbody>
</table>
1.2 Demonstrate creativity by asking challenging questions and applying innovative procedures and methods.

<table>
<thead>
<tr>
<th>Teamwork and Problem Solving</th>
<th>Meeting Etiquette</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thinking Creatively</td>
<td>Preparation and Participation in Meetings</td>
</tr>
<tr>
<td>Taking Risks</td>
<td>Conducting Two-Person or Large Group Meetings</td>
</tr>
<tr>
<td>Building Team Communication</td>
<td>Inviting and Introducing Speakers</td>
</tr>
<tr>
<td></td>
<td>Facilitating Discussions and Closing</td>
</tr>
<tr>
<td></td>
<td>Preparing Visual Aids</td>
</tr>
<tr>
<td></td>
<td>Virtual Meetings</td>
</tr>
</tbody>
</table>

1.3 Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations.

<table>
<thead>
<tr>
<th>Problem Solving</th>
<th>Customer Service</th>
<th>The Application Process</th>
<th>Interviewing Skills</th>
<th>Finding the Right Job</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transferable Job Skills</td>
<td>Gaining Trust and Interacting with Customers</td>
<td>Providing Information, Accuracy and Double Checking</td>
<td>Preparing for an Interview</td>
<td>Locating Jobs and Networking</td>
</tr>
<tr>
<td>Becoming a Problem Solver</td>
<td>Learning and Giving Customers What They Want</td>
<td>Online Application Process</td>
<td>Questions to Ask in an Interview</td>
<td>Job Shopping Online</td>
</tr>
<tr>
<td>Identifying a Problem</td>
<td>Keeping Customers Coming Back</td>
<td>Following Up After Submitting an Application</td>
<td>Things to Include in a Career Portfolio</td>
<td>Job Search Websites</td>
</tr>
<tr>
<td>Becoming a Critical Thinker</td>
<td>Seeing the Customer’s Point</td>
<td>Effective Résumés:</td>
<td>Traits Employers are Seeking</td>
<td>Participation in Job Fairs</td>
</tr>
<tr>
<td>Managing</td>
<td>Selling Yourself and the Company</td>
<td>Matching Your Talents to a Job</td>
<td>Considerations Before Taking a Job</td>
<td>Searching the Classified Ads</td>
</tr>
<tr>
<td>Handling Customer Complaints</td>
<td>When a Résumé Should be Used</td>
<td></td>
<td></td>
<td>Using Employment Agencies</td>
</tr>
<tr>
<td>Strategies for Customer Service</td>
<td></td>
<td></td>
<td></td>
<td>Landing an Internship</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Staying Motivated to Search</td>
</tr>
</tbody>
</table>

1.4 Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity.

<table>
<thead>
<tr>
<th>Workplace Ethics</th>
<th>Personal Characteristics</th>
<th>Employer Expectations</th>
<th>Business Etiquette</th>
<th>Communicating at Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demonstrating Good Work Ethic</td>
<td>Demonstrating a Good Attitude</td>
<td>Behaviors Employers Expect</td>
<td>Language and Behavior</td>
<td>Handling Anger</td>
</tr>
<tr>
<td>Behaving Appropriately</td>
<td>Gaining and Showing Respect</td>
<td>Objectionable Behaviors</td>
<td>Keeping Information Confidential</td>
<td>Dealing with Difficult Coworkers</td>
</tr>
<tr>
<td>Maintaining Honesty</td>
<td>Demonstrating Responsibility</td>
<td>Establishing Credibility</td>
<td>Avoiding Gossip</td>
<td>Dealing with a Difficult Boss</td>
</tr>
<tr>
<td>Playing Fair</td>
<td>Showing Dependability</td>
<td>Demonstrating Your Skills</td>
<td>Appropriate Work Email</td>
<td>Dealing with Difficult Customers</td>
</tr>
<tr>
<td>Using Ethical Language</td>
<td>Being Courteous</td>
<td>Building Work Relationships</td>
<td>Cell Phone Etiquette</td>
<td>Dealing with Conflict</td>
</tr>
</tbody>
</table>
## 1.5 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.

<table>
<thead>
<tr>
<th>Expected Work Traits</th>
<th>Teamwork</th>
<th>Time Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demonstrating Responsibility</td>
<td>Teamwork Skills</td>
<td>Managing Time</td>
</tr>
<tr>
<td>Dealing with Information Overload</td>
<td>Reasons Companies Use Teams</td>
<td>Putting First Things First</td>
</tr>
<tr>
<td>Transferable Job Skills</td>
<td>Decisions Teams Make</td>
<td>Juggling Many Priorities</td>
</tr>
<tr>
<td>Managing Change</td>
<td>Team Responsibilities</td>
<td>Overcoming Procrastination</td>
</tr>
<tr>
<td>Adopting a New Technology</td>
<td>Problems That Affect Teams</td>
<td>Organizing Workspace and Tasks</td>
</tr>
<tr>
<td>Expressing Yourself on a Team</td>
<td>Staying Organized</td>
<td></td>
</tr>
<tr>
<td>Giving and Receiving Constructive Criticism</td>
<td>Finding More Time</td>
<td></td>
</tr>
<tr>
<td>Managing Projects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prioritizing Personal and Work Life</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## 1.6 Present a professional image through appearance, behavior and language.

<table>
<thead>
<tr>
<th>On-the-Job Etiquette</th>
<th>Person-to-Person Etiquette</th>
<th>Communication Etiquette</th>
<th>Presenting Yourself</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using Professional Manners</td>
<td>Meeting Business Acquaintances</td>
<td>Creating a Good Impression</td>
<td>Looking Professional</td>
</tr>
<tr>
<td>Introducing People</td>
<td>Meeting People for the First Time</td>
<td>Keeping Phone Calls Professional</td>
<td>Dressing for Success</td>
</tr>
<tr>
<td>Appropriate Dress</td>
<td>Showing Politeness</td>
<td>Proper Use of Work Email</td>
<td>Showing a Professional Attitude</td>
</tr>
<tr>
<td>Business Meal Functions</td>
<td></td>
<td>Proper Use of Cell Phone</td>
<td>Using Good Posture</td>
</tr>
<tr>
<td>Behavior at Work Parties</td>
<td></td>
<td>Proper Use in Texting</td>
<td>Presenting Yourself to Associates</td>
</tr>
<tr>
<td>Behavior at Conventions</td>
<td></td>
<td></td>
<td>Accepting Criticism</td>
</tr>
<tr>
<td>International Etiquette</td>
<td></td>
<td></td>
<td>Demonstrating Leadership</td>
</tr>
<tr>
<td>Cross-Cultural Etiquette</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Working in a Cubicle</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**Support of CTAE Foundation Course Standards and Georgia Standards of Excellence L9-10RST 1-10 and L9-10WHST 1-10:**

Georgia Standards of Excellence ELA/Literacy standards have been written specifically for technical subjects and have been adopted as part of the official standards for all CTAE courses.
Course Standard 2

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

2.1 Wear approved PPE (shoes, eye wear, gloves, hard hats, etc.).
2.2 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).
2.3 Discuss the Material Safety Data Sheets (MSDS) Right-to-Know Law.
2.4 Identify types of fires, types of fire extinguishers, and types of protective clothing.
2.5 Identify the appropriate action for reporting fires and appropriate firefighting procedures.
2.6 Demonstrate Use of Lab Emergency Power Disconnect (“Kill Switch”).
2.7 Demonstrate an understanding of safety precautions and procedures.
2.8 Demonstrate the safe use of test equipment.
2.9 Understand safety rules to follow when working with mechanical and electrical systems.
2.10 Identify and discuss the potential safety hazards and precautions of working with mechanical and electrical systems.

Course Standard 3

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

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

Course Standard 4

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

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

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

5.1 Identify common belts and the belt codes used in mechanical systems.
5.2 Define the common terms used in belt drive systems.
5.3 Align pulleys used in belt drive systems.
5.4 Install and tension a belt.
5.5 Define the common terms used in chain drive systems.
5.6 Identify common chains and chain codes used in chain drive systems.
5.7 Align a sprocket used in a chain drive system.
5.8 Install and tension a chain.
5.9 Define common terms used in gear drive systems.
5.10 Identify common gears used in gear drive systems.
5.11 Demonstrate the ability to properly use a gear gauge.
5.12 Remove and install gears used in a gear drive system.

Course Standard 6

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

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

Course Standard 7

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

7.1 Inspect and clean a pedestal grinder.
7.2 Inspect and position eye shields and tool rests.
7.3 Demonstrate the proper dressing of grinding wheels.
7.4 Demonstrate the proper sharpening of center punches and chisels.
7.5 Demonstrate the proper sharpening of drill bits.

Course Standard 8

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

8.1 Demonstrate the proper inspecting and cleaning of a drill press.
8.2 Demonstrate the proper mounting and securing of a work piece.
8.3 Accurately calculate proper revolutions per minute (RPMs) on a drill press.
8.4 Demonstrate center drilling.
8.5 Demonstrate the proper drilling of pilot holes.
8.6 Demonstrate the proper drilling of blind holes.
8.7 Demonstrate the proper method of drilling through holes.

**Course Standard 9**

**AC-IM-9**

**Perform necessary operations in order to use a lathe.**

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

**Course Standard 10**

**AC-IM-10**

**Perform the necessary operations to use a milling machine.**

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

**Course Standard 11**

**AC-IM-11**

**Demonstrate safe operating procedures for the use of Oxyacetylene welding and cutting equipment.**

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

**Course Standard 12**

**AC-IM-12**

**Demonstrate knowledge of basic shielded gas metal arc welding (GMAW).**

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

**Course Standard 13**

**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.

13.1 Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA.

13.2 Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development.

13.3 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.

13.4 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.