Transportation, Distribution and Logistics Career Cluster
Advanced Automotive Technology Pathway
Advanced Automotive Technologies 4
Course Number 47.44400

Course Description: This course is designed as the first course for the Advanced Automotive Technology Pathway. Students in this course will learn the basic skills needed to gain employment as an entry level automotive technician. Students will be exposed to courses in automotive preventative maintenance, brakes, steering and suspension, electrical systems, engine repair, engine performance, automatic transmission, manual transmission and differential & automotive HVAC. The hours completed in this course are aligned with ASE standards and are a base for the entry-level technician. The prerequisite for this course is advisor approval and successful completion of Automotive Technology 3.

All the tasks are assigned a priority number: P-1, P-2, or P-3 (refer to ASE Education Foundation task list https://www.aseeducation.org/resources). The standards recognize that program content requirements vary by program type and regional employment needs. Therefore, flexibility has been built into the task list by assigning each task a priority number. The priority number simply indicates the minimum percentage of tasks that a program must include in their curriculum.

- Ninety-five percent (95%) of Priority 1 (P-1) tasks must be taught.
- Eighty percent (80%) of Priority 2 (P-2) tasks must be taught.
- Fifty percent (50%) of the Priority 3 (P-3) tasks must be taught.

Note: A task is a psychomotor or cognitive entry-level learning activity consisting of one or more measurable steps accomplished through an instructor presentation, demonstration, visualization or a student application.

Theory instruction and hands-on performance of all the basic tasks will provide initial training for entry-level employment in the automotive service field or prepare the student for further training. Competency in the tasks will indicate to employers that the graduate has the skills needed for entry-level employment in the automotive service field.

1. It is assumed that:
   - at all levels, appropriate theory, safety, and support instruction will be required for performing each task;
   - the instruction has included identification and use of appropriate tools and testing and measurement equipment required to accomplish certain tasks;
   - the student has received the necessary training to locate and use current reference and training materials from accepted industry publications and resources;
   - at all levels, the student has demonstrated the ability to write work orders and warranty reports, to include information regarding problem resolution and the results of the work performed for the customer and manufacturer. The writing process will incorporate the “Three C’s” (concern, cause and correction) as a format to communicate this information.
   - at all levels, students will become familiar with and use service information and reference materials to develop a problem-solving process/procedure

2. It is assumed that:
   - all diagnostic and repair tasks described in this document are to be accomplished in accordance with manufacturer’s recommended procedures and safety precautions as published.
3. It is assumed that:
   - Individual courses of study will differ across automobile training programs and any redundancies in the technical standards are built in to ensure that appropriate review and individual task mastery can be achieved at different levels of the program. They are also built in to allow instruction at different levels of understanding as regional and local industry needs may dictate. Additionally, these standards are a framework from which curriculum, lessons, and units of instruction are built from.
   - development of appropriate learning delivery systems and tests which monitor student progress will be the responsibility of the individual training program.
   - the learning progress of students will be monitored and evaluated against these performance standards;
   - a system is in place that informs all students of their individual progress through all phases of the training program.

4. It is assumed that:
   - all students will receive instruction in the storage, handling, and use of Hazardous Materials as required in Hazard Communication Title 29, Code of Federal Regulation Part 1910.1200, “Right to Know Law”, and state and local requirements.
   - hazardous and toxic materials will be handled, removed and recycled or disposed of according to federal, state, and local regulations.

5. It is assumed that:
   - All required supplemental tasks are being taught and reinforced continually throughout the pathway, they are not intended to be taught as stand-alone concepts or units.

REQUIRED SUPPLEMENTAL TASKS

Shop and Personal Safety

1. Identify general shop safety rules and procedures.
2. Utilize safe procedures for handling of tools and equipment.
3. Identify and use proper placement of floor jacks and jack stands.
4. Identify and use proper procedures for safe lift operation.
5. Utilize proper ventilation procedures for working within the lab/shop area.
6. Identify marked safety areas.
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.
8. Identify the location and use of eye wash stations.
9. Identify the location of the posted evacuation routes.
10. Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities.
11. Identify and wear appropriate clothing for lab/shop activities.
12. Secure hair and jewelry for lab/shop activities.
13. Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high voltage circuits.
14. Demonstrate awareness of the safety aspects of high voltage circuits (such as high intensity discharge (HID) lamps, ignition systems, injection systems, etc.).
15. Locate and demonstrate knowledge of material safety data sheets (MSDS).
16. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.
Tools and Equipment
1. Identify tools and their usage in automotive applications.
2. Identify standard and metric designation.
3. Demonstrate safe handling and use of appropriate tools.
4. Demonstrate proper cleaning, storage, and maintenance of tools and equipment.
5. Demonstrate proper use of precision measuring tools (i.e. micrometer, dial-indicator, dial-caliper).

Preparing Vehicle for Service
1. Identify information needed and the service requested on a repair order.
2. Identify purpose and demonstrate proper use of fender covers, mats.
3. Demonstrate use of the three C’s (concern, cause, and correction).
4. Review vehicle service history.

Preparing Vehicle for Customer
1. Ensure vehicle is prepared to return to customer per school/company policy (floor mats, steering wheel cover, vehicle cleanliness, radio presets, etc.).

GENERAL COURSE STANDARDS
The following are the General Course Standards, to be integrated throughout the three pathway courses, they are not intended to be taught as stand-alone concepts or units.

Course Standard 1
TDL-AT4-GS1
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.

<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>
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<td>Effective Written Communication</td>
<td>Ways We Filter What We Hear</td>
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<tr>
<td>Interacting with Suppliers</td>
<td>Making Cold Calls</td>
<td>Effective Nonverbal Skills</td>
<td>Developing a Listening Attitude</td>
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</tr>
<tr>
<td></td>
<td>Handling Conference Calls</td>
<td>Effective Word Use</td>
<td>Show You Are Listening</td>
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<tr>
<td></td>
<td>Handling Unsolicited Calls</td>
<td>Giving and Receiving Feedback</td>
<td>Asking Questions</td>
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<td>Obtaining Feedback</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Getting Others to Listen</td>
<td></td>
</tr>
</tbody>
</table>
Nonverbal Communication | Written Communication | Speaking | Applications and Effective Résumés
--- | --- | --- | ---
Communicating Nonverbally | Writing Documents | Using Language Carefully | Completing a Job Application
Reading Body Language and mixed Messages | Constructive Criticism in Writing | One-on-One Conversations | Writing a Cover Letter
Matching Verbal and Nonverbal communication | Small Group Communication | Things to Include in a Résumé
Improving Nonverbal Indicators | Large Group Communication | Selling Yourself in a Résumé
Nonverbal Feedback | Making Speeches | Terms to Use in a Résumé
Showing Confidence Nonverbally | Involving the Audience | Describing Your Job Strengths
Showing Assertiveness | Answering Questions | Organizing Your Résumé
Visual and Media Aids | Writing an Electronic Résumé
Errors in Presentation | Dressing Up Your Résumé

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>
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<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>
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<td></td>
<td>Facilitating Discussions and Closing</td>
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<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></td>
<td>Handling Customer Complaints</td>
<td>When a Résumé Should be Used</td>
<td>Using Employment Agencies</td>
<td>Landing an Internship</td>
</tr>
<tr>
<td></td>
<td>Strategies for Customer Service</td>
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</tbody>
</table>

Staying Motivated to Search
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>Behavior 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>
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<tr>
<td>Showing Responsibility</td>
<td>Gaining Coworkers’ Trust</td>
<td></td>
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<tr>
<td>Reducing Harassment</td>
<td>Persevering</td>
<td></td>
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<tr>
<td>Respecting Diversity</td>
<td>Handling Criticism</td>
<td></td>
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<tr>
<td>Making Truthfulness a Habit</td>
<td>Showing Professionalism</td>
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<tr>
<td>Leaving a Job Ethically</td>
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</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>
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<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>
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<tr>
<td>Adopting a New Technology</td>
<td>Problems That Affect Teams</td>
<td>Organizing Workspace and Tasks</td>
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<tr>
<td></td>
<td>Expressing Yourself on a Team</td>
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<tr>
<td></td>
<td>Giving and Receiving Constructive Criticism</td>
<td>Finding More Time</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>
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<tr>
<td>Behavior at Work Parties</td>
<td></td>
<td>Proper Use in Texting</td>
<td>Presenting Yourself to Associates</td>
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<tr>
<td>Behavior at Conventions</td>
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<td></td>
<td>Accepting Criticism</td>
</tr>
<tr>
<td>International Etiquette</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. Additional Georgia Standards of Excellence ELA/Literacy standards for Speaking and Listening are listed in the foundational course standards below.

**Course Standard 2**

TDL-AT4-GS2
Idenfity and utilize 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).

Support of CTAE Foundation Course Standards and Georgia Standards of Excellence
ELACC9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.

**Course Standard 3**

TDL-AT4-GS3
Research and utilize proper tools and equipment.

3.1 Identify tools and their usage in automotive applications.
3.2 Identify standard and metric designations.
3.3 Demonstrate safe handling and use of appropriate tools.
3.4 Demonstrate proper cleaning, storage, and maintenance of tools and equipment.
3.5 Demonstrate proper use of precision measuring tools (e.g. micrometer, dial-indicator, and dial-caliper).

Support of CTAE Foundation Course Standards and Georgia Standards of Excellence
ELACC9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.
ELACC9-10SL4: Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

Course Standard 4

TDL-AT4-GS4
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.

Support of CTAE Foundation Course Standards and Georgia Standards of Excellence

ELACC9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.

Course Standard 5

TDL-AT4-GS5
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.

Support of CTAE Foundation Course Standards and Georgia Standards of Excellence

ELACC9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.

ELACC9-10SL4: Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

Course Standard 6

TDL-AT4-GS6
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.

6.1 Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA.
6.2 Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development.
6.3 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.

6.4 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.

Support of CTAE Foundation Course Standards and Georgia Standards of Excellence

ELACC9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.

ELACC9-10SL4: Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.
TECHNICAL STANDARDS

TDL-AT4-TS1

Technical Standard 1

Perform general engine service.
(ASE: A1 Engine Repair)

For every task in Engine Repair, the following safety requirement must be strictly enforced: Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

I. ENGINE REPAIR

A. General: Engine Diagnosis; Removal and Reinstallation (R & R)
1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.
2. Research vehicle service information including fluid type, internal engine operation, vehicle service history, service precautions, and technical service bulletins.
3. Verify operation of the instrument panel engine warning indicators.
4. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine needed action.
5. Install engine covers using gaskets, seals, and sealers as required.
6. Verify engine mechanical timing.
7. Perform common fastener and thread repair, to include: remove broken bolt, restore internal and external threads, and repair internal threads with thread insert.
8. Inspect, remove and/or replace engine mounts.
9. Identify service precautions related to service of the internal combustion engine of a hybrid vehicle.
10. Remove and reinstall engine on a newer vehicle equipped with OBD; reconnect all attaching components and restore the vehicle to running condition.

I. ENGINE REPAIR

D. Lubrication and Cooling Systems Diagnosis and Repair
1. Perform cooling system pressure and dye tests to identify leaks; check coolant condition and level; inspect and test radiator, pressure cap, coolant recovery tank, heater core, and galley plugs; determine needed action.
2. Identify causes of engine overheating.
3. Inspect, replace, and/or adjust drive belts, tensioners, and pulleys; check pulley and belt alignment.
4. Inspect and/or test coolant; drain and recover coolant; flush and refill cooling system; use proper fluid type per manufacturer specification; bleed air as required.
5. Inspect, remove, and replace water pump.
6. Remove and replace radiator.
7. Remove, inspect, and replace thermostat and gasket/seal.
8. Inspect and test fan(s), fan clutch (electrical or mechanical), fan shroud, and air dams; determine needed action.
9. Perform oil pressure tests; determine needed action.
10. Perform engine oil and filter change; use proper fluid type per manufacturer specification.
11. Inspect auxiliary coolers; determine needed action.  
12. Inspect, test, and replace oil temperature and pressure switches and sensors.  
13. Inspect oil pump gears or rotors, housing, pressure relief devices, and pump drive; perform needed action.

**Support of CTAE Foundation Course Standards and Georgia Standards of Excellence**

**ELACC9-10SL4:** Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.
Technical Standard 2

Perform general automatic transmission service.
(ASE: A2 Automatic Transmission/Transaxle Service and Repair)

For every task in Automatic Transmission/Transaxle Service and Repair, the following safety requirement must be strictly enforced: Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

II. AUTOMATIC TRANSMISSION AND TRANSAXLE

A. General: Transmission and Transaxle Diagnosis
1. Identify and interpret transmission/transaxle concerns, differentiate between engine performance and transmission/transaxle concerns; determine needed action.
2. Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins.
3. Diagnose fluid loss and condition concerns; determine needed action.
4. Check fluid level in a transmission or a transaxle equipped with a dip-stick.
5. Check fluid level in a transmission or a transaxle not equipped with a dip-stick.
6. Perform pressure tests (including transmissions/transaxles equipped with electronic pressure control); determine needed action.
7. Diagnose noise and vibration concerns; determine needed action.
8. Perform stall test; determine needed action.
9. Perform lock-up converter system tests; determine needed action.
10. Diagnose transmission/transaxle gear reduction/multiplication concerns using driving, driven, and held member (power flow) principles.
11. Diagnose electronic transmission/transaxle control systems using appropriate test equipment and service information.

B. In-Vehicle Transmission/Transaxle Maintenance and Repair
1. Inspect, adjust, and/or replace external manual valve shift linkage, transmission range sensor/switch, and/or park/neutral position switch.
2. Inspect for leakage; replace external seals, gaskets, and bushings.
3. Inspect, test, adjust, repair, and/or replace electrical/electronic components and circuits including computers, solenoids, sensors, relays, terminals, connectors, switches, and harnesses; demonstrate understanding of the relearn procedure.
4. Drain and replace fluid and filter(s); use proper fluid type per manufacturer specification.
5. Inspect, replace and align powertrain mounts.

Support of CTAE Foundation Course Standards and Georgia Standards of Excellence

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TDL-AT4-TS3

Technical Standard 3

Perform general manual transmission/transaxle/axle service.
(ASE: A3 Manual Drivetrain and Axle Service and Repair)

For every task in Manual Drivetrain and Axle Service and Repair, the following safety requirement must be strictly enforced: Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

III. MANUAL DRIVE TRAIN AND AXLES

B. Clutch Diagnosis and Repair

1. Diagnose clutch noise, binding, slippage, pulsation, and chatter; determine needed action. P-1
2. Inspect clutch pedal linkage, cables, automatic adjuster mechanisms, brackets, bushings, pivots, and springs; perform needed action. P-1
3. Inspect and/or replace clutch pressure plate assembly, clutch disc, release (throw-out) bearing, linkage, and pilot bearing/bushing (as applicable). P-1
4. Bleed clutch hydraulic system. P-1
5. Check and adjust clutch master cylinder fluid level; check for leaks; use proper fluid type per manufacturer specification. P-1
6. Inspect flywheel and ring gear for wear, cracks, and discoloration; determine needed action. P-1
7. Measure flywheel runout and crankshaft end play; determine needed action. P-2
8. Describe the operation and service of a system that uses a dual mass flywheel. P-3

C. Transmission/Transaxle Diagnosis and Repair

1. Inspect, adjust, lubricate, and/or replace shift linkages, brackets, bushings, cables, pivots, and levers. P-2
2. Describe the operational characteristics of an electronically-controlled manual transmission/transaxle. P-2
3. Diagnose noise concerns through the application of transmission/transaxle powerflow principles. P-2
4. Diagnose hard shifting and jumping out of gear concerns; determine needed action. P-2
5. Diagnose transaxle final drive assembly noise and vibration concerns; determine needed action. P-3
6. Disassemble, inspect clean, and reassemble internal transmission/transaxle components. P-2

III. MANUAL DRIVE TRAIN AND AXLES

E. Drive Axle Diagnosis and Repair

E.1 Ring and Pinion Gears and Differential Case Assembly

1. Clean and inspect differential case; check for leaks; inspect housing vent. P-1
2. Check and adjust differential case fluid level; use proper fluid type per manufacturer specification. P-1
3. Drain and refill differential case; use proper fluid type per manufacturer specification. P-1
4. Diagnose noise and vibration concerns; determine needed action. P-2
5. Inspect and replace companion flange and/or pinion seal; measure companion flange runout. P-2
6. Inspect ring gear and measure runout; determine needed action. P-3
7. Remove, inspect, reinstall and/or drive pinion and ring gear, spacers, sleeves, and bearings. P-3
8. Measure and adjust drive pinion depth. P-3
9. Measure and adjust drive pinion bearing preload. P-3
10. Measure and adjust side bearing preload and ring and pinion gear total backlash and backlash variation on a differential carrier assembly (threaded cup or shim types).  
11. Check ring and pinion tooth contact patterns; perform needed action.  
12. Disassemble, inspect, measure, adjust, and/or replace differential pinion gears (spiders), shaft, side gears, side bearings, thrust washers, and case.  
13. Reassemble and reinstall differential case assembly; measure runout; determine needed action.

**E.2 Limited Slip Differential**

1. Diagnose noise, slippage, and chatter concerns; determine needed action.  
2. Measure rotating torque; determine needed action.

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**IV. SUSPENSION AND STEERING**

**B. Steering Systems Diagnosis and Repair**

1. Disable and enable supplemental restraint system (SRS); verify indicator lamp operation.
2. Remove and replace steering wheel; center/time supplemental restraint system (SRS) coil (clock spring).

3. Diagnose steering column noises, looseness, and binding concerns (including tilt/telescoping mechanisms); determine needed action.

4. Diagnose power steering gear (non-rack and pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine needed action.

5. Diagnose power steering gear (rack and pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine needed action.

6. Inspect steering shaft universal-joint(s), flexible coupling(s), collapsible column, lock cylinder mechanism, and steering wheel; determine needed action.

7. Remove and replace rack and pinion steering gear; inspect mounting bushings and brackets.

8. Inspect rack and pinion steering gear inner tie rod ends (sockets) and bellows boots; replace as needed.

9. Inspect power steering fluid level and condition.

10. Flush, fill, and bleed power steering system; use proper fluid type per manufacturer specification.

11. Inspect for power steering fluid leakage; determine needed action.

12. Remove, inspect, replace, and/or adjust power steering pump drive belt.

13. Remove and reinstall power steering pump.

14. Remove and reinstall press fit power steering pump pulley; check pulley and belt alignment.

15. Inspect, remove and/or replace power steering hoses and fittings.

16. Inspect, remove and/or replace pitman arm, relay (centerlink/intermediate) rod, idler arm, mountings, and steering linkage damper.

17. Inspect, replace, and/or adjust tie rod ends (sockets), tie rod sleeves, and clamps.

18. Inspect, test and diagnose electrically-assisted power steering systems (including using a scan tool); determine needed action.

19. Identify hybrid vehicle power steering system electrical circuits and safety precautions.

20. Test power steering system pressure; determine needed action.

IV. SUSPENSION AND STEERING

C. Suspension Systems Diagnosis and Repair

1. Diagnose short and long arm suspension system noises, body sway, and uneven ride height concerns; determine needed action.

2. Diagnose strut suspension system noises, body sway, and uneven ride height concerns; determine needed action.

3. Inspect, remove, and/or replace upper and lower control arms, bushings, shafts, and rebound bumpers.

4. Inspect, remove, and/or replace strut rods and bushings.

5. Inspect, remove, and/or replace upper and/or lower ball joints (with or without wear indicators).

6. Inspect, remove, and/or replace steering knuckle assemblies.

7. Inspect, remove and/or replace short and long arm suspension system coil springs and spring insulators.

8. Inspect, remove, and/or replace torsion bars and mounts.

9. Inspect, remove, and/or replace front/rear stabilizer bar (sway bar) bushings, brackets, and links.

10. Inspect, remove, and/or replace strut cartridge or assembly, strut coil spring, insulators (silencers), and upper strut bearing mount.

11. Inspect, remove, and/or replace track bar, strut rods/radius arms, and related mounts and bushings.
12. Inspect rear suspension system leaf spring(s), spring insulators (silencers), shackles, brackets, bushings, center pins/bolts, and mounts.

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TDL-AT4-TS5

Technical Standard 5

Brake System Service

(ASE: A5 Brakes System Service and Repair)

For every task in Brakes, the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

V. BRAKES

G. Electronic Brake Control Systems: Antilock Brake (ABS), Traction Control (TCS), and Electronic Stability Control (ESC) Systems Diagnosis and Repair

1. Identify and inspect electronic brake control system components (ABS, TCS, ESC); determine needed action. P-1

2. Describe the operation of a regenerative braking system. P-3

3. Diagnose poor stopping, wheel lock-up, abnormal pedal feel, unwanted application, and noise concerns associated with the electronic brake control system; determine needed action. P-2

4. Diagnose electronic brake control system electronic control(s) and components by retrieving diagnostic trouble codes, and/or using recommended test equipment; determine needed action. P-2

5. Depressurize high-pressure components of an electronic brake control system. P-2

6. Bleed the electronic brake control system hydraulic circuits. P-1

7. Test, diagnose, and service electronic brake control system speed sensors (digital and analog), toothed ring (tone wheel), and circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO) (includes output signal, resistance, shorts to voltage/ground, and frequency data). P-2

8. Diagnose electronic brake control system braking concerns caused by vehicle modifications (tire size, curb height, final drive ratio, etc.). P-1

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Technical Standard 6

Electrical System Service  
(ASE: A6 Electrical/Electronic Systems Service and Repair)

For every task in Electrical/Electronic Systems, the following safety requirement must be strictly enforced: Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

VI. ELECTRICAL/ELECTRONIC SYSTEMS

G. Body Electrical Systems Diagnosis and Repair

1. Diagnose operation of comfort and convenience accessories and related circuits (such as: power window, power seats, pedal height, power locks, truck locks, remote start, moon roof, sun roof, sun shade, remote keyless entry, voice activation, steering wheel controls, back-up camera, parking assist, cruise control, and auto dimming headlamps); determine needed repairs.  

2. Diagnose operation of security/anti-theft systems and related circuits (such as: theft deterrent, door locks, remote keyless entry, remote start, and starter/fuel disable); determine needed repairs.  

3. Diagnose operation of entertainment and related circuits (such as: radio, DVD, remote CD changer, navigation, amplifiers, speakers, antennas, and voice-activated accessories); determine needed repairs.  

Support of CTAE Foundation Course Standards and Georgia Standards of Excellence

ELACC9-10SL4: Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.
TDL-AT4-TS7

Technical Standard 7

Heating, Ventilation and Air Conditioning Service (Automotive HVAC)
(ASE: A7 Heating and Air Conditioning System Service and Repair)

For every task in Heating, Ventilation and Air Conditioning (HVAC), the following safety requirement must be strictly enforced: Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

VII. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

A. General: A/C System Diagnosis and Repair

1. Identify and interpret heating and air conditioning problems; determine needed action.

2. Research vehicle service information including refrigerant/oil type, vehicle service history, service precautions, and technical service bulletins.

3. Performance test A/C system; identify problems.

4. Identify abnormal operating noises in the A/C system; determine needed action.

5. Identify refrigerant type; select and connect proper gauge set/test equipment; record temperature and pressure readings.

6. Leak test A/C system; determine needed action.

7. Inspect condition of refrigerant oil removed from A/C system; determine needed action.

8. Determine recommended oil and oil capacity for system application.

9. Using a scan tool, observe and record related HVAC data and trouble codes.

B. Refrigeration System Component Diagnosis and Repair

1. Inspect, remove, and/or replace A/C compressor drive belts, pulleys, tensioners and visually inspect A/C components for signs of leaks; determine needed action.

2. Inspect, test, service and/or replace A/C compressor clutch components and/or assembly; check compressor clutch air gap; adjust as needed.

3. Remove, inspect, reinstall, and/or replace A/C compressor and mountings; determine recommended oil type and quantity.

4. Identify hybrid vehicle A/C system electrical circuits and service/safety precautions.

5. Determine need for an additional A/C system filter; perform needed action.

6. Remove and inspect A/C system mufflers, hoses, lines, fittings, O-rings, seals, and service valves; perform needed action.

7. Inspect for proper A/C condenser airflow; determine needed action.

8. Remove, inspect, and replace receiver/drier or accumulator/drier; determine recommended oil type and quantity.

9. Remove, inspect, and install expansion valve or orifice (expansion) tube.

10. Inspect evaporator housing water drain; perform needed action.

11. Diagnose A/C system conditions that cause the protection devices (pressure, thermal, and/or control module) to interrupt system operation; determine needed action.

12. Determine procedure to remove and reinstall evaporator; determine required oil type and quantity.

13. Remove, inspect, reinstall, and/or replace condenser; determine required oil type and quantity.
VII. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

C. Heating, Ventilation, and Engine Cooling Systems Diagnosis and Repair
1. Inspect engine cooling and heater systems hoses and pipes; perform needed action. P-1
2. Inspect and test heater control valve(s); perform needed action. P-2
3. Diagnose temperature control problems in the HVAC system; determine needed action. P-2
4. Determine procedure to remove, inspect, reinstall, and/or replace heater core. P-2

VII. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

D. Operating Systems and Related Controls Diagnosis and Repair
1. Inspect and test HVAC system blower motors, resistors, switches, relays, wiring, and protection devices; determine needed action. P-1
2. Diagnose A/C compressor clutch control systems; determine needed action. P-2
3. Diagnose malfunctions in the vacuum, mechanical, and electrical components and controls of the heating, ventilation, and A/C (HVAC) system; determine needed action. P-2
4. Inspect and test HVAC system control panel assembly; determine needed action. P-3
5. Inspect and test HVAC system control cables, motors, and linkages; perform needed action. P-3
6. Inspect HVAC system ducts, doors, hoses, cabin filters, and outlets; perform needed action. P-1
7. Identify the source of HVAC system odors. P-2
8. Check operation of automatic or semi-automatic HVAC control systems; determine needed action. P-2

VII. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

E. Refrigerant Recovery, Recycling, and Handling
1. Perform correct use and maintenance of refrigerant handling equipment according to equipment manufacturer’s standards. P-1
2. Identify A/C system refrigerant; test for sealants; recover, evacuate, and charge A/C system; add refrigerant oil as required. P-1
3. Recycle, label, and store refrigerant. P-1

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TDL-AT4-TS8

Technical Standard 8

Engine Performance Service

(ASE: A8 Engine Performance Service and Repair)

For every task in Engine Performance the following safety requirement must be strictly enforced: Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

VIII. ENGINE PERFORMANCE

A. General: Engine Diagnosis

1. Identify and interpret engine performance concerns; determine needed action. P-1
2. Research vehicle service information including vehicle service history, service precautions, and technical service bulletins. P-1
3. Diagnose abnormal engine noises or vibration concerns; determine needed action. P-3
4. Diagnose the cause of excessive oil consumption, coolant consumption, unusual exhaust color, odor, and sound; determine needed action. P-2
5. Perform engine absolute manifold pressure tests (vacuum/boost); determine needed action. P-1
6. Perform cylinder power balance test; determine needed action. P-2
7. Perform cylinder cranking and running compression tests; determine needed action. P-1
8. Perform cylinder leakage test; determine needed action. P-1
10. Verify engine operating temperature; determine needed action. P-1
11. Verify correct camshaft timing including engines equipped with variable valve timing systems (VVT). P-1

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