

Delaware Department of Education CTE & STEM Office 401 Federal Street, Suite 256 Dover, DE 19901 Phone: 302.735.4015 Submit via email to: CTE.STEM@doe.k12.de.us

DELAWARE CTE PROGRAM OF STUDY APPLICATION

LOCAL EDUCATION AGENCY I	NFORMATION			
Local Education Agency (LEA):				
School(s) where the Program of Study will be Located:		Program of Study Start Date:		
LEA CTE Coordinator Name:	Phone:	E-Mail Address:		
Career Cluster Title:	Career Pathway Title:	Program of Study Title:		
Transportation, Distribution &	Facility and Mobile Equipment	Automotive Technology Pre-		
Logistics	Maintenance	Apprenticeship Program (6 credit)		
CTE Program of Study Course Ti	tles & Sequence:			
1.	1. Foundations of Automotive Technology 4.			
Engine Repair				
2.	Engine and Electrical Systems 5.			
Transmissions, Drive Train and Axles, HVAC-R				
3.	Brakes, Suspension and Steering 6.			
Automotive Industry Experie	ence			
CTE Program of Study Request:				
State-model CTE Program of Study				
Local CTE Program of Study				
ASSURANCES & SIGNATURES				
CTE Program of Study approval	and funding is contingent upon th	e following assurances:		
1. The LEA will comply with De	laware Administrative Code, 14 D	E Admin. 525, Requirements for Career		
and Technical Education Programs and the Delaware State Plan for the Carl D. Perkins Career and				
Technical Education Act of 2006;				
2. The LEA will submit CTE program data as required by the Delaware Department of Education;				
3. All teachers are certified in the appropriate CTE area and participate in program specific professional				
learning;				
4. The LEA will convene and engage a program advisory committee for the purposes of program				
development, implementation, and continuous improvement;				
5. All students have equal access to the program of study as well as early career/early college options;				
6. Career and Technical Studer	. Career and Technical Student Organizations are integral components of the program of study;			
7. The LEA will maintain safe fa	The LEA will maintain safe facilities and equipment aligned with the program of study goals; and			

8. A process for continuous improvement has been established, which includes a model of evaluation and program improvement.

LEA CTE Coordinator Signature:	Date:
LEA Chief School Officer Signature:	Date:
PROGRAM ADVISORY COMMITTEE MEMBE	ER INFORMATION
Complete the list of program advisory committ	ee members. Program of study representatives should
include but are not limited to: CTE and acaden	nic teachers, CTE/curriculum district coordinators, school
counselors, business and industry representati	ves, labor representatives, and post-secondary partners.
Community stakeholders including parents and	students can also be considered. Attach additional
information if applicable.	
Name:	Title:
Affiliation:	
Address:	
Phone:	E-Mail:
Area of Expertise:	
Automotive Technology Education	
Representing:	
Business/Industry	
Secondary Education	
Name:	Title:
Affiliation:	
Address:	
Phone:	E-Mail:
Area of Expertise:	
Representing:	
Business/Industry	
Secondary Education	
Post-Secondary Education	
Community/Other	
Name:	Title:

Affiliation:	
Address:	
Phone:	E-Mail:
Area of Expertise:	
Representing:Business/IndustrySecondary EducationPost-Secondary EducationCommunity/Other	
Name:	Title:
Affiliation:	
Address:	
Phone:	E-Mail:
Area of Expertise:	
Representing:         Business/Industry         Secondary Education         Post-Secondary Education         Community/Other	
Name:	Title:
Affiliation:	
Address:	
Phone:	E-Mail:
Area of Expertise:	

Representing:

Business/Industry

Secondary Education

Post-Secondary Education

Community/Other

## LABOR MARKET DEMAND

Certify that a labor market needs analysis has been completed for the proposed CTE program of study. Attach the *Labor Market Information (LMI) Review* document.

Access the Labor Market Information (LMI) Review document (see Appendix A).

- The LEA certifies that regional, state, and local labor market data have been reviewed to assure a demand exists for the POS occupations and that the number of POS completers will not significantly exceed this demand. Department of Labor data are available and/or documented. Supporting evidence of supply and demand is submitted with this proposal.
- No data exist for POS due to a unique labor market demand. Supporting evidence of demand is submitted with this proposal. Evidence may include but is not limited to: real-time labor market information, documentation of national, regional, state, or local labor trends, or letters from employers or workforce agencies documenting projected employment specific to the Career Cluster and Career Pathway.

## ACADEMIC AND TECHNICAL SKILL STANDARDS

List the academic, technical, and workplace skills and knowledge used to develop the program of study.

#### Title and source of academic standards:

#### Common Core State Standards (CCSS)

The Common Core State Standards (CCSS) are national standards that set clear college- and careerready expectations for kindergarten through 12th grade in English language arts/literacy and Mathematics. The standards help to ensure that students graduating from high school are prepared to take credit bearing introductory courses in two- or four-year college programs and enter the workforce. The standards were developed by the nation's governors and education commissioners, through their representative organizations, the National Governors Association Center for Best Practices (NGA) and the Council of Chief State School Officers (CCSSO). Teachers, parents, school administrators, and experts from across the country provided input into the development of the standards. The implementation of the Common Core, including how the standards are taught, the curriculum developed, and the materials used to support teachers as they help students reach the standards, is led entirely at the state and local levels. For more information on CCSS, please visit the link above.

## Next Generation Science Standards (NGSS)

The Next Generation Science Standards (NGSS) are national standards for science that lay out the disciplinary core ideas, science and engineering practices, as well as crosscutting concepts that students should master in preparation for college and careers. The standards were developed through a state-led effort that was managed by Achieve. The development of the NGSS involved the National Research Council (NRC), the National Science Teachers Association (NSTA), the American Association for the Advancement of Science (AAAS), and other critical partners such as K–12 teachers, state science and policy staff, higher education faculty, scientists, engineers, cognitive scientists, and

business leaders. For more information on the NGSS, please visit the link above.

#### Title and source of technical skill standards:

#### National Institute for Automotive Service Excellence (ASE)

ASE standards were developed to improve the quality of automotive and truck service and repair through the voluntary testing and certification of technicians. <u>ASE certification</u> is widely accepted and recognized as the industry standard credential for automotive professionals.

#### Transportation, Distribution and Logistics (TDL) Career Cluster Content Standards

TDL standards shape the design of a Facility and Mobile Equipment Maintenance Pathway program as defined by: 1) foundational academic expectations; 2) essential knowledge and skills; 3) cluster (foundation) knowledge and skills; and 4) pathway knowledge and skills. For more information on the TDL standards, please visit the link above.

Title and source of workplace or other skill standards, as applicable:

## Common Career Technical Core (CCTC)

The Common Career Technical Core (CCTC) are national standards for Career & Technical Education (CTE) that help inform the establishment of state standards and/or programs of study. The CCTC were developed by educators, school administrators, representatives from business and industry, faculty from higher education, as well as workforce and labor markets economists. The CCTC includes a set of standards for each of the sixteen (16) Career Clusters and the corresponding Career Pathways that help to define what students should know and be able to do after completing instruction in the automotive technology program of study. Within the automotive technology program of study, the CCTC standards for the Transportation, Distribution and Logistics Cluster have been embedded in each course. The program has students apply the CCTC TDL standards. For more information on the CCTC, please visit the link above.

#### Career Ready Practices (CRP)

The Career Ready Practices (CRP) are a component of the CCTC framework and includes twelve (12) statements that address the knowledge, skills, and dispositions that are important to becoming career ready. The CRP describes the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline, or level of education and should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a career pathway. Within the AT program of study, the CRP statements are embedded throughout the program to ensure students display the appropriate workplace and soft skills required to be successful in a career. For more information on the CRP, please visit the link above.

## EARLY CAREER AND EARLY COLLEGE OPPORTUNITIES

Identify CTE program of study early career opportunities, industry-recognized certifications and licenses, options for early college credit, two- and four-year degree and certification program alignment, and the technical skill attainment measures for the program of study. *Attach all* 

*Memorandum of Understanding that serve as articulation/dual enrollment agreement(s).* 

Describe early career opportunities (i.e. work-based learning experiences and industry-mentored projects):

The Automotive Technology is a six (6) course program of study that provides students with the mathematical, scientific, and mechanical principles and methods required to understand and perform the maintenance, repair and servicing of vehicles. Students participating in this pre-apprenticeship program will be prepared to enter into a <u>Delaware Automotive Technician Tech C Registered</u> <u>Apprenticeship Program</u>.

Work-based learning opportunities provide senior Automotive Technology students with coordinated on the job training not ordinarily available in the classroom. Local business partners and agencies work with educators by serving on advisory boards and as mentors to provide a real-world connection to the Automotive Technology coursework. Work-based learning experiences and industry-mentored projects are included in each course and will be reviewed with the LEA Program Advisory Council (PAC) to further identify opportunities to engage the community. The work-based learning experiences provides students with the opportunity to consider multiple careers and occupations, demonstrate workplace behavior, develop skills within the automotive field, and apply academic and occupational skills in the workplace or a simulated workplace environment.

List industry-recognized certifications and/or licenses, as appropriate (include the partner organization and credential):

## National Institute of Automotive Service Excellence

ASE provides industry-recognized, portable credentials for students and professionals. ASE certification exams improve the quality of vehicle repair and service by offering tangible proof of technical knowledge.

## Delaware Department of Labor Apprenticeship and Training

Students will receive a Delaware Department of Labor Pre-Apprenticeship Certificate upon completion of this program of study. The Automotive Technology Pre-Apprenticeship Program of Study is aligned with the Delaware Department of Labor Automotive Technician Tech C Registered Apprenticeship Program that is offered through the Adult Education Division of New Castle County Vo Tech, Polytech and Sussex Technical School Districts. Students who pass the ASE G-1 Exam will not be required to complete pre-requisite automotive course work.

Describe early college credit options (i.e. advanced placement, dual enrollment, Tran scripted and/or articulated credit, credit by exam, pre-apprenticeship, other) and options for two- and fouryear degree and/or certification program alignment (attach articulation/dual enrollment agreement). The partner organization and hours of credit earned should be included, as applicable:

Students completing the Automotive Technology Pre-Apprenticeship program of study will be eligible to enroll in the Delaware Department of Labor Automotive Technician Tech C registered apprenticeship program through the adult education divisions of the New Castle County, Polytech, and Sussex Technical schools systems. Students that pass the ASE G-1 Certification Exam will not be required to complete pre-requisite automotive course work.

The Department of Education is currently negotiating articulation agreements with Delaware Technical Community College (DTCC) and the University of Northwestern Ohio.

List technical skill attainment measures for the program of study (i.e. industry recognized certification or license, advanced placement, dual enrollment, transcripted and/or articulated credit, credit by exam):

- Certification/credentialing exam (specify):
- Licensing exam (specify):
- Nationally recognized exam (specify): <u>ASE G-1 Automotive Maintenance & Light Repair</u>
- Advanced standing (specify): <u>Students that pass the ASE G-1 Exam will not be required to</u> <u>complete pre-requisite automotive course work when they enroll in the Delaware Registered</u> <u>Apprenticeship Program.</u>
- Other (specify):

## POS OVERVIEW, COURSE DESCRIPTIONS, END-OF-COURSE, AND PROGRAM ASSESSMENTS

Provide a CTE program of study overview that broadly describes the program and student expectations. Identify end-of-program assessment(s) and opportunities for students to participate in early college and early career experiences. List each course title in the CTE program of study. Provide an overview of each course and define what students should know and be able to demonstrate upon completion of each level. Identify appropriate end-of-course assessment(s).

#### **CTE Program of Study Overview:**

The Automotive Technology POS is a six (6) course program of study that provides students with the mathematical, scientific, and mechanical knowledge to understand and perform the maintenance, repair and servicing of automotive vehicles. Students participating in this pre-apprenticeship program will be prepared to enter into a Delaware Department of Labor Automotive Technician Tech C Registered Apprenticeship program. Students that pass the ASE G-1 Certification Exam will not be required to complete pre-requisite automotive course work. Students are prepared for a variety of careers including automotive technician, service contract writers, parts technicians, and sales.

- Foundations of Automotive Technology (FAT) introduces students to the skills needed for automotive maintenance and repair. This course offers hands-on opportunities in shop safety, tools and equipment operation, work habits/ethics, communication skills, preparing the vehicle for service, preparing the vehicle for the customer, and general service tasks.
- Engine and Electrical Systems (EES) enables students to build on the knowledge and experiences gained in FAT. Students explore engine systems and electrical systems.
- Brakes, Suspension and Steering (BSS) focuses on suspension and steering, including wheels, tires, wheel alignment; drum brakes; disc brakes; and power assist units.

• Engine Repair (ER) provides training in general engine diagnosis, engine removal and engine				
reinstallation; and lubrication and cooling systems diagnosis and repair.				
• Transmissions, Drive Train and Axles, HVAC-R (TDT) focuses on automatic				
transmission/transaxle, manual drive train and axles, drive shaft, half-shaft, universal				
joints/constant velocity (CV) joint_rear wheel drive axle inspection_four-wheel drive_all-wheel				
drive and heating air conditioning ventilation and refrigerant				
anve, and heating, an conditioning, ventilation and reingerant.				
Automative Inductor Evantiance (AIE)) provides students with worked based leaving				
Automotive industry Experience (AIE)) provides students with worked based learning				
experiences as well as review and test preparation for the ASE G-1 exam. Safety, work				
habits/ethics and communication skills are reinforced.				
End-of-Program Assessment(s):				
Certification/credentialing exam (specify):				
ASE Entry-Level Certification Exams				
ASE Auto Maintenance and Light Repair Exam (G-1)				
Licensing exam (specify):				
Nationally recognized exam (specify):				
Other (specify):				
Course title:				
Foundations of Automotive Technology (FAT)				
Course description (include prerequisites):				
Foundations of Automotive Technology (FAT) introduces students to the skills needed for automotive				
maintenance and repair. This course offers hands-on opportunities in shop safety, tools and				
equipment operation, work habits/ethics, communication skills, preparing the vehicle for service,				
preparing the vehicle for the customer, and general service tasks.				
Course knowledge and skills (what students will know and be able to do):				
By the end of this course students will:				
1. Shop and Personal Safety:				
a. Identify general shop safety rules and procedures:				
b Utilize safe procedures for handling of tools and equipment:				
c. Identify and use proper placement of floor jacks and jack stands:				
d. Identify and use proper procedures for safe lift operation:				
a. Identify and use proper procedures for safe lift operation;				
<ul> <li>a. Identify and use proper procedures for safe lift operation;</li> <li>e. Utilize proper ventilation procedures for waking within the lab/shop area;</li> </ul>				
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<ul> <li>a. Identify and use proper procedures for safe fit operation;</li> <li>e. Utilize proper ventilation procedures for waking within the lab/shop area;</li> <li>f. Identify marked safety areas;</li> <li>g. Identify the location and the types of fire extinguishers and other fire safety equipment;</li> <li>demonstrate knowledge of the procedures for using fire extinguishers and other fire safety</li> </ul>				
<ul> <li>d. Identify and use proper procedures for safe fit operation;</li> <li>e. Utilize proper ventilation procedures for waking within the lab/shop area;</li> <li>f. Identify marked safety areas;</li> <li>g. Identify the location and the types of fire extinguishers and other fire safety equipment;</li> <li>demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment;</li> </ul>				
<ul> <li>d. Identify and use proper procedures for safe fit operation;</li> <li>e. Utilize proper ventilation procedures for waking within the lab/shop area;</li> <li>f. Identify marked safety areas;</li> <li>g. Identify the location and the types of fire extinguishers and other fire safety equipment;</li> <li>demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment;</li> <li>h. Identify the location and use of eye wash stations;</li> </ul>				
<ul> <li>dentify and use proper procedures for safe fift operation;</li> <li>e. Utilize proper ventilation procedures for waking within the lab/shop area;</li> <li>f. Identify marked safety areas;</li> <li>g. Identify the location and the types of fire extinguishers and other fire safety equipment;</li> <li>demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment;</li> <li>h. Identify the location and use of eye wash stations;</li> <li>i. Identify the location of the posted evacuation routes;</li> </ul>				

- j. Comply with the requirement use of safety glasses, ear protection, gloves, and shoes during lab/shop activities;
- k. Identify and wear appropriate clothing for the lob/shop activities;
- I. Secure hair and jewelry for shop/lab activities;
- m. Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS); electronic brake control systems, and hybrid vehicle high voltage circuits;
- n. Demonstrate awareness of the safety aspects of high voltage circuits (such as high intensity discharge (HID) lamps, ignition systems, injection systems, etc.); and
- o. Locate and demonstrate knowledge of materials safety data sheets (MSDS).
- 2. Tools and Equipment:
  - a. Identify tools and their use in automotive applications;
  - b. Identify standard and metric designation;
  - c. Demonstrate safe handling and use of appropriate tools;
  - d. Demonstrate proper cleaning, storage, and maintenance of tools and equipment; and
  - e. Demonstrate proper use of precision measuring tools (i.e. micrometer, dial-indicator, and dialcaliper).
- 3. Career Certifications and Progression:
  - a. Demonstrate knowledge of the National Institute for Automotive Service and the series of 9 automotive technician credentialing exams that are offered to certify technical knowledge and skills related to specific automotive systems and tasks.
- 4. Personal Behavior:
  - a. Reports to work daily on time; able to take directions and motivated to accomplish the task at hand;
  - b. Dresses appropriately and uses language and manners suitable for the workplace;
  - c. Maintains appropriate personal hygiene;
  - d. Meets and maintains employment eligibility criteria, such as drug/alcohol-free status, clean driving record, etc.; and
  - e. Demonstrates honesty, integrity and reliability.
- 5. Work Habits/Ethics:
  - a. Complies with workplace policies/laws;
  - b. Contributes to the success of the team, assists others and requests help when needed;
  - c. Works well with all customers and coworkers;
  - d. Negotiates solutions to interpersonal and workplace conflicts;
  - e. Contributes ideas and initiative;
  - f. Follows directions;
  - g. Communicates (written and verbal) effectively with customers and coworkers;
  - h. Reads and interprets workplace documents; writes clearly and concisely;
  - i. Analyzes and resolves problems that arise in completing assigned tasks;
  - j. Organizes and implements a productive plan of work;
  - k. Uses scientific, technical, engineering and mathematics principles and reasoning to accomplish assigned tasks; and
  - I. Identifies and addresses the needs of all customers, providing helpful, courteous and knowledgeable service and advice as needed.
- 6. Communication Skills:
  - a. Actively listen to give full attention to what other people are saying, taking time to

understand the points being made, asking questions as appropriate and not interrupting at inappropriate times;

- b. Comprehend written sentences and paragraphs in work related documents;
- c. Understanding the implications of new information for both current and future problemsolving and decision-making;
- d. Monitoring/assessing performance of yourself, other individuals, or organizations to make improvements or take corrective action;
- e. Talking to others to convey information effectively;
- f. Managing one's own time and the time of others;
- g. Coordination or adjusting actions in response to others' actions;
- h. Actively looking for ways to help people;
- i. Being aware of others' reactions and understanding why they react as they do;
- j. Bringing others together and trying to reconcile differences;
- k. Persuading others to change their minds or behaviors;
- I. Communicating effectively with technical writing as appropriate for the needs of the audience;
- m. Selecting and using training/instructional methods and procedures appropriate for the situation when learning or teaching new things;
- n. Effectively apply automotive measurement and math skills;
- o. Use scientific rules and methods to solve problems;
- p. Generate or adapt equipment and technology to serve user needs;
- q. Demonstrate ethical professional practices; and
- r. Demonstrate accuracy and efficiency.
- 7. Preparing Vehicle for Service:
  - a. Identify information needed and the service requested on a repair order;
  - b. Identify purpose and demonstrate proper use of fender covers, mats;
  - c. Demonstrate use of the three C's (concerns cause, and correction);
  - d. Review vehicle service history; and
  - e. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause and correction.
- 8. Preparing Vehicle for Customer:
  - a. Ensure vehicle is prepared to return to customer per school/company policy (floor mats, steering wheel cover, etc.)
- 9. General Service Tasks:
  - a. Prepare vehicle for service;
  - b. Perform vehicle safety and maintenance inspection;
  - c. Perform oil and filter service;
  - d. Inspect and advise on condition of belts;
  - e. Prefer to manufacturer guidance on sparkplug service life;
  - f. Inspect tire condition, identify wear, rotate tires according to manufacturer guidelines, dismount, remount and balance wheel and tire assembly including vehicles with tire pressure monitoring system;
  - g. Inspect, measure, and advise disc and drum brake service life remaining;

- h. Retrieve and record diagnostic trouble codes;
- i. Demonstrate proper use of digital multi-meter to measure volts, amps and ohms; and
- j. Inspect battery and cables, and test battery.

## End-of-Course Assessment(s):

- Teacher designed assessment
- LEA designed assessment
- Certification/credentialing exam (specify):
- Licensing exam (specify):
- Nationally recognized exam (specify):
- Other (specify):

## Course title:

Engine and Electrical Systems (EES)

Course description (include prerequisites):

Engine and Electrical Systems (EES) enables students to build on the knowledge and experiences gained in FAT. Students explore engine systems and electrical systems.

Prerequisite: Foundations of Automotive Technology (FAT)

#### Course knowledge and skills (what students will know and be able to do):

By the end of this course students will:

#### New Skills:

- 1. Engine Systems: (ASE G-1 Task List)
  - a. Verify driver's complaint and/or road test vehicle; determine necessary action. Utilize service manuals, technical service bulletins (TSBs), and product information;
  - b. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action.
  - c. Check for abnormal engine noises;
  - d. Inspect and replace pans and covers including gaskets, seals and sealers as required;
  - e. Change engine oil and filter; reset oil life monitor;
  - f. Inspect and test radiator, heater core, pressure cap, and coolant recovery system; determine needed repairs; perform cooling system pressure and dye tests;
  - g. Inspect, replace, and adjust drive belt(s), tensioner(s), and pulleys;
  - h. Inspect and replace engine cooling system and heater system hoses, pipes, and fittings;
  - i. Remove and replace engine thermostat and coolant bypass;
  - j. Inspect and test coolant; drain, flush, and refill cooling system with recommended coolant; bleed air as required;

- k. Inspect and replace accessory belt driven water pumps;
- I. Confirm fan operation (both electrical and mechanical); inspect fan clutch, fan shroud, and air dams;
- m. Verify operation of engine-related warning indicators;
- n. Perform air induction/ throttle body service;
- o. Verify engine mechanical timing;
- p. Inspect, service, or replace air filter(s), filter housing(s), and air intake system components;
- q. Inspect and replace crankcase ventilation system components;
- r. Inspect exhaust system for leaks; check hangers, brackets, and heat shields; determine needed repairs;
- s. Retrieve and record diagnostic trouble codes (DTCs);
- t. Remove and replace spark plugs; inspect secondary ignition components for wear or damage;
- u. Inspect fuel tank, filler neck, fuel cap, lines, fittings, and hoses; replace external fuel filter;
- v. Inspect canister, lines/hoses, and mechanical and electrical components of the evaporative emissions control system (EVAP); and
- w. Check and refill diesel exhaust fluid (DEF).
- 2. Engine Diagnosis: (ASE Entry-Level Certification Task List)
  - a. Identify and interpret engine performance concerns; determine necessary action;
  - b. Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins;
  - c. Diagnose abnormal engine noises or vibration concerns; determine necessary action;
  - d. Diagnose the cause of excessive oil consumption, coolant consumption, unusual exhaust color, odor, and sound; determine necessary action;
  - e. Perform engine absolute manifold pressure tests (vacuum/boost); determine necessary action;
  - f. Perform cylinder power balance test; determine necessary action;
  - g. Perform cylinder cranking and running compression tests; determine necessary action;
  - h. Perform cylinder leakage test; determine necessary action;
  - i. Diagnose engine mechanical, electrical, electronic, fuel, and ignition concerns; determine necessary action;
  - j. Verify engine operating temperature; determine necessary action; and
  - k. Verify correct camshaft timing including Variable Valve Timing systems (VVT).
- 3. Computerized Controls Diagnosis and Repair: (ASE Entry-Level Certification Task List)
  - a. Retrieve and record Diagnostic Trouble Codes (DTC), OBD monitor status, and freeze frame data; clear codes when applicable;
  - b. Access and use service information to perform step-by-step (troubleshooting) diagnosis;
  - c. Perform active tests of actuators using a scan tool; determine necessary action;
  - d. Describe the use of OBD monitors for repair verification;
  - e. Diagnose the causes of emissions or drivability concerns with stored or active diagnostic trouble codes; obtain, graph, and interpret scan tool data;

- f. Diagnose emissions or drivability concerns without stored diagnostic trouble codes; determine necessary action;
- g. Inspect and test computerized engine control system sensors, powertrain/engine control module (PCM/ECM), actuators, and circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO); perform necessary action; and
- h. Diagnose drivability and emissions problems resulting from malfunctions of interrelated systems (cruise control, security alarms, suspension controls, traction controls, (HVAC), automatic transmissions, non-OEM installed accessories, or similar systems); determine necessary action.
- 4. Ignition System Diagnosis and Repair: (ASE Entry-Level Certification Task List)
  - a. Diagnose (troubleshoot) ignition system related problems such as no-starting, hard starting, engine misfire, poor drivability, spark knock, power loss, poor mileage, and emissions concerns; determine necessary action;
  - b. Inspect and test crankshaft and camshaft position sensor(s); perform necessary action;
  - c. Inspect, test, and/or replace ignition control module, powertrain/engine control module; reprogram/initialize as necessary; and
  - d. Remove and replace spark plugs; inspect secondary ignition components for wear and damage.
- 5. Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair: (ASE Entry-Level Certification Task List)
  - a. Diagnose (troubleshoot) hot or cold no-starting, hard starting, poor drivability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, dieseling, and emissions problems; determine necessary action;
  - b. Check fuel for contaminants; determine necessary action;
  - c. Inspect and test fuel pumps and pump control systems for pressure, regulation, and volume; perform necessary action;
  - d. Replace fuel filter(s) when applicable;
  - e. Inspect, service, or replace air filters, filter housings, and intake duct work;
  - f. Inspect throttle body, air induction system, intake manifold and gaskets for vacuum leaks and/or unmetered air;
  - g. Inspect, test, and/or replace fuel injectors;
  - h. Verify idle control operation;
  - i. Inspect integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shields; perform necessary action;
  - j. Inspect condition of exhaust system hangers, brackets, clamps, and heat shields; determine necessary action;
  - k. Perform exhaust system back-pressure test; determine necessary action;
  - I. Check and refill diesel exhaust fluid; and
  - m. Test the operation of turbocharger/supercharger systems; determine necessary action.
- 6. Emissions Control Systems Diagnosis and Repair: (ASE Entry-Level Certification Task List)
  - a. Diagnose oil leaks, emissions, and drivability concerns caused by the positive crankcase ventilation (PCV) system; determine necessary action;
  - b. Inspect, test, service, and/or replace positive crankcase ventilation (PCV) filter/breather, valve, tubes, orifices, and hoses; perform necessary action;
  - c. Diagnose emissions and drivability concerns caused by the exhaust gas recirculation (EGR) system; inspect, test, service and/or replace electrical/electronic sensors, controls, and

wiring of exhaust gas recirculation (EGR) systems including tubing, exhaust passages, vacuum/pressure controls, filters and hoses; determine necessary action;

- d. Diagnose emissions and drivability concerns caused by the secondary air injection system; components and circuits of air injection systems; inspect, test, repair, and/or replace electrical/electronically-operated components and circuits of air injection systems; determine necessary action;
- e. Diagnose emissions and drivability concerns caused by the evaporative emissions control (EVAP) system; determine necessary action;
- f. Diagnose emission and drivability concerns caused by catalytic converter system; determine necessary action; and
- g. Interpret diagnostic trouble codes (DTCs) and scan tool data related to the emissions control systems; determine necessary action. oscilloscope (DSO); perform necessary action.
- 7. Brakes: (ASE G-1 Exam Task List)
  - a. Check for poor stopping, pulling, dragging, noises, high or low pedal, and hard or spongy pedal;
  - b. Check the master cylinder fluid level and condition; inspect for external fluid leakage;
  - c. Inspect flexible brake hoses, brake lines, valves, and fittings for routing, leaks, dents, kinks, rust, cracks, or wear; inspect for loose fittings and supports; determine needed repairs;
  - d. Verify operation of brake warning light and ABS warning light; inspect brake system wiring damage and routing;
  - e. Test parking brake indicator light, switch, and wiring;
  - f. Bleed and/or flush hydraulic system; and
  - g. Select, handle, store, and install proper brake fluids.
- 8. Electrical: (ASE G-1 Exam Task List)
  - a. Disarm/re-enable air bag; verify lamp operation;
  - b. Check voltages, grounds, and voltage drops in electrical circuits; interpret readings;
  - c. Check current flow in electrical circuits and components; interpret readings;
  - d. Check continuity and resistances in electrical circuits and components; interpret readings;
  - e. Perform battery tests (load and capacitance); determine needed service;
  - f. Maintain or restore electronic memory functions;
  - g. Inspect, clean, fill, or replace battery;
  - h. Perform slow/fast battery charge in accordance with manufacturers' recommendations;
  - i. Inspect, clean, and repair or replace battery cables, connectors, clamps, and hold-downs;
  - j. Jumpstart a vehicle with a booster battery or auxiliary power supply;
  - k. Perform starter current draw test; interpret readings;
  - I. Inspect switches, connectors, and wires of starter control circuits;
  - m. Remove and replace starter;
  - n. Perform charging system output test and identify undercharge, no-charge, or overcharge condition;
  - o. Inspect, adjust, and replace generator (alternator) drive belts, pulleys, and tensioners;
  - p. Remove, inspect, and replace generator (alternator);
  - q. Inspect, replace, and aim headlights/bulbs and auxiliary lights (fog lights/driving lights);
  - r. Inspect interior and exterior lamps and sockets; repair as needed;
  - s. Inspect lenses; determine needed repairs;
  - t. Verify instrument gauges and warning/indicator light operation; reset maintenance indicators;

- u. Verify horn operation; determine needed repairs; and
- v. Verify wiper and washer operation; replace wiper motor, blades, washer pump, and hoses and nozzles as needed. Identify A/C refrigerant type; recover and recharge system per manufacturer's specifications.
- 9. Electrical System Diagnosis: (ASE Entry-Level Certification Task List)
  - a. Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins;
  - b. Demonstrate knowledge of electrical/electronic series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law);
  - c. Demonstrate proper use of a digital multimeter (DMM) when measuring source voltage, voltage drop (including grounds), current flow and resistance;
  - d. Demonstrate knowledge of the causes and effects from shorts, grounds, opens, and resistance problems in electrical/electronic circuits;
  - e. Demonstrate proper use of a test light on an electrical circuit;
  - f. Check operation of electrical circuits fused jumper wires;
  - g. Use wiring diagrams during the diagnosis (troubleshooting) of electrical/electronic circuit problems;
  - h. Diagnose the cause(s) of excessive key-off battery drain (parasitic draw); determine necessary action;
  - i. Inspect and test fusible links, circuit breakers, and fuses; determine necessary action;
  - j. Inspect and test switches, connectors, relays, solenoid solid state devices, and wires of electrical/electronic circuits; determine necessary action;
  - k. Inspect, test, repair, and/or replace components, connectors, terminals, harnesses, and wiring in electrical/electronic systems (including solder repairs);
  - I. Check electrical/electronic circuit waveforms; interpret readings and determine needed repairs; and
  - m. Repair Data BUS wiring harness.
- 10. Battery Diagnosis and Service: (ASE Entry-Level Certification Task List)
  - a. Perform battery state-of-charge test; determine necessary action;
  - b. Confirm proper battery capacity for vehicle application; perform battery capacity and load test; determine necessary action;
  - c. Maintain or restore electronic memory functions;
  - d. Inspect and clean battery; fill battery cells; check battery cables, connectors, clamps, and holddowns;
  - e. Perform slow/fast battery charge according to manufacturer's recommendations;
  - f. Jump-start vehicle using jumper cables and a booster battery or an auxiliary power supply;
  - g. Identify safety precautions for high voltage systems on hybrid, hybrid electric, and diesel vehicles;
  - h. Identify electrical/electronic modules, security systems, radios, and other accessories that require reinitialization or code entry after reconnecting vehicle battery;
  - i. Identify hybrid vehicle auxiliary (12v) battery service, repair, and test procedures;
- 11. Starting System Diagnosis and Repair:
  - a. Perform starter current draw tests; determine necessary action;
  - b. Perform starter circuit voltage drop tests; determine necessary action;
  - c. Inspect and test starter relays and solenoids; determine necessary action;

- d. Remove and install starter in a vehicle;
- e. Inspect and test switches, connectors, and wires of starter control circuits;
- f. Determine necessary action. Differentiate between electrical and engine mechanical problems that cause a slow-crank or a nocrank condition; and
- g. Demonstrate knowledge of an automatic idle-stop/start-stop system.
- 12. Charging System Diagnosis and Repair: (ASE Entry-Level Certification Task List)
  - a. Perform charging system output test; determine necessary action;
  - b. Diagnose (troubleshoot) charging system for causes of undercharge, no-charge, or overcharge conditions;
  - c. Inspect, adjust, and/or replace generator (alternator) drive belts; check pulleys and tensioners for wear; check pulley and belt alignment;
  - d. Remove, inspect, and/or replace generator (alternator); and
  - e. Perform charging circuit voltage drop tests; determine necessary action.
- 13. Lighting Systems Diagnosis and Repair: (ASE Entry-Level Certification Task List)
  - a. Diagnose (troubleshoot) the causes of brighter-than-normal, intermittent, dim, or no light operation; determine necessary action;
  - b. Inspect interior and exterior lamps and sockets including headlights and auxiliary lights (fog lights/driving lights); replace as needed;
  - c. Aim headlights; and
  - d. Identify system voltage and safety precautions associated with high-intensity discharge headlights.
- 14. Instrument Cluster and Driver Information Systems Diagnosis and Repair: (ASE Entry-Level Certification Task List)
  - a. Inspect and test gauges and gauge sending units for causes of abnormal readings; determine necessary action;
  - b. Diagnose (troubleshoot) the causes of incorrect operation of warning devices and other driver information systems; determine necessary action; and
  - c. Reset maintenance indicators as required.
- 15. Body Electrical Systems Diagnosis and Repair: (ASE Entry-Level Certification Task List)
  - 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, park assist, cruise control, and auto dimming headlamps); determine needed repairs;
  - b. 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;
  - c. 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;
  - d. Diagnose operation of safety systems and related circuits (such as: horn, airbags, seat belt pretensioners, occupancy classification, wipers, washers, speed control/collision avoidance, headsup display, park assist, and back-up camera); determine needed repairs;
  - e. Diagnose body electronic systems circuits using a scan tool; check for module communication errors (DATA BUS systems); determine necessary action; and
  - f. Describe the process for software transfer, software updates, or reprogramming of electronic

#### modules

#### **Reinforced Skills:**

- 16. Shop and Personal Safety:
  - a. Identify general shop safety rules and procedures;
  - b. Utilize safe procedures for handling of tools and equipment;
  - c. Identify and use proper placement of floor jacks and jack stands;
  - d. Identify and use proper procedures for safe lift operation;
  - e. Utilize proper ventilation procedures for waking within the lab/shop area;
  - f. Identify marked safety areas;
  - g. 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;
  - h. Identify the location and use of eye wash stations;
  - i. Identify the location of the posted evacuation routes;
  - j. Comply with the requirement use of safety glasses, ear protection, gloves, and shoes during lab/shop activities;
  - k. Identify and wear appropriate clothing for the lob/shop activities;
  - I. Secure hair and jewelry for shop/lab activities;
  - m. Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high voltage circuits;
  - n. Demonstrate awareness of the safety aspects of high voltage circuits (such as high intensity discharge (HID) lamps, ignition systems, injection systems, etc.); and
  - o. Locate and demonstrate knowledge of materials safety data sheets (MSDS)
- 17. Tools and Equipment:
  - a. Identify tools and their use in automotive applications;
  - b. Identify standard and metric designation;
  - c. Demonstrate safe handling and use of appropriate tools;
  - d. Demonstrate proper cleaning, storage, and maintenance of tools and equipment; and
  - e. Demonstrate proper use of precision measuring tools (i.e. micrometer, dial-indicator, dialcaliper);
- 18. Career Certifications and Progression:
  - a. Demonstrate knowledge of the National Institute for Automotive Service and the series of 9 automotive technician credentialing exams that are offered to certify technical knowledge and skills related to specific automotive systems and tasks.
- 19. Personal Behavior:
  - a. Reports to work daily on time; able to take directions and motivated to accomplish the task at hand;
  - b. Dresses appropriately and uses language and manners suitable for the workplace;
  - c. Maintains appropriate personal hygiene;
  - d. Meets and maintains employment eligibility criteria, such as drug/alcohol-free status, clean driving record, etc.; and
  - e. Demonstrates honesty, integrity and reliability.
- 20. Work Habits/Ethics:
  - a. Complies with workplace policies/laws;

- b. Contributes to the success of the team, assists others and requests help when needed;
- c. Works well with all customers and coworkers;
- d. Negotiates solutions to interpersonal and workplace conflicts;
- e. Contributes ideas and initiative;
- f. Follows directions;
- g. Communicates (written and verbal) effectively with customers and coworkers;
- h. Reads and interprets workplace documents; writes clearly and concisely;
- i. Analyzes and resolves problems that arise in completing assigned tasks;
- j. Organizes and implements a productive plan of work;
- k. Uses scientific, technical, engineering and mathematics principles and reasoning to accomplish assigned tasks; and
- I. Identifies and addresses the needs of all customers, providing helpful, courteous and knowledgeable service and advice as needed.
- 21. Communication Skills:
  - Actively listen to give full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate and not interrupting at inappropriate times;
  - b. Comprehend written sentences and paragraphs in work related documents;
  - c. Understanding the implications of new information for both current and future problemsolving and decision-making;
  - d. Monitoring/assessing performance of yourself, other individuals, or organizations to make improvements or take corrective action;
  - e. Talking to others to convey information effectively;
  - f. Managing one's own time and the time of others;
  - g. Coordination or adjusting actions in response to others' actions;
  - h. Actively looking for ways to help people;
  - i. Being aware of others' reactions and understanding why they react as they do;
  - j. Bringing others together and trying to reconcile differences;
  - k. Persuading others to change their minds or behaviors;
  - I. Communicating effectively with technical writing as appropriate for the needs of the audience;
  - m. Selecting and using training/instructional methods and procedures appropriate for the situation when learning or teaching new things;
  - n. Effectively apply automotive measurement and math skills;
  - o. Use scientific rules and methods to solve problems;
  - p. Generate or adapt equipment and technology to serve user needs;
  - q. Demonstrate ethical professional practices; and
  - r. Demonstrate accuracy and efficiency.
- 22. Preparing Vehicle for Service:
  - a. Identify information needed and the service requested on a repair order;
  - b. Identify purpose and demonstrate proper use of fender covers, mats;
  - c. Demonstrate use of the three C's (concerns cause, and correction);
  - d. Review vehicle service history; and
  - e. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause and correction.
- 23. Preparing Vehicle for Customer:
  - a. Ensure vehicle is prepared to return to customer per school/company policy (floor mats,

steering wheel cover, etc.).

24. ASE Review and Test Prep

a. ASE Entry-Level A6 Electrical/Electronic Systems Certification Exam; and

b. ASE Entry-Level A8 Engine Performance Certification Exam.

# End-of-Course Assessment(s):

Teacher designed assessment

- LEA designed assessment
- Certification/credentialing exam (specify):
   ASE Entry-Level A6 Electrical/Electronic Systems Certification Exam
   ASE Entry-Level A8 Engine Performance Certification Exam
- Licensing exam (specify):
- Nationally recognized exam (specify):
- Other (specify):

## Course title:

Brakes, Suspension and Steering (BSS)

## Course description (include prerequisites):

Brakes, Suspension and Steering (BSS) focuses on suspension and steering, including wheels, tires, wheel alignment; drum brakes; disc brakes; and power assist units.

Prerequisite: Engine and Electrical Systems (EES)

#### Course knowledge and skills (what students will know and be able to do):

By the end of this course students will:

New Skills:

- 1. Suspension and Steering: (ASE G-1Exam Task List)
  - a. Disarm airbag (SRS) system;
  - b. Check power steering fluid level; determine fluid type and adjust fluid level; identify system type (electric or hydraulic);
  - c. Inspect, adjust, and replace power steering pump belt(s), tensioners and pulleys; verify pulley alignment;
  - d. Identify power steering pump noises, vibration, and fluid leakage;
  - e. Remove and replace power steering pump; inspect pump mounting and attaching brackets; remove and replace power steering pump pulley; transfer related components;
  - f. Inspect and replace power steering hoses, fittings, O-rings, coolers, and filters;
  - g. Inspect and replace rack and pinion steering gear bellows/boots;
  - h. Flush, fill, and bleed power steering system;
  - i. Retrieve and record diagnostic trouble codes (DTCs); and
  - j. Inspect electronic suspension components (ride height sensors, wiring, etc.).
- 2. Suspension and Steering Systems: (ASE Entry-Level Certification Task List)
  - a. Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins; and
  - b. Identify and interpret suspension and steering system concerns; determine necessary action.
- 3. Steering Systems Diagnosis and Repair: (ASE Entry-Level Certification Task List)
  - a. Disable and enable supplemental restraint system (SRS); verify indicator lamp operation;
  - Remove and replace steering wheel; center/time supplemental restraint system (SRS) coil (clock spring);
  - c. Diagnose steering column noises, looseness, and binding concerns (including tilt/telescoping mechanisms); determine necessary action;
  - d. Diagnose power steering gear (non-rack and pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine necessary action;
  - e. Diagnose power steering gear (rack and pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine necessary action;
  - f. Inspect steering shaft universal-joint(s), flexible coupling(s), collapsible column, lock cylinder mechanism, and steering wheel; perform necessary action;
  - g. Remove and replace rack and pinion steering gear; inspect mounting bushings and brackets.
  - h. Inspect rack and pinion steering gear inner tie rod ends (sockets) and bellows boots; replace as needed;
  - i. Inspect power steering fluid level and condition;

- j. Flush, fill, and bleed power steering system; use proper fluid type per manufacturer specification;
- k. Inspect for power steering fluid leakage; determine necessary action;
- I. Remove, inspect, replace, and/or adjust power steering pump drive belt;
- m. Remove and reinstall power steering pump;
- n. Remove and reinstall press fit power steering pump pulley; check pulley and belt alignment;
- o. Inspect, remove and/or replace power steering hoses and fittings;
- p. Inspect, remove and/or replace pitman arm, relay (centerlink/intermediate) rod, idler arm, mountings, and steering linkage damper;
- q. Inspect, replace, and/or adjust tie rod ends (sockets), tie rod sleeves, and clamps;
- r. Inspect, test and diagnose electrically assisted power steering systems (including using a scan tool); determine necessary action;
- s. Identify hybrid vehicle power steering system electrical circuits and safety precautions; and
- t. Test power steering system pressure; determine necessary action.
- 4. Steering Linkage: (ASE G-1 Exam Task List)
  - a. Inspect, adjust (where applicable), and replace pitman arm, center link (relay rod/ drag link/intermediate rod), idler arm(s) and mountings;
  - b. Inspect, replace, and adjust tie rods, tie rod sleeves/adjusters, clamps, and tie rod ends (sockets/bushings); and

c. Inspect and replace steering linkage damper(s).

- 5. Front Suspension: (ASE G-1 Exam Task List)
  - a. Identify front suspension system noises, handling, ride height, and ride quality concerns; disable air suspension system;
  - b. Inspect upper and lower control arms, bushings, and shafts;
  - c. Inspect and replace rebound and jounce bumpers;
  - d. Inspect track bar, strut rods/radius arms, and related mounts and bushings;
  - e. Inspect upper and lower ball joints (with or without wear indicators);
  - f. Inspect non-independent front axle assembly for damage and misalignment;
  - g. Inspect front steering knuckle/spindle assemblies and steering arms;
  - h. Inspect front suspension system coil/air springs and spring insulators (silencers);
  - i. Inspect front suspension system leaf spring(s), leaf spring insulators (silencers), shackles, brackets, bushings, center pins/bolts, and mounts;
  - j. Inspect front suspension system torsion bars and mounts;
  - k. Inspect and replace front stabilizer bar (sway bar) bushings, brackets, and links;
  - I. Inspect front strut cartridge or assembly;
  - m. Inspect front strut bearing and mount;
  - n. Identify noise and service front wheel bearings/hub assemblies; and
  - o. Identify driver assist systems, if applicable.
- 6. Suspension Systems Diagnosis and Repair: (ASE Entry-Level Certification Task List)

- a. Diagnose short and long arm suspension system noises, body sway, and uneven ride height concerns; determine necessary action;
- b. Diagnose strut suspension system noises, body sway, and uneven ride height concerns; determine necessary action;
- c. Inspect, remove, and/or replace upper and lower control arms, bushings, shafts, and rebound bumpers;
- d. Inspect, remove, and/or replace strut rods and bushings;
- e. Inspect, remove, and/or replace upper and/or lower ball joints (with or without wear indicators);
- f. Inspect, remove, and/ or replace steering knuckle assemblies;
- g. Inspect, remove and/or replace short and long arm suspension system coil springs and spring insulators;
- h. Inspect, remove, and/or replace torsion bars and mounts;
- i. Inspect, remove, and/or replace front/rear stabilizer bar (sway bar) bushings, brackets, and links;
- j. Inspect, remove, and/or replace strut cartridge or assembly, strut coil spring, insulators (silencers), and upper strut bearing mount;
- k. Inspect, remove, and/or replace track bar, strut rods/radius arms, and related mounts and bushing; and
- I. Inspect rear suspension system leaf spring(s), spring insulators (silencers), shackles, brackets, bushings, center pins/bolts, and mounts.
- 7. Related Suspension and Steering Service: (ASE Entry-Level Certification Task List)
  - a. Inspect, remove, and/or replace shock absorbers; inspect mounts and bushings;
  - b. Remove, inspect, service and/or replace front and rear wheel bearings; and
  - c. Describe the function of steering and suspension control systems and components, (i.e. active suspension, and stability control).
- 8. Wheel Alignment: (ASE G-1 Exam Task List)
  - a. Identify alignment-related symptoms such as vehicle wander, drift, and pull;
  - b. Perform pre-alignment inspection; prepare vehicle for alignment, and perform initial wheel alignment measurements;
  - c. Measure front and rear wheel camber; adjust as needed;
  - d. Measure caster; adjust as needed;
  - e. Measure front wheel toe; adjust as needed;
  - f. Center the steering wheel using mechanical methods;
  - g. Measure rear wheel toe; adjust as needed;
  - h. Measure thrust angle; and
  - i. Calibrate steering angle sensor.
- 9. Wheel Alignment Diagnosis, Adjustment, and Repair: (ASE Entry-Level Certification Task List)
  - a. Diagnose vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer, and steering return concerns; determine necessary action;
  - b. Perform pre-alignment inspection; measure vehicle ride height; determine necessary action;
  - c. Prepare vehicle for wheel alignment on alignment machine; perform four-wheel alignment by checking and adjusting front and rear wheel caster, camber and toe as required; center

steering wheel;

- d. Check toe-out-on-turns (turning radius); determine necessary action;
- e. Check Steering Axis Inclination (SAI) and included angle; determine necessary action;
- f. Check rear wheel thrust angle; determine necessary action;
- g. Check for front wheel setback; determine necessary action;
- h. Check front and/or rear cradle (subframe) alignment; determine necessary action; andi. Reset steering angle sensor.
- 10. Wheel and Tires: (ASE G-1 Exam Task List)
  - a. Identify tire wear patterns;
  - b. Inspect tire condition, tread depth, size, and application (load and speed ratings);
  - c. Check and adjust tire air pressure. Utilize vehicle tire placard and information;
  - d. Diagnose wheel/tire vibration, shimmy, and noise concerns; determine needed repairs;
  - e. Rotate tires/wheels and torque fasteners/wheel locks;
  - f. Dismount and mount tire on wheel;
  - g. Balance wheel and tire assembly;
  - h. Identify and test tire pressure monitoring systems (TPMS) (indirect and direct) for operation. Verify instrument panel lamps operation; conduct relearn procedure; and
  - i. Repair tire according to tire manufacturers' standards.
- 11. Wheels and Tires Diagnosis and Repair: (ASE Entry-Level Certification Task List)
  - a. Inspect tire condition; identify tire wear patterns; check for correct tire size, application (load and speed ratings), and air pressure as listed on the tire information placard/label;
  - b. Diagnose wheel/tire vibration, shimmy, and noise; determine necessary action;
  - c. Rotate tires according to manufacturer's recommendations including vehicles equipped with Tire Pressure Monitoring Systems (TPMS) ;
  - d. Measure wheel, tire, axle flange, and hub runout; determine necessary action;
  - e. Diagnose tire pull problems; determine necessary action;
  - f. Dismount, inspect, and remount tire on wheel; balance wheel and tire assembly;
  - g. Dismount, inspect, and remount tire on wheel equipped with tire pressure monitoring system sensor;
  - h. Inspect tire and wheel assembly for air loss; perform necessary action;
  - i. Repair tire following vehicle manufacturer approved procedure;
  - j. Identify tire pressure monitoring system (indirect and direct), calibrate system; verify operation of instrument panel lamps; and
  - k. Demonstrate knowledge of steps required to remove and replace sensors in a tire pressure monitoring system; including relearn procedure.
- 12. Drum Brakes: (ASE G-1 Exam Task List)
  - a. Remove, clean, inspect, and measure brake drums; follow manufacturers' recommendations in determining need to machine or replace;
  - b. Machine drums according to manufacturers' procedures and specifications;
  - c. Using proper safety procedures, remove, clean, and inspect brake shoes/linings, springs, pins, self-adjusters, levers, clips, brake backing (support) plates, and other related brake hardware; determine needed repairs;
  - d. Lubricate brake shoe support pads on backing (support) plate, self-adjuster mechanisms, and other brake hardware;

- e. Inspect wheel cylinder(s) for leakage, operation, and mounting; remove and replace wheel cylinder(s);
- f. Install brake shoes and related hardware;
- g. Adjust brake shoes and parking brake;
- h. Check parking brake system operation; inspect cables and components for wear, rust, and corrosion; clean or replace components as necessary; lubricate and adjust assembly; and
- i. Reinstall wheel, torque lug nuts, and make final brake checks and adjustments.
- 13. Brake Systems Diagnosis: (ASE Entry-Level Certification Task List)
  - a. Identify and interpret brake system concerns; determine necessary action;
  - b. Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins; and
  - c. Describe procedure for performing a road test to check brake system operation; including an anti-lock brake system (ABS). BR-A.4 Install wheel and torque lug nuts.
- 14. Hydraulic System Diagnosis and Repair: (ASE Entry-Level Certification Task List)
  - a. Diagnose pressure concerns in the brake system using hydraulic principles (Pascal's Law);
  - b. Measure brake pedal height, travel, and free play (as applicable); determine necessary action;
  - c. Check master cylinder for internal/external leaks and proper operation; determine necessary action;
  - d. Remove, bench bleed, and reinstall master cylinder;
  - e. Diagnose poor stopping, pulling or dragging concerns caused by malfunctions in the hydraulic system; determine necessary action;
  - f. Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging, wear; for loose fittings/supports; determine necessary action;
  - g. Replace brake lines, hoses, fittings, and supports;
  - h. Fabricate brake lines using proper material and flaring procedures (double flare and ISO types);
  - i. Select, handle, store, and fill brake fluids to proper level; use proper fluid type per manufacturer specification;
  - j. Inspect, test, and/or replace components of brake warning light system;
  - k. Identify components of hydraulic brake warning light system;
  - I. Bleed and/or flush brake system; and
  - m. Test brake fluid for contamination.
- 15. Drum Brake Diagnosis and Repair: (ASE Entry-Level Certification Task List)
  - a. Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging or pedal pulsation concerns; determine necessary action;
  - b. Remove, clean, and inspect brake drum; measure brake drum diameter; determine necessary action;
  - c. Refinish brake drum and measure final drum diameter; compare with specification;
  - d. Remove, clean, inspect, and/or replace brake shoes, springs, pins, clips, levers, adjusters/selfadjusters, other related brake hardware, and backing support plates; lubricate and reassemble;
  - e. Inspect wheel cylinders for leaks and proper operation; remove and replace as needed; and
  - f. Pre-adjust brake shoes and parking brake; install brake drums or drum/hub assemblies and wheel bearings; perform final checks and adjustments.

- 16. Disc Brakes: (ASE G-1 Exam Task List)
  - a. Retract integral parking brake caliper piston(s) according to manufacturers' recommendations;
  - b. Remove caliper assembly from mountings; inspect for leaks and damage to caliper housing;
  - c. Clean and inspect caliper mountings and slides/pins for wear and damage;
  - d. Remove, clean, and inspect pads and retaining hardware; determine needed repairs, adjustments, and replacements;
  - e. Clean caliper assembly; inspect external parts for wear, rust, scoring, and damage; replace any damaged or worn parts; determine the need to repair or replace caliper assembly;
  - f. Clean, inspect, and measure rotors with a dial indicator and a micrometer; determine the need to index, machine, or replace the rotor;
  - g. Remove and replace rotors;
  - h. Machine rotors, using on-car or off-car method;
  - i. Install pads, calipers, and related attaching hardware; lubricate components; bleed system;
  - j. Adjust calipers with integral parking brakes;
  - k. Fill master cylinder with recommended fluid; reset system;
  - I. Reinstall wheel, torque lug nuts, and make final brake checks and adjustments; and
  - m. Road test vehicle and burnish/break-in pads according to manufacturers' recommendations.
- 17. Disc Brake Diagnosis and Repair: (ASE Entry-Level Certification Task List)
  - a. Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging, or pulsation concerns; determine necessary action;
  - b. Remove and clean caliper assembly; inspect for leaks and damage/wear; determine necessary action;
  - c. Inspect caliper mounting and slides/pins for proper operation, wear, and damage; determine necessary action;
  - d. Remove, inspect, and/or replace brake pads and retaining hardware; determine necessary action;
  - e. Lubricate and reinstall caliper, brake pads, and related hardware; seat brake pads and inspect for leaks;
  - f. Clean and inspect rotor and mounting surface; measure rotor thickness, thickness variation, and lateral runout; determine necessary action;
  - g. Remove and reinstall/replace rotor;
  - h. Refinish rotor on vehicle; measure final rotor thickness and compare with specification;
  - i. Retract and re-adjust caliper piston on an integrated parking brake system;
  - j. Check brake pad wear indicator; determine necessary action; and
  - k. Describe importance of operating vehicle to burnish/break-in replacement brake pads according to manufacturer's recommendations.
- 18. Power Assist Units: (ASE G-1 Exam Task List)
  - a. Test brake pedal free travel with and without engine running to check power booster operation;

- b. Check vacuum supply (manifold or auxiliary pump) to vacuum-type power booster;
- c. Inspect the vacuum-type power booster unit for operation, and vacuum leaks; inspect the check valve for proper operation;
- d. Identify operation of electric-hydraulic assist system; check system for leaks and operation; and
- e. Identify operation of hydro-boost assist system; check system for leaks and operation.
- 19. Power-Assist Units Diagnosis and Repair: (ASE Entry-Level Certification Task List)
  - a. Check brake pedal travel with, and without, engine running to verify proper power booster operation;
  - b. Identify components of the brake power assist system (vacuum and hydraulic); check vacuum supply (maniford or auxiliary pump) to vacuum type power booster;
  - c. Inspect vacuum-type power booster unit for leaks; inspect the check-valve for proper operation; determine necessary action;
  - d. Inspect and test hydraulically-assisted power brake system for leaks and proper operation; determine necessary action; and
  - e. Measure and adjust master cylinder pushrod length.
- 20. Miscellaneous (Wheel Bearings, Parking Brakes, Electrical, Etc.) Diagnosis and Repair: (ASE Entry-Level Certification Task List)
  - a. Diagnose wheel bearing noises, wheel shimmy, and vibration concerns; determine necessary action;
  - b. Remove, clean, inspect, repack, and install wheel bearings; replace seals; install hub and adjust bearings;
  - c. Check parking system and components for wear, binding, and corrosion; clean, lubricate, adjust and/or replace as needed;
  - d. Check parking brake operation and parking brake indicator light system operation; determine necessary action;
  - e. Check operation of brake stop light system;
  - f. Replace wheel bearing and race;
  - g. Remove and reinstall sealed wheel bearing assembly; and
  - h. Inspect and replace wheel studs.
- 21. Electronic Brake Control Systems: Antilock Brake Systems (ABS), Traction Control System (TCS), and Electronic Stability Control Systems (ESC) Diagnosis and Repair: (ASE Entry-Level Certification Task List)
  - a. Identify and inspect electronic brake control system components (ABS, TCS, ECS); determine necessary action;
  - b. Describe the operation of a regenerative braking system;
  - c. Diagnose poor stopping, wheel lock-up, abnormal pedal feel, unwanted application, and noise concerns associated with the electronic brake control system; determine necessary action;
  - d. Diagnose electronic brake control system electronic control(s) and components by retrieving diagnostic trouble codes, and/or using recommended test equipment; determine necessary action;
  - e. Depressurize high-pressure components of an electronic brake control system;
  - f. Bleed the electronic brake control system hydraulic circuits;
  - g. 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);

h. Diagnose electronic brake control system braking concerns caused by vehicle modifications (tire size, curb height, final drive ratio, etc.);

## **Reinforced Skills:**

- 22. Shop and Personal Safety:
  - a. Identify general shop safety rules and procedures;
  - b. Utilize safe procedures for handling of tools and equipment;
  - c. Identify and use proper placement of floor jacks and jack stands;
  - d. Identify and use proper procedures for safe lift operation;
  - e. Utilize proper ventilation procedures for waking within the lab/shop area;
  - f. Identify marked safety areas;
  - g. 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;
  - h. Identify the location and use of eye wash stations;
  - i. Identify the location of the posted evacuation routes;
  - j. Comply with the requirement use of safety glasses, ear protection, gloves, and shoes during lab/shop activities;
  - k. Identify and wear appropriate clothing for the lab/shop activities;
  - I. Secure hair and jewelry for shop/lab activities;
  - m. Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high voltage circuits;
  - n. Demonstrate awareness of the safety aspects of high voltage circuits (such as high intensity discharge (HID) lamps, ignition systems, injection systems, etc.); and
  - o. Locate and demonstrate knowledge of materials safety data sheets (MSDS).
- 23. Tools and Equipment:
  - a. Identify tools and their use in automotive applications;
  - b. Identify standard and metric designation;
  - c. Demonstrate safe handling and use of appropriate tools;
  - d. Demonstrate proper cleaning, storage, and maintenance of tools and equipment; and
  - e. Demonstrate proper use of precision measuring tools (i.e. micrometer, dial-indicator, dialcaliper)
- 24. Career Certifications and Progression:
  - a. Demonstrate knowledge of the National Institute for Automotive Service and the series of automotive technology skills exams that are offered to certify knowledge and skills related to specific automotive systems and tasks.
- 25. Personal Behavior:
  - a. Reports to work daily on time; able to take directions and motivated to accomplish the task at hand;
  - b. Dresses appropriately and uses language and manners suitable for the workplace;
  - c. Maintains appropriate personal hygiene;
  - d. Meets and maintains employment eligibility criteria, such as drug/alcohol-free status, clean driving record, etc.; and
  - e. Demonstrates honesty, integrity and reliability.

#### 26. Work Habits/Ethics:

- a. Complies with workplace policies/laws;
- b. Contributes to the success of the team, assists others and requests help when needed;
- c. Works well with all customers and coworkers;
- d. Negotiates solutions to interpersonal and workplace conflicts;
- e. Contributes ideas and initiative;
- f. Follows directions;
- g. Communicates (written and verbal) effectively with customers and coworkers;
- h. Reads and interprets workplace documents; writes clearly and concisely;
- i. Analyzes and resolves problems that arise in completing assigned tasks;
- j. Organizes and implements a productive plan of work;
- k. Uses scientific, technical, engineering and mathematics principles and reasoning to accomplish assigned tasks; and
- I. Identifies and addresses the needs of all customers, providing helpful, courteous and knowledgeable service and advice as needed
- 27. Communication Skills:
  - Actively listen to give full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate and not interrupting at inappropriate times;
  - b. Comprehend written sentences and paragraphs in work related documents;
  - c. Understanding the implications of new information for both current and future problemsolving and decision-making;
  - d. Monitoring/assessing performance of yourself, other individuals, or organizations to make improvements or take corrective action;
  - e. Talking to others to convey information effectively;
  - f. Managing one's own time and the time of others;
  - g. Coordination or adjusting actions in response to others' actions;
  - h. Actively looking for ways to help people;
  - i. Being aware of others' reactions and understanding why they react as they do;
  - j. Bringing others together and trying to reconcile differences;
  - k. Persuading others to change their minds or behaviors;
  - I. Communicating effectively with technical writing as appropriate for the needs of the audience;
  - m. Selecting and using training/instructional methods and procedures appropriate for the situation when learning or teaching new things;
  - n. Effectively apply automotive measurement and math skills;
  - o. Use scientific rules and methods to solve problems;
  - p. Generate or adapt equipment and technology to serve user needs;
  - q. Demonstrate ethical professional practices; and
  - r. Demonstrate accuracy and efficiency.
- 28. ASE Review and Test Prep:
  - a. ASE Entry-Level A4 Suspension and Steering Certification Exam; and
  - b. ASE Entry-Level A5 Brakes Certification Exam.

#### End-of-Course Assessment(s):

- Teacher designed assessment
- LEA designed assessment
- Certification/credentialing exam (specify):
  - ASE Entry-Level A4 Suspension and Steering Certification Exam
  - ASE Entry-Level A5 Brakes Certification Exam
- Licensing exam (specify):
- Nationally recognized exam (specify):
- Other (specify

## Course title:

Engine Repair (ER)

## Course description (include prerequisites):

Engine Repair (ER) provides training in general engine diagnosis, engine removal and reinstallation, and lubrication and cooling systems diagnosis and repair.

Prerequisite: Brakes, Suspension and Steering (BSS)

## Course knowledge and skills (what students will know and be able to do):

By the end of this course students will:

## New Skills:

- 1. Engine Diagnosis; Removal and Reinstallation: (ASE Entry-Level Certification Task List)
  - a. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction;
  - b. Research vehicle service information including fluid type, internal engine operation, vehicle service history, service precautions, and technical service bulletins;
  - c. Verify operation of the instrument panel engine warning indicators;
  - d. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action;
  - e. Install engine covers using gaskets, seals, and sealers as required;
  - f. Verify engine mechanical timing;
  - g. Perform common fastener and thread repair, to include: remove broken bolt, restore internal and external threads, and repair internal threads with thread insert;
  - h. Inspect, remove and replace engine mounts;
  - i. Identify service precautions related to service of the internal combustion engine of a hybrid vehicle; and
  - j. Remove and reinstall engine in an OBD or newer vehicle; reconnect all attaching components and restore the vehicle to running condition.
- 2. Cylinder Head and Valve Train Diagnosis and Repair: (ASE Entry-Level Certification Task List)
  - a. Remove cylinder head; inspect gasket condition; install cylinder head and gasket; tighten according to manufacturer's specification and procedure;
  - b. Clean and visually inspect a cylinder head for cracks; check gasket surface areas for warpage and surface finish; check passage condition;
  - c. Inspect pushrods, rocker arms, rocker arm pivots and shafts for wear, bending, cracks,

looseness, and blocked oil passages (orifices); determine necessary action;

- d. Adjust valves (mechanical or hydraulic lifters);
- Inspect and replace camshaft and drive belt/chain; includes checking drive gear wear and backlash, end play, sprocket and chain wear, overhead cam drive sprocket(s), drive belt(s), belt tension, tensioners, camshaft reluctor ring/tone-wheel, and valve timing components; verify correct camshaft timing;
- f. Establish camshaft position sensor indexing;
- g. Inspect valve springs for squareness and free height comparison; determine necessary action;
- h. Replace valve stem seals on an assembled engine; inspect valve spring retainers, locks/keepers, and valve lock/keeper grooves; determine necessary action;
- i. Inspect valve guides for wear; check valve stem-to-guide clearance; determine necessary action;
- j. Inspect valves and valve seats; determine necessary action;
- k. Check valve spring assembled height and valve stem height; determine necessary action;
- I. Inspect valve lifters; determine necessary action;
- m. Inspect and/or measure camshaft for runout, journal wear and lobe wear; and
- n. Inspect camshaft bearing surface for wear, damage, out-of-round, and alignment; determine necessary action.
- 3. Engine Block Assembly Diagnosis and Repair: (ASE Entry-Level Certification Task List)
  - a. Remove, inspect, and/or replace crankshaft vibration damper (harmonic balancer);
  - b. Disassemble engine block; clean and prepare components for inspection and reassembly;
  - c. Inspect engine block for visible cracks, passage condition, core and gallery plug condition, and surface warpage; determine necessary action;
  - d. Inspect and measure cylinder walls/sleeves for damage, wear, and ridges; determine necessary action;
  - e. Deglaze and clean cylinder walls;
  - f. Inspect and measure camshaft bearings for wear, damage, out-of-round, and alignment; determine necessary action;
  - g. Inspect crankshaft for straightness, journal damage, keyway damage, thrust flange and sealing surface condition, and visual surface cracks; check oil passage condition; measure end play and journal wear; check crankshaft position sensor reluctor ring (where applicable); determine necessary action;
  - h. Inspect main and connecting rod bearings for damage and wear; determine necessary action;
  - i. Identify piston and bearing wear patterns that indicate connecting rod alignment and main bearing bore problems; determine necessary action;
  - j. Inspect and measure piston skirts and ring lands; determine necessary action;
  - k. Determine piston-to-bore clearance;
  - I. Inspect, measure, and install piston ring;
  - Inspect auxiliary shaft(s) (balance, intermediate, idler, counterbalance and/or silencer); inspect shaft(s) and support bearings for damage and wear; determine necessary action; reinstall and time; and
  - n. Assemble engine block.
- 4. Lubrication and Cooling Systems Diagnosis and Repair(ASE Entry-Level Certification Task List)
  - a. 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 necessary action;
  - b. Identify causes of engine overheating;
  - c. Inspect, replace, and/or adjust drive belts, tensioners, and pulleys; check pulley and belt alignment;

- d. Inspect and/or test coolant; drain and recover coolant; flush and refill cooling system with proper fluid type per manufacturer specification; bleed air as required;
- e. Inspect, remove, and replace water pump;
- f. Remove and replace radiator;
- g. Remove, inspect, and replace thermostat and gasket/seal;
- h. Inspect and test fan(s) (electrical or mechanical), fan clutch, fan shroud, and air dams;
- i. Perform oil pressure tests; determine necessary action;
- j. Perform engine oil and filter change; use proper fluid type per manufacturer specification;
- k. Inspect auxiliary coolers; determine necessary action;
- I. Inspect, test, and replace oil temperature and pressure switches and sensors; and
- m. Inspect oil pump gears or rotors, housing, pressure relief devices, and pump drive; perform necessary action.

#### **Reinforced Skills:**

- 5. Shop and Personal Safety:
  - a. Identify general shop safety rules and procedures;
  - b. Utilize safe procedures for handling of tools and equipment;
  - c. Identify and use proper placement of floor jacks and jack stands;
  - d. Identify and use proper procedures for safe lift operation;
  - e. Utilize proper ventilation procedures for waking within the lab/shop area;
  - f. Identify marked safety areas;
  - g. 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;
  - h. Identify the location and use of eye wash stations;
  - i. Identify the location of the posted evacuation routes;
  - j. Comply with the requirement use of safety glasses, ear protection, gloves, and shoes during lab/shop activities;
  - k. Identify and wear appropriate clothing for the lob/shop activities;
  - I. Secure hair and jewelry for shop/lab activities;
  - m. Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high voltage circuits;
  - n. Demonstrate awareness of the safety aspects of high voltage circuits (such as high intensity) discharge (HID) lamps, ignition systems, injection systems, etc.); and
  - o. Locate and demonstrate knowledge of materials safety data sheets (MSDS)
- 6. Tools and Equipment:
  - a. Identify tools and their use in automotive applications;
  - b. Identify standard and metric designation;
  - c. Demonstrate safe handling and use of appropriate tools;
  - d. Demonstrate proper cleaning, storage, and maintenance of tools and equipment; and
  - e. Demonstrate proper use of precision measuring tools (i.e. micrometer, dial-indicator, and dial-caliper).
- 7. Career Certifications and Progression:
  - a. Demonstrate knowledge of the National Institute for Automotive Service and the series of 9 automotive technician credentialing exams that are offered to certify technical knowledge and skills related to specific automotive systems and tasks.

- 8. Personal Behavior:
  - a. Reports to work daily on time; able to take directions and motivated to accomplish the task at hand;
  - b. Dresses appropriately and uses language and manners suitable for the workplace;
  - c. Maintains appropriate personal hygiene;
  - d. Meets and maintains employment eligibility criteria, such as drug/alcohol-free status, clean driving record, etc.; and
  - e. Demonstrates honesty, integrity and reliability.
- 9. Work Habits/Ethics:
  - a. Complies with workplace policies/laws;
  - b. Contributes to the success of the team, assists others and requests help when needed;
  - c. Works well with all customers and coworkers;
  - d. Negotiates solutions to interpersonal and workplace conflicts;
  - e. Contributes ideas and initiative;
  - f. Follows directions;
  - g. Communicates (written and verbal) effectively with customers and coworkers;
  - h. Reads and interprets workplace documents; writes clearly and concisely;
  - i. Analyzes and resolves problems that arise in completing assigned tasks;
  - j. Organizes and implements a productive plan of work;
  - k. Uses scientific, technical, engineering and mathematics principles and reasoning to accomplish assigned tasks; and
  - I. Identifies and addresses the needs of all customers, providing helpful, courteous and knowledgeable service and advice as needed
- 10. Communication Skills:
  - a. Actively listen to give full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate and not interrupting at inappropriate times;
  - b. Comprehend written sentences and paragraphs in work related documents;
  - c. Understanding the implications of new information for both current and future problemsolving and decision-making;
  - d. Monitoring/assessing performance of yourself, other individuals, or organizations to make improvements or take corrective action;
  - e. Talking to others to convey information effectively;
  - f. Managing one's own time and the time of others;
  - g. Coordination or adjusting actions in response to others' actions;
  - h. Actively looking for ways to help people;
  - i. Being aware of others' reactions and understanding why they react as they do;
  - j. Bringing others together and trying to reconcile differences;
  - k. Persuading others to change their minds or behaviors;
  - I. Communicating effectively with technical writing as appropriate for the needs of the audience;
  - m. Selecting and using training/instructional methods and procedures appropriate for the situation when learning or teaching new things;
  - n. Effectively apply automotive measurement and math skills;
  - o. Use scientific rules and methods to solve problems;
  - p. Generate or adapt equipment and technology to serve user needs;
  - q. Demonstrate ethical professional practices; and

- r. Demonstrate accuracy and efficiency.
- 11. ASE Review and Test Prep
  - a. ASE Entry-Level A1 Engine Repair Certification Exam;

## End-of-Course Assessment(s):

- Teacher designed assessment
- LEA designed assessment
- Certification/credentialing exam (specify):
   ASE Entry-Level A1 Engine Repair Certification Exam
- Licensing exam (specify):
- Nationally recognized exam (specify):
- Other (specify):

#### Course title:

Transmissions, Drive Train and Axles, HVAC-R (TDT)

## **Course description (include prerequisites):**

Transmissions, Drive Train and Axles, and HVAC-R (TDT) focuses on automatic transmission/transaxle, manual drive train and axles, drive shaft, half shaft and universal joints/constant velocity (CV) Joint (front and rear wheel drive), rear wheel drive axle inspection, four-wheel and all-wheel drive, and heating, ventilation, air conditioning and refrigerant. Safety, work habits/ethics and communication skills are reinforced.

Prerequisite: Engine Repair (ER)

## Course knowledge and skills (what students will know and be able to do):

By the end of this course students will:

## New Skills:

- 1. Automatic Transmission/Transaxle: (ASE G-1 Exam Task List)
  - a. Road test the vehicle to normal operation; retrieve and record diagnostic trouble codes (DTCs);
  - b. Determine fluid type, level, and condition;
  - c. Inspect transmission for leaks; replace external seals and gaskets;
  - d. Inspect and replace CV boots, axles, drive shafts, U-joints, drive axle joints, and seals;
  - e. Visually inspect condition of transmission cooling system, lines, and fittings;
  - f. Inspect and replace power train mounts; and
  - g. Replace fluid and filter(s).
- 2. Transmission and Transaxle Diagnosis: (ASE Entry-Level Certification Task List)
  - a. Identify and interpret transmission/transaxle concern, differentiate between engine performance and transmission/transaxle concerns; determine necessary action;

- b. Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins;
- c. Diagnose fluid loss and condition concerns; determine necessary action;
- d. Check fluid level in a transmission or a transaxle equipped with a dip-stick;
- e. Check fluid level in a transmission or a transaxle not equipped with a dip-stick;
- f. Perform pressure tests (including transmissions/transaxles equipped with electronic pressure control); determine necessary action;
- g. Diagnose noise and vibration concerns; determine necessary action;
- h. Perform stall test; determine necessary action;
- i. Perform lock-up converter system tests; determine necessary action;
- j. Diagnose transmission/transaxle gear reduction/multiplication concerns using driving, driven, and held member (power flow) principles;
- k. Diagnose electronic transmission/transaxle control systems using appropriate test equipment and service information; and
- I. Diagnose pressure concerns in a transmission using hydraulic principles (Pascal's Law).
- 3. In-Vehicle Transmission/Transaxle Maintenance and Repair: (ASE Entry-Level Certification Task List)
  - a. Inspect, adjust, and/or replace external manual valve shift linkage, transmission range sensor/switch, and/or park/neutral position switch;
  - b. Inspect for leakage; replace external seals, gaskets, and bushings;
  - c. Inspect, test, adjust, repair, and/or replace electrical/electronic components and circuits including computers, solenoids, sensors, relays, terminals, connectors, switches, and harnesses; perform demonstrated understanding of the relearn procedure;
  - d. Drain and replace fluid and filter(s); use proper fluid type per manufacturer specification; and
    - Inspect, replace and align powertrain mounts.
- 4. Off-Vehicle Transmission and Transaxle Repair: (ASE Entry-Level Certification Task List)
  - a. Remove and reinstall transmission/transaxle and torque converter; inspect engine core plugs, rear crankshaft seal, dowel pins, dowel pin holes, and mounting surfaces;
  - b. Inspect, leak test, and flush or replace transmission/transaxle oil cooler, lines, and fittings;
  - c. Inspect converter flex (drive) plate, converter attaching bolts, converter pilot, converter pump drive surfaces, converter end play, and crankshaft pilot bore;
  - d. Describe the operational characteristics of a continuously variable transmission (CVT);
  - e. Describe the operational characteristics of a hybrid vehicle drive train;
  - f. Disassemble, clean, and inspect transmission/transaxle;
  - g. Inspect, measure, clean, and replace valve body (includes surfaces, bores, springs, valves, switches, solenoids, sleeves, retainers, brackets, check valves/balls, screens, spacers, and gaskets).;
  - h. Inspect servo and accumulator bores, pistons, seals, pins, springs, and retainers; determine necessary action;
  - i. Assemble transmission/transaxle;

e.

- j. Inspect, measure, and reseal oil pump assembly and components;
- k. Measure transmission/transaxle end play and/or preload; determine necessary action;
- I. Inspect, measure, and/or replace thrust washers and bearings;
- m. Inspect oil delivery circuits, including seal rings, ring grooves, and sealing surface areas, feed pipes, orifices, and check valves/balls;

- n. Inspect bushings; determine necessary action;
- o. Inspect and measure planetary gear assembly components; determine necessary action;
- p. Inspect case bores, passages, bushings, vents, and mating surfaces; determine necessary action;
- q. Diagnose and inspect transaxle drive, link chains, sprockets, gears, bearings, and bushings; perform necessary action;
- r. Inspect measure, repair, adjust or replace transaxle final drive components;
- s. Inspect clutch drum, piston, check-balls, springs, retainers, seals, friction and pressure plates, and bands; determine necessary action;
- t. Measure clutch pack clearance; determine necessary action;
- u. Air test operation of clutch and servo assemblies; and
- v. Inspect one way clutches, races, rollers, sprags, springs, cages, retainers; determine necessary action.
- 5. Manual Drive Train and Axles: (ASE G-1 Exam Task List)
  - a. Inspect, adjust, replace, and bleed external hydraulic clutch slave/release cylinder, master cylinder, lines, and hoses; clean and flush hydraulic system; refill with proper fluid;
  - b. Inspect and replace power train mounts;
  - c. Inspect, adjust, and replace transmission/transaxle external shifter assembly, shift linkages, brackets, bushings/grommets, pivots, and levers;
  - d. Inspect and replace external seals; and
  - e. Check fluid level; refill with fluid.
- 6. Drive Train Diagnosis: (ASE Entry-Level Certification Task List)
  - a. Identify and interpret drive train concerns; determine necessary action;
  - b. Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins;
  - c. Check fluid condition; check for leaks; determine necessary action; and
  - d. Drain and refill manual transmission/transaxle and final drive unit; use proper fluid type per manufacturer specification.
- 7. Clutch Diagnosis and Repair: (ASE Entry-Level Certification Task List)
  - a. Diagnose clutch noise, binding, slippage, pulsation, and chatter; determine necessary action;
  - b. Inspect clutch pedal linkage, cables, automatic adjuster mechanisms, brackets, bushings, pivots, and springs; perform necessary action;
  - c. Inspect and/or replace clutch pressure plate assembly, clutch disc, release (throw-out) bearing/ linkage, and pilot bearing/bushing (as applicable);
  - d. Bleed clutch hydraulic system;
  - e. Check and adjust clutch master cylinder fluid level; check for leaks; use proper fluid type per manufacturer specification;
  - f. Inspect flywheel and ring gear for wear, cracks, and discoloration; determine necessary action;
  - g. Measure flywheel runout and crankshaft end play; determine necessary action; and
  - h. Describe the operation and service of a system that uses a dual mass flywheel.
- 8. Transmission/Transaxle Diagnosis and Repair: (ASE Entry-Level Certification Task List)
  - a. Inspect, adjust, lubricate, and reinstall shift linkages, brackets, bushings, cables, pivots, and levers;
  - b. Describe the operational characteristics of an electronically-controlled manual transmission/transaxle;

- c. Diagnose noise concerns through the application of transmission/transaxle powerflow principles;
- d. Diagnose hard shifting and jumping out of gear concerns; determine necessary action;
- e. Diagnose transaxle final drive assembly noise and vibration concerns; determine necessary action; and
- f. Disassemble, inspect clean, and reassemble internal transmission/transaxle components.
- 9. Drive Shaft, Half-Shaft, and Universal Joints/Constant Velocity (CV) Joint (Front and Rear Wheel Drive): (ASE G-1 Task List
  - a. Road test the vehicle to verify drive train noises and vibration;
  - b. Inspect, service, and replace shafts, yokes, boots, universal/CV joints; verify proper phasing;
  - c. Inspect, service, and replace drive shaft center support bearings; and
  - d. Inspect, service, and replace wheel bearings, seals, and hubs, excluding press-type bearings.
- Drive Shaft and Half Shaft, Universal and Constant-Velocity (CV) Joint Diagnosis and Repair (Front, Rear, All wheel drive, 4-wheel drive): (ASE Entry-Level Certification Task List)
  - a. Diagnose constant-velocity (CV) joint noise and vibration concerns; determine necessary action;
  - b. Diagnose universal joint noise and vibration concerns; perform necessary action;
  - c. Inspect, remove, and/or replace bearings, hubs, and seals;
  - d. Inspect, service, and/or replace shafts, yokes, boots, and universal/CV joints; and
  - e. Check shaft balance and phasing; measure shaft runout; measure and adjust driveline angles.
- 11. Drive Axle Diagnosis and Repair: (ASE Entry-Level Certification Task List)
  - a. Ring and Pinion Gears and Differential Case Assembly:
    - 1. Clean and inspect differential case; check for leaks; inspect housing vent;
    - 2. Check and adjust differential case fluid level; use proper fluid type per manufacturer specification;
    - 3. Drain and refill differential case; use proper fluid type per manufacturer specifications.
    - 4. Diagnose noise and vibration concerns; determine necessary action;
    - 5. Inspect and replace companion flange and/or pinion seal; measure companion flange runout;
    - 6. Inspect ring gear and measure runout; determine necessary action;
    - 7. Remove, inspect, and/or reinstall drive pinion and ring gear, spacers, sleeves, and bearings;
    - 8. Measure and adjust drive pinion depth;
    - 9. Measure and adjust drive pinion bearing preload;
    - 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 necessary action;
    - 12. Disassemble, inspect, measure, adjust, and/or replace differential pinion gears (spiders), shaft, side gears, side bearings, thrust washers, and case; and
    - 13. Reassemble and reinstall differential case assembly; measure runout; determine necessary action.
  - b. Limited Slip Differential: (ASE Entry-Level Certification Task List)
    - 1. Diagnose noise, slippage, and chatter concerns; determine necessary action; and
    - 2. Measure rotating torque; determine necessary action.
  - c. Drive Axles:
    - 1. Inspect and replace drive axle wheel studs;

- 2. Remove and replace drive axle shafts;
- 3. Inspect and replace drive axle shaft seals, bearings, and retainers;
- 4. Measure drive axle flange runout and shaft end play; determine necessary action; and
- 5. Diagnose drive axle shafts, bearings, and seals for noise, vibration, and fluid leakage concerns; determine necessary action.
- 12. Rear Wheel Drive Axle Inspection: (ASE G-1 Exam Task List)
  - a. Identify fluid leakage problems;

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- b. Inspect, drain, and refill with lubricant;
- c. Inspect and replace rear axle shaft wheel studs; and
- d. Inspect axle housing and vent; inspect rear axle mountings.
- 13. Four-Wheel/All-Wheel Drive: (ASE G-1 Exam Task List)
  - a. Inspect, adjust, and repair transfer case manual shifting mechanisms, bushings, mounts, levers, and brackets;
  - b. Check transfer case fluid level and inspect condition; drain and refill with fluid;
  - c. Inspect, service, and replace front drive/propeller shaft and universal/CV joints;
  - d. Inspect front drive axle universal/CV joints and drive/half shafts, axle seals, and vents;
  - e. Inspect front wheel bearings, seals, and hubs;
  - f. Inspect transfer case, front differential, and axle seals and vents;
  - g. Inspect tires for correct size for vehicle application; check for wear;
  - h. Retrieve and record diagnostic trouble codes (DTCs); and
  - i. Inspect and verify operation of 4WD/AWD system.
  - Four-wheel Drive/All-wheel Drive Component Diagnosis and Repair: (ASE Entry-Level Certification Task List)
  - a. Inspect, adjust, and repair shifting controls (mechanical, electrical, and vacuum), bushings, mounts, levers, and brackets;
  - b. Inspect locking hubs; determine necessary action;
  - c. Check for leaks at drive assembly and transfer case seals; check vents; check fluid level; use proper fluid type per manufacturer specification;
  - d. Identify concerns related to variations in tire circumference and/or final drive ratios;
  - e. Diagnose noise, vibration, and unusual steering concerns; determine necessary action;
  - f. Diagnose, test, adjust, and/or replace electrical/electronic components of four-wheel drive/all wheel drive systems; and
  - g. Disassemble, service, and reassemble transfer case and components.
- 15. Heating, Ventilation, and Air Conditioning: (ASE G-1 Exam Task List)
  - a. Verify HVAC operation (vent temperature, blower and condenser fan, compressor engagement, blend and mode door(s) operation);
  - b. Identify A/C refrigerant type; recover and recharge system per manufacturer's specifications;
  - c. Visually check A/C components for signs of leaks;
  - d. Inspect A/C condenser for restricted air flow;
  - e. Inspect and replace cabin air filter;
  - f. Check drive belt for wear and tension; adjust or replace as needed; and
  - g. Inspect and clean evaporator drains.
- 16. A/C System Diagnosis and Repair: (ASE Entry-Level Certification Task List)
  - a. Identify and interpret heating and air conditioning problems; determine necessary action;
  - b. Research vehicle service information including refrigerant/oil type, vehicle service history, service precautions, and technical service bulletins;

- c. Performance test A/C system; identify problems;
- d. Identify abnormal operating noises in the A/C system; determine necessary action;
- e. Identify refrigerant type; select and connect proper gauge set/test equipment; record temperature and pressure readings;
- f. Leak test A/C system; determine necessary action;
- g. Inspect condition of refrigerant oil removed from A/C system; determine necessary action;
- h. Determine recommended oil and oil capacity for system application; and
- i. Using a scan tool, observe and record related HVAC data and trouble codes.
- 17. Refrigeration System Component Diagnosis and Repair: (ASE Entry-Level Certification Task List)
  - a. Inspect, remove, and/or replace A/C compressor drive belts, pulleys, tensioners and visually inspect A/C components for signs of leaks; determine necessary action;
  - b. Inspect, test, service and/or replace A/C compressor clutch components and/or assembly; check compressor clutch air gap; adjust as needed;
  - c. Remove, inspect, and/or reinstall A/C compressor and mountings; determine recommended oil type and quantity;
  - d. Identify hybrid vehicle A/C system electrical circuits and service/safety precautions;
  - e. Determine need for an additional A/C system filter; perform necessary action;
  - f. Remove and inspect A/C system mufflers, hoses, lines, fittings, O-rings, seals, and service valves; perform necessary action;
  - g. Inspect for proper A/C condenser airflow; determine necessary action;
  - h. Remove, inspect, and replace receiver/drier or accumulator/drier; determine recommended oil type and quantity;
  - i. Remove, inspect, and install expansion valve or orifice (expansion) tube;
  - j. Inspect evaporator housing water drain; perform necessary action;
  - k. Diagnose A/C system conditions that cause the protection devices (pressure, thermal, and PCM) to interrupt system operation; determine necessary action;
  - I. Determine procedure to remove and reinstall evaporator; determine required oil type and quantity; and
  - m. Remove, inspect, and reinstall condenser; determine required oil type and quantity.
- 18. Heating, Ventilation, and Engine Cooling Systems Diagnosis and Repair: (ASE Entry-Level Certification Task List)
  - a. Inspect engine cooling and heater systems hoses and pipes; perform necessary action;
  - b. Inspect and test heater control valve(s); perform necessary action;
  - c. Diagnose temperature control problems in the heater/ventilation system; determine necessary action; and
  - d. Determine procedure to remove, inspect, and/or replace heater core.
- 19. Operating Systems and Related Controls Diagnosis and Repair: (ASE Entry-Level Certification Task List)
  - a. Inspect and test HVAC system blower motors, resistors, switches, relays, wiring, and protection devices; perform necessary action;
  - b. Diagnose A/C compressor clutch control systems; determine necessary action;
  - c. Diagnose malfunctions in the vacuum, mechanical, and electrical components and controls of the heating, ventilation, and A/C (HVAC) system; determine necessary action;
  - d. Inspect and test HVAC system control panel assembly; determine necessary action;
  - e. Inspect and test HVAC system control cables, motors, and linkages; perform necessary action;
  - f. Inspect HVAC system ducts, doors, hoses, cabin filters, and outlets; perform necessary action;

- g. Identify the source of HVAC system odors; and
- h. Check operation of automatic or semi-automatic heating, ventilation, and air-conditioning (HVAC) control systems; determine necessary action.
- 20. Refrigerant Recovery, Recycling, and Handling: (ASE Entry-Level Certification Task List)
  - a. Perform correct use and maintenance of refrigerant handling equipment according to equipment manufacturer's standards;
  - b. Identify A/C system refrigerant; test for sealants; recover, evacuate, and charge A/C system; add refrigerant oil as required; and
  - c. Recycle, label, and store refrigerant.

# **Reinforced Skills:**

- 21. Shop and Personal Safety:
  - a. Identify general shop safety rules and procedures;
  - b. Utilize safe procedures for handling of tools and equipment;
  - c. Identify and use proper placement of floor jacks and jack stands;
  - d. Identify and use proper procedures for safe lift operation;
  - e. Utilize proper ventilation procedures for waking within the lab/shop area;
  - f. Identify marked safety areas;
  - g. 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;
  - h. Identify the location and use of eye wash stations;
  - i. Identify the location of the posted evacuation routes;
  - j. Comply with the requirement use of safety glasses, ear protection, gloves, and shoes during lab/shop activities;
  - k. Identify and wear appropriate clothing for the lab/shop activities;
  - I. Secure hair and jewelry for shop/lab activities;
  - m. Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high voltage circuits;
  - n. Demonstrate awareness of the safety aspects of high voltage circuits (such as high intensity discharge (HID) lamps, ignition systems, injection systems, etc.); and
  - o. Locate and demonstrate knowledge of materials safety data sheets (MSDS)
- 22. Tools and Equipment:
  - a. Identify tools and their use in automotive applications;
  - b. Identify standard and metric designation;
  - c. Demonstrate safe handling and use of appropriate tools;
  - d. Demonstrate proper cleaning, storage, and maintenance of tools and equipment; and
  - e. Demonstrate proper use of precision measuring tools (i.e. micrometer, dial-indicator, and dialcaliper).
- 23. Career Certifications and Progression:
  - a. Demonstrate knowledge of the National Institute for Automotive Service and the series of automotive technology skills exams that are offered to certify knowledge and skills related to specific automotive systems and tasks.
- 24. Personal Behavior:
  - a. Reports to work daily on time; able to take directions and motivated to accomplish the task at

hand;

- b. Dresses appropriately and uses language and manners suitable for the workplace;
- c. Maintains appropriate personal hygiene;
- d. Meets and maintains employment eligibility criteria, such as drug/alcohol-free status, clean driving record, etc.; and
- e. Demonstrates honesty, integrity and reliability.
- 25. Work Habits/Ethics:
  - a. Complies with workplace policies/laws;
  - b. Contributes to the success of the team, assists others and requests help when needed;
  - c. Works well with all customers and coworkers;
  - d. Negotiates solutions to interpersonal and workplace conflicts;
  - e. Contributes ideas and initiative;
  - f. Follows directions;
  - g. Communicates (written and verbal) effectively with customers and coworkers;
  - h. Reads and interprets workplace documents; writes clearly and concisely;
  - i. Analyzes and resolves problems that arise in completing assigned tasks;
  - j. Organizes and implements a productive plan of work;
  - k. Uses scientific, technical, engineering and mathematics principles and reasoning to accomplish assigned tasks; and
  - I. Identifies and addresses the needs of all customers, providing helpful, courteous and knowledgeable service and advice as needed.
- 26. Communication Skills:
  - a. Actively listen to give full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate and not interrupting at inappropriate times;
  - b. Comprehend written sentences and paragraphs in work related documents;
  - c. Understanding the implications of new information for both current and future problemsolving and decision-making;
  - d. Monitoring/assessing performance of yourself, other individuals, or organizations to make improvements or take corrective action;
  - e. Talking to others to convey information effectively;
  - f. Managing one's own time and the time of others;
  - g. Coordination or adjusting actions in response to others' actions;
  - h. Actively looking for ways to help people;
  - i. Being aware of others' reactions and understanding why they react as they do;
  - j. Bringing others together and trying to reconcile differences;
  - k. Persuading others to change their minds or behaviors;
  - I. Communicating effectively with technical writing as appropriate for the needs of the audience;
  - m. Selecting and using training/instructional methods and procedures appropriate for the situation when learning or teaching new things;
  - n. Effectively apply automotive measurement and math skills;
  - o. Use scientific rules and methods to solve problems;
  - p. Generate or adapt equipment and technology to serve user needs;
  - q. Demonstrate ethical professional practices; and
  - r. Demonstrate accuracy and efficiency.
- 27. ASE Review and Test Prep:

- a. ASE Entry-Level A2 Automatic Transmission/Transaxle Certification Exam;
- b. ASE Entry-Level A3 Manual Drive Train and Axles Certification Exam; and
- c. ASE Entry-Level A7 Heating, Ventilation and Air Conditioning Certification Exam.
- 28. Worked Based Learning Experience

## End-of-Course Assessment(s):

- Teacher designed assessment
- LEA designed assessment
- Certification/credentialing exam (specify):
   ASE Entry Level A2 Automatic Transmission/Transaxle Certification Exam
  - ASE Entry-LevelA3 Manual Drive Train and Axles Certification Exam
  - ASE Entry-Level A7 Heating, Ventilation and Air Conditioning Certification Exam
- Licensing exam (specify):
- Nationally recognized exam (specify):
- Other (specify):

#### Course title:

## Automotive Industry Experience (AIE)

**Course description (include prerequisites):** 

Automotive Industry Experience (AIE) provides students with work-based learning experience as well as review and test preparation for the ASE G-1 exam. Safety, work habits/ethics and communication skills are reinforced.

Prerequisite: Transmissions, Drive Train and Axles, and HVAC-R (TDT)

Course knowledge and skills (what students will know and be able to do):

By the end of this course students will:

## **Reinforced Skills:**

- 1. Shop and Personal Safety:
  - a. Identify general shop safety rules and procedures;
  - b. Utilize safe procedures for handling of tools and equipment;
  - c. Identify and use proper placement of floor jacks and jack stands;
  - d. Identify and use proper procedures for safe lift operation;
  - e. Utilize proper ventilation procedures for waking within the lab/shop area;
  - f. Identify marked safety areas;
  - 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;
  - h. Identify the location and use of eye wash stations;
  - i. Identify the location of the posted evacuation routes;
  - j. Comply with the requirement use of safety glasses, ear protection, gloves, and shoes during

lab/shop activities;

- k. Identify and wear appropriate clothing for the lab/shop activities;
- I. Secure hair and jewelry for shop/lab activities;
- m. Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high voltage circuits;
- n. Demonstrate awareness of the safety aspects of high voltage circuits (such as high intensity discharge (HID) lamps, ignition systems, injection systems, etc.); and
- o. Locate and demonstrate knowledge of materials safety data sheets (MSDS).

## 2. Tools and Equipment:

- a. Identify tools and their use in automotive applications;
- b. Identify standard and metric designation;
- c. Demonstrate safe handling and use of appropriate tools;
- d. Demonstrate proper cleaning, storage, and maintenance of tools and equipment; and
- e. Demonstrate proper use of precision measuring tools (i.e. micrometer, dial-indicator, and dial-caliper).
- 3. Career Certifications and Progression:
  - a. Demonstrate knowledge of the National Institute for Automotive Service and the series of automotive technology skills exams that are offered to certify knowledge and skills related to specific automotive systems and tasks.
- 4. Personal Behavior:
  - a. Reports to work daily on time; able to take directions and motivated to accomplish the task at hand;
  - b. Dresses appropriately and uses language and manners suitable for the workplace;
  - c. Maintains appropriate personal hygiene;
  - d. Meets and maintains employment eligibility criteria, such as drug/alcohol-free status, clean driving record, etc.; and
  - e. Demonstrates honesty, integrity and reliability.
- 5. Work Habits/Ethics:
  - a. Complies with workplace policies/laws;
  - b. Contributes to the success of the team, assists others and requests help when needed;
  - c. Works well with all customers and coworkers;
  - d. Negotiates solutions to interpersonal and workplace conflicts;
  - e. Contributes ideas and initiative;
  - f. Follows directions;
  - g. Communicates (written and verbal) effectively with customers and coworkers;
  - h. Reads and interprets workplace documents; writes clearly and concisely;
  - i. Analyzes and resolves problems that arise in completing assigned tasks;
  - j. Organizes and implements a productive plan of work;
  - k. Uses scientific, technical, engineering and mathematics principles and reasoning to accomplish assigned tasks; and
  - I. Identifies and addresses the needs of all customers, providing helpful, courteous and knowledgeable service and advice as needed
- 6. Communication Skills:
  - a. Actively listen to give full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate and not interrupting at inappropriate times;
  - b. Comprehend written sentences and paragraphs in work related documents;

- c. Understanding the implications of new information for both current and future problemsolving and decision-making;
- d. Monitoring/assessing performance of yourself, other individuals, or organizations to make improvements or take corrective action;
- e. Talking to others to convey information effectively;
- f. Managing one's own time and the time of others;
- g. Coordination or adjusting actions in response to others' actions;
- h. Actively looking for ways to help people;
- i. Being aware of others' reactions and understanding why they react as they do;
- j. Bringing others together and trying to reconcile differences;
- k. Persuading others to change their minds or behaviors;
- I. Communicating effectively with technical writing as appropriate for the needs of the audience;
- m. Selecting and using training/instructional methods and procedures appropriate for the situation when learning or teaching new things;
- n. Effectively apply automotive measurement and math skills;
- o. Use scientific rules and methods to solve problems;
- p. Generate or adapt equipment and technology to serve user needs;
- q. Demonstrate ethical professional practices; and
- r. Demonstrate accuracy and efficiency.
- 7. ASE Review and Test Prep:
  - a. ASE G1 Auto Maintenance and Light Repair Certification Exam.
- 8. Worked Based Learning Experience

## End-of-Course Assessment(s):

- ☑ Teacher designed assessment
- LEA designed assessment
- Certification/credentialing exam (specify):
  - ASE G1 Automotive Maintenance and Light Repair Certification Exam
- Licensing exam (specify):
- Nationally recognized exam (specify):
- Other (specify):

## PROGRAM OF STUDY CURRICULUM

Identify the method of technical and academic curriculum development (adopted, adapted, or developed in accordance with guidance from the program advisory committee).

## POS technical and academic curriculum will be:

- Adopted (specify source): <u>State model program of study</u>
- Adapted (specify source):
- Developed locally (describe):
- Other (specify):

## TEACHER CERTIFICATION

Provide valid teacher certification(s), candidate experience, pre-requisite and requisite licensure or
certification requirement(s) for POS teachers.

POS teacher requirements include:

- Teacher certification(s) (list): <u>Skilled and Technical Sciences (STS) in Facility and Mobile</u> <u>Equipment Maintenance.</u>
- Candidate experience (describe): <u>Candidate may have experience in applying knowledge of</u> <u>automotive technology. For more information, please see the National Institute for Automotive</u> <u>Service Excellence.</u>
- Pre-requisite professional licensure or certification requirement(s) (list): <u>ASE Master Technician</u> <u>Certification</u>
- Requisite professional licensure or certification requirement(s) (list):
- Other (describe):

# VALUE-ADDED OPPORTUNITIES

List extended early career and college credit opportunities available during the student's senior year. Document transition services, cooperative learning experiences, additional dual enrollment, or other.

## Opportunities for extended and accelerated learning include:

- Cooperative education (describe):
- Structured internship (describe): Work Based Learning Experience
- Dual enrollment (list):
- Advanced Placement (list):
- Transition services (describe):
- Other (describe):

## CAREER AND TECHNICAL STUDENT ORGANIZATIONS

Indicate the Career and Technical Student Organization (CTSO) that will be offered by checking the appropriate box.

SkillsUSA

# PROGRAM OF STUDY MATRIX

Complete the program of study matrix to demonstrate the alignment of academic and technical courses, culminating early career and early college experiences. Identify appropriate certification and licensure options, opportunities for obtaining early college credit (courses with articulated or dual enrollment credit agreements should be appropriately designated within the matrix), the post-secondary program sequence, and potential career options. *Attach the Program of Study Matrix*. Access the Program of Study Matrix (see Appendix A).

DEPARTMENT OF EDUCATION PROGRAM OF STUDY APPROVAL				
The following section will be co	ompleted by staff from the Delaw	/are Department of Education, CTE &		
STEM Office and reported to th	e LEA as part of the CTE program	n of study approval process.		
Date Delaware CTE Program of	f Study Application Received:			
Local Education Agency (LEA):		Program of Study Start Date:		
School(s):				
LEA CTE Coordinator Nome	Dhanai			
LEA CIE Coordinator Name:	Phone:	E-Mail Address:		
Career Cluster & Code:	Career Pathway & Code:	Program of Study Title & Code:		
Transportation, Distribution	Facility and Mobile	Automotive Technology Pre-		
& Logistics / 16	Equipment Maintenance /	Apprenticeship Program (6 credit) /		
	16.04	16.04809		
CTE Program of Study Course Titles, Course Codes, and Funding Levels:				
1. Foundations of Automotive 7	rechnology – Tech (FAT) / 16.048	309011/3		
2. Engine and Electrical System	s – Tech (EES) / 1.04809022 / 3			
3. Brakes, Suspension and Stee	ring – Tech (BSS) / 1.04809032 /	3		
4. Engine Repair – Tech (ER) / 1	.04809042 / 3			
5. Transmissions, Drive Train ar	nd Axles, HVAC-R – Tech (TDT) / 1	1.04809052 / 3		
6. Automotive Industry Experie	nce – Tech (AIE) / 1.04809063 /	3		
CTE Concentrator/Completer C	Course Titles:			
Concentrator Course: Engine Re	epair – Tech (ER) / 1.04809042			
Completer Course: Automotive	Industry Experience– Tech (AIE)	/ 1.04809063		
CTE Program of Study Request	:			
State-model CTE Program o	f Study			
Local CTE Program of Study				
CTE Program of Study Attachm	ients:			
🔀 Labor Market Information (LMI) Review;				
Articulation/Dual Enrollment Agreement(s); and				
Program of Study Matrix.				
DDOE CTE & STEM Director Sig	Date:			
DDOE Chief Academic Officer Signature:				