Course Description:
This course is designed as the fourth course for the General Automotive Technology Pathway. Students in this course will learn the basic skills and knowledge needed to gain employment as an entry level automotive technician. Students will be exposed to evolving technologies related to light duty hybrid/electric vehicles. Emphasis on overall shop safety with high voltage systems will be addressed.

Instructor/Program Qualifications:
Due to the extreme nature associated with hybrid/electric vehicles. All current safety equipment and procedures must be followed to prevent injury or death!
Programs are required to be Accredited by the National Institute of Automotive Service Excellence (ASE) at the AST Level or Higher. Instructors teaching Light Duty Hybrid/Electric Vehicle Technology are required to be certified by ASE in L3: Light Duty Hybrid/Electric Vehicle Technology. Instructors must have completed a manufacturer Hybrid/EV Training Program.

Course Standard 1
TDL-AT3-EV1
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>Using Blogs</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>
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<tr>
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<td></td>
<td></td>
<td></td>
<td>Getting Feedback</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Getting Others to Listen</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>
</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>
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<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>
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<td></td>
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<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>
</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 teamwork 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></td>
<td>Staying Organized</td>
</tr>
<tr>
<td>Giving and Receiving Constructive Criticism</td>
<td></td>
<td>Finding More Time</td>
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<tr>
<td></td>
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<td>Managing Projects</td>
</tr>
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<td></td>
<td></td>
<td>Prioritizing Personal and Work Life</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>
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<td></td>
<td>Accepting Criticism</td>
</tr>
<tr>
<td>International Etiquette</td>
<td></td>
<td></td>
<td>Demonstrating Leadership</td>
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<tr>
<td>Cross-Cultural Etiquette</td>
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<tr>
<td>Working in a Cubicle</td>
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</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

**TDL-AT3-EV-2**  
**Identify and utilize general safety procedures and proper tools.**  
2.1 Identify general shop safety rules and procedures.  
2.2 Utilize safe procedures for handling of tools and equipment.  
2.3 Identify and use proper placement of floor jacks and jack stands.  
2.4 Identify and use proper procedures for safe lift operation.  
2.5 Utilize proper ventilation procedures for working within the lab/shop area.  
2.6 Identify marked safety areas.  
2.7 Identify the location and the types of fire extinguishers and other fire safety equipment; demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment.  
2.8 Identify the location and use of eye wash stations.  
2.9 Identify the location of the posted evacuation routes.  
2.10 Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities.  
2.11 Identify and wear appropriate clothing for lab/shop activities.  
2.12 Secure hair and jewelry for lab/shop activities.  
2.13 Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high voltage circuits.  
2.14 Demonstrate awareness of the safety aspects of high voltage circuits (such as high intensity discharge (HID) lamps, ignition systems, injection systems, etc.)  
2.15 Locate and demonstrate knowledge of material safety data sheets (MSDS).  

# Course Standard 3

**TDL-AT3-EV-3**  
**Research and utilize proper handling procedures for general high voltage systems.**  
3.1 Identify tools and their usage in high voltage automotive applications.  
3.2 Demonstrate safe handling and use of appropriate high voltage tools and equipment.  
3.3 Demonstrate proper cleaning, storage, and maintenance of high voltage tools and equipment.  
3.4 Describe the difference between high voltage glove ratings.  
3.5 Identify and demonstrate high voltage glove testing procedure.  
3.6 Identify and demonstrate proper key fob isolation procedures.  
3.7 Identify and apply high voltage work area preparation.  
3.8 Identify and perform manufacturer’s safety protocols.  
3.9 Identify high voltage components and wiring/color designations.  

# Course Standard 4

**TDL-AT3-EV-4**  
**Research and utilize vehicle service information.**  
4.1 Identify information needed and the service requested on a repair order.  
4.2 Identify purpose and demonstrate proper use of fender covers and mats.  
4.3 Demonstrate use of the three C’s (concern, cause, and correction).  
4.4 Review vehicle service history.  
4.5 Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.  
4.6 Ensure vehicle is prepared to return to customer per school/company policy (floor mats, steering wheel cover, etc.).  
4.7 Identify and use applicable service information materials to include service manuals, manufacturer service information, and bulletins to develop a process/procedure for diagnostics.
Course Standard 5

TDL-AT3-EV-5
Develop an understanding of automotive careers, describing the principal fields of specializations and identifying associated career opportunities.

5.1 Identify education requirements for automotive occupations and locations where programs of study are available.
5.2 Match automotive job titles with qualifications and responsibilities.
5.3 Participate in activities related to career interests.

Course Standard 6

TDL-AT3-EV-6
Identify and utilize general hybrid/electric vehicle service.

6.1 Identify different types of hybrid and electric vehicles.
6.2 Explain the difference in hybrid vehicle levels and electric vehicle types.
6.3 Identify the differences and uses of vehicle propulsion alternatives.
6.4 Describe vehicle lifting procedures on a hybrid and electric vehicle.
6.5 Explain preventative maintenance on hybrid and electric vehicles.
6.6 Perform oil and filter change on a hybrid vehicle and describe the service caution needed.
6.7 Identify procedures necessary to establish the proper vehicle operational power mode during service (OFF, ACCESSORY, POWER ON, READY TO DRIVE).
6.8 Identify hybrid and electric vehicle high voltage components including inverter, converter, high voltage cables, traction battery, traction motor, etc.
6.9 Describe DC and AC current.
6.10 Describe electric shock potential of high voltage systems.
6.11 Identify health and environmental concerns of carbon-based fuels and their alternatives.
6.12 Identify transmission fluid and coolant fluid requirements and verify fluid levels.

Course Standard 7

TDL-AT3-EV-7
Identify and apply hybrid/electric battery systems safety and diagnostic procedures.

7.1. Apply high voltage safety practices.
7.2. Analyze or perform high voltage disconnect procedure and reconnect/enable high voltage system.
7.3. Select, test, and use proper high voltage safety gloves.
7.4. Select, qualify, and use proper electrical testing equipment and leads.
7.5. Retrieve and diagnose Diagnostic Trouble Codes (DTCs) and determine needed repairs.
7.6. Diagnose problems caused by damaged or failed harnesses, connectors, terminals, and fuses.
7.7. Identify and describe high voltage (HV) battery pack malfunctions.
7.8. Identify and describe removal and installation of high voltage battery pack according to manufacturer’s service procedures.
7.9. Identify and describe high voltage leaks/loss of isolation testing.
7.10. Identify and describe high voltage battery pack heating and cooling systems.
7.11. Identify and describe charging problems when using electric vehicle supply equipment (EVSE).
7.12. Describe the difference between Level 1 AC, Level 2 AC and DC Fast Charge according to SAE Standard J1772.
7.13. Describe the different types of high voltage batteries.

Course Standard 8

TDL-AT3-EV-8
Identify and explain internal combustion engine operations related to hybrid systems.

8.1. Apply high voltage safety practices.
8.2. Retrieve and diagnose Diagnostic Trouble Codes (DTCs) and determine needed repairs.
8.3. Determine if the internal combustion engine (ICE) is in CRANK mode or RUN mode.
8.4. Differentiate between drivability problems caused by the internal combustion engine and/or hybrid drive system.
8.5. Perform internal combustion engine cranking compression test.
8.6. Perform a procedure to put the vehicle into inspection mode that keeps the ICE actively running.
8.7. Describe the process of diagnosing internal combustion engine no-crank condition.
8.8. Describe the process of diagnosing internal combustion engine cranks/no-start condition.
8.9. Interpret vacuum and compression readings on Atkinson cycle engines.
8.10. Explain the Atkinson cycle and how it affects engine efficiency compared to the Otto cycle.
8.11. Describe engine start/stop strategy and diagnose malfunctions.
8.12. Describe engine cooling system service.

**Course Standard 9**

**TDL-AT3-EV-9**

*Identify and explain hybrid/electric vehicle drive systems.*

9.1. Apply high voltage safety practices.
9.2. Describe and explain high voltage disconnect procedure; reconnect/enable high voltage system.
9.3. Select, test, and use proper high voltage safety gloves.
9.4. Select, qualify, and use proper electrical testing equipment and leads.
9.5. Retrieve and diagnose driveline Diagnostic Trouble Codes (DTCs) and determine needed repairs.
9.6. Diagnose problems caused by damaged or failed harnesses, connectors, and terminals.
9.7. Describe the procedure test and diagnose and repair high voltage leaks/loss of isolation.
9.8. Describe the process to remove and install rotor from stator.
9.9. Explain the difference between resolver and encoder type motor-rotor position sensor.
9.10. Research electrically actuated parking pawl operations.
9.11. Identify transmission fluid and coolant fluid requirements and verify fluid levels.

**Course Standard 10**

**TDL-AT3-EV-10**

*Identify and explain hybrid/electric vehicle power electronics systems.*

10.1. Apply high voltage safety practices.
10.2. Describe and explain high voltage disconnect procedure and reconnect/enable high voltage system.
10.3. Select, test, and use proper high voltage safety gloves.
10.4. Select, qualify, and use proper electrical testing equipment and leads.
10.5. Retrieve and diagnose Diagnostic Trouble Codes (DTCs) and determine needed repairs.
10.6. Diagnose problems caused by damaged or failed harnesses, connectors, and terminals.
10.7. Identify procedures necessary to establish the proper vehicle operational power mode during service (OFF, ACCESSORY, POWER ON, READY TO DRIVE).
10.8. Describe hybrid system warnings displayed on the instrument panel and/or a drivability complaint.
10.9. Describe impact sensor functions.
10.10. Explain the operation of the AC/DC inverter.
10.11. Analyze the functions and failures in the data communications bus network.
10.12. Describe the purpose of high voltage capacitors.
10.13 Describe or locate safety interlocks.
10.14 Explain the operations of the DC/DC converter.
10.15 Describe how to test high voltage cable integrity and loss of isolation.
10.16 Describe the function of a low voltage battery.
10.17 Identify types of low voltage batteries.
10.18 Perform low voltage battery testing.
10.19 Explain the function of the HV system main relay (SMR)/contactor malfunctions.

### Course Standard 11

**TDL-AT3-EV-11**

**Identify and explain hybrid supporting systems.**

- 11.1 Apply high voltage safety practices.
- 11.2 Describe and explain high voltage disconnect procedure and reconnect/enable high voltage system.
- 11.3 Select, test, and use proper high voltage safety gloves.
- 11.4 Select, qualify, and use proper electrical testing equipment and leads.
- 11.5 Diagnose problems caused by damaged or failed harnesses, connectors, and terminals.
- 11.6 Observe and interpret driver indicators, power flow display and energy monitor and determine necessary action.
- 11.7 Analyze high voltage air conditioning compressor systems.
- 11.8 Determine the proper AC system oil.
- 11.9 Identify and describe cabin heating system performance problems.
- 11.10 Identify and describe electric/electronic steering systems.
- 11.11 Analyze brake system performance problems; differentiate between braking problems caused by hydraulic system and regenerative system malfunctions.
- 11.12 Explain the procedure to deactivate brake system self-test prior to service.
- 11.13 Describe power electronics and battery coolant systems.

### Course Standard 12

**TDL-AT3-EV-12**

**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.**

- 12.1 Explain the purpose, mission, objectives, motto, colors, official dress, and other distinguishing characteristics of SkillsUSA.
- 12.2 Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth, and development.
- 12.3 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.
- 12.4 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.