



Program of Study Guide: **Automotive Technology**

Comprehensive guidelines and course standards for the
Automotive Technology pathway

Office of College and Career Pathways

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MARYLAND STATE DEPARTMENT OF EDUCATION

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Purpose

The purpose of this document is to communicate the required Career and Technical Education (CTE) academic standards for the Automotive Technology Program of Study. The academic standards in this document are theoretical and performance based. The standards contain content from multiple state departments of education, industry related resources and have been reviewed and vetted by members of the Maryland business and industry community.

In addition to academic standards, the Maryland State Department of Education (MSDE) has incorporated into this document Labor Market Information (LMI) definitions and explanations for the Program of Study; program aligned Industry Recognized Credentials; and Work-Based Learning resources and requirements by course level.

Sources of Standards

The following sources collectively support a progression of standards from foundational to advanced Automotive Technology concepts in a high school context, preparing students for industry-aligned certifications like ASE Entry Level Certifications, OSHA 10/30, and EPA 609, with the necessary knowledge and skills for career readiness in Automotive Technology careers.

Here are the key standards sources for Automotive Technology curriculum:

1. **Automotive Service Excellence Education Foundation Standards**

- A. **Description:** The National Institute for Automotive Service Excellence (ASE) develops and maintains standards for automotive education programs, including detailed task lists and program requirements.
- B. **Usage:** The ASE Education Foundation standards provide the primary framework for automotive education programs, detailing specific tasks students must master at different levels (MLR, AST, MAST). They include required hours, instructor qualifications, facility requirements, and tool/equipment specifications. These standards ensure programs meet industry needs and prepare students for ASE certification. Teachers can use the task lists to develop curriculum, create assessments, and track student progress. The standards also help in designing lab activities and determining necessary equipment.
- C. **Source:** www.ASEeducationfoundation.org

2. **Society of Automotive Engineers (SAE) Standards**

- A. **Description:** Technical standards and professional development resources focused on advancing mobility engineering knowledge.
- B. **Usage:** SAE provides technical standards, research papers, and professional development resources that can enhance automotive instruction. Teachers can use SAE materials to incorporate current technology trends, engineering principles, and industry innovations into their curriculum. These resources are particularly valuable for advanced topics and emerging technologies like electric vehicles and autonomous systems. SAE materials can help students understand the engineering principles behind automotive systems.
- C. **Source:** www.sae.org

Course Descriptions

Course Level	Course Information	Description
Core: Course 1	Automotive Basics SCED: Pending Grades: 9-12 Prerequisite: None Credit: 1	Automotive Basics includes the knowledge of the basic automotive systems and the theory and principles of the components that make up each system, and how to service these systems. Automotive Basics includes applicable safety and environmental rules and regulations. In Automotive Basics, students will gain knowledge and skills in the repair, maintenance, and servicing of vehicle systems. This study allows students to reinforce, apply, and transfer academic knowledge and skills to various interesting and relevant activities, problems, and settings. The focus of this course is to teach safety, tool identification, proper tool use, and employability.
Core: Course 2	Automotive Technology I: Maintenance and Light Repair SCED: Pending Grades: 10-12 Prerequisite: Automotive Basics: Credit: 1	Automotive Technology I: Maintenance and Light Repair includes knowledge of the major automotive systems and the principles of diagnosing and servicing these systems. This course includes applicable safety and environmental rules and regulations. In Automotive Technology I: Maintenance and Light Repair, students will gain knowledge and skills in the repair, maintenance, and diagnosis of vehicle systems. This study will allow students to reinforce, apply, and transfer academic knowledge and skills to a variety of interesting and relevant activities, problems, and settings. The focus of this course is to teach safety, tool identification, proper tool use, and employability.
Core: Course 3	Automotive Technology II: Automotive Service SCED: Pending Grades: 11-12 Prerequisite: Automotive Technology I Credit: 1	Automotive Technology II: Automotive Service includes knowledge of the major automotive systems and the principles of diagnosing and servicing these systems. Automotive Technology II: Automotive Service includes applicable safety and environmental rules and regulations. In this course, students will gain knowledge and skills in the repair, maintenance, and diagnosis of vehicle systems. This study will allow students to reinforce, apply, and transfer academic knowledge and skills to a variety of interesting and relevant activities, problems, and settings. The focus of this course is to teach safety, tool identification, proper tool use, and employability.

Course Level	Course Information	Description
Optional Flex: Course	Career Connected Learning I SCED: Pending Grades: 11-12 Prerequisite: See Course Description Credits: 1-3	<u>Prerequisites:</u> 1. Alignment to the student's 6-Year Plan 2. Completion of: a. Minimum two sequential courses in a CTE pathway, OR b. Minimum two years of the same world language; OR c. Minimum two sequential courses in a comprehensive arts program; OR d. Inclusion in the IEP/504 transition plan with supporting documentation (as required) 3. Endorsement from an educator, mentor, employer, or career coach 4. No more than one course recovery credit in core subjects is needed by the student. This flexible, work-based learning course introduces students to real-world applications of classroom knowledge and technical skills through on-the-job experiences and reflective practices. Students engage in career exploration, skill development, and professional networking by participating in youth apprenticeships, registered apprenticeships, pre-apprenticeships, internships, capstone projects, or other approved career-connected opportunities. Variable credit (1–3) accommodates the required on-the-job training hours and related instruction. By integrating industry standards, employability skills, and personalized learning goals, Career Connected Learning I equips students to make informed career decisions, develop a professional portfolio, and build a strong foundation for success in postsecondary education, training, or the workforce.

Course Level	Course Information	Description
Optional Flex: Course	Career Connected Learning II SCED: Pending Grades: 11-12 Prerequisite: Career Connected Learning I Credits: 1-3	Building on the foundational experiences of Career Connected Learning I, this advanced work-based learning course provides students with deeper on-the-job practice, leadership opportunities, and refined career exploration. Students continue to enhance their technical and professional skills, expanding their industry networks and aligning personal goals with evolving career interests. Variable credit (1–3) remains aligned with the required training hours and related instruction. Through elevated responsibilities and skill application, Career Connected Learning II prepares students to confidently transition into higher-level postsecondary programs, apprenticeships, or the workforce.

Industry-Recognized Credentials and Career-Connected Learning

The *Blueprint for Maryland's Future* and the High School Level of a Registered Apprenticeship

The Maryland State Department of Education recognizes the high-school level of a Registered Apprenticeship (RA), defined as a State-approved Registered Apprenticeship begun during high school in which students complete at least 144 hours of related technical instruction and 250 hours of paid on-the-job training before graduation, with the remaining required apprenticeship hours completed post-graduation, as the gold standard of Career Connected Learning.

The CTE Committee of the Governor's Workforce Development Board, in alignment with federal apprenticeship standards, requires 144 hours of RTI for all high school RA participants, and the Apprenticeship Maryland Program (AMP) defines the minimum RTI as **one course credit equivalent**. This high-school-level Registered Apprenticeship is the preferred career-connected learning option for students to meet the Blueprint's goal that 45% of public high school graduates complete either the high-school level of a Registered Apprenticeship or another industry-recognized credential.

To the extent practicable, the greatest number of students should achieve this goal through participation in a high-school level Registered Apprenticeship, with schools ensuring these requirements are scheduled, completed, and documented for transcript and reporting purposes.

To the extent practicable, the greatest number of students should achieve this goal through the high-school level of a Registered Apprenticeship.

Career-Connected Learning Resources

Course 1: Career Awareness	Course 2: Career Preparation	Flex Courses: Career-Connected Learning
- Industry Visits - Guest Speakers - Participation in Career and Technical Student Organizations - Postsecondary Visits – Program Specific Site Tours - Mock Interviews	- All of Career Awareness plus the following: - Job Shadow - Employer Mentoring	- Registered Apprenticeship - Internship - School-Based Enterprise - Employer-Directed Capstone

Industry-Recognized Credentials - The standards in this document are aligned to the following certifications:

By the end of Automotive Technology I: ASE Entry Level Certifications: Electrical/Electronic Systems, Suspension and Steering, and Brakes

By the end of Automotive Technology II: ASE Entry Level Certifications: Engine Repair, Manual Drive Train and Axles, Automatic Transmission/Transaxle, Heating and Air Conditioning, and Engine Performance

By the end of Practicum in Automotive Technology: ASE Entry Level Certification: Maintenance & Light Repair (MLR)

AUTOMOTIVE TEST SPECIFICATIONS AND TASK LIST

- Automotive Technology and Light Repair (MLR):
https://www.ase.com/dist/docs/Auto_Test_Specs_MLR-AST_2022.pdf
- Master Automobile Service Technology (MAST) Series:
https://www.ase.com/dist/docs/Auto_Test_Specs_Individual-8_2022.pdf

Labor Market Information: Definitions and Data

Labor market information (LMI) plays a crucial role in shaping Career and Technical Education (CTE) programs by providing insights into industry demands, employment trends, and skills gaps. This data helps education leaders assess the viability of existing programs and identify opportunities for new offerings. By aligning CTE programs with real-time labor market needs, schools can better prepare students for in-demand careers and ensure that resources are effectively used to support pathways that lead to high-quality, sustainable employment.

Standard Occupational Code (SOC) and Aligned Industry:

Indicator	Definition	Pathway Labor Market Data
High Wage¹	Those occupations that have a 25th percentile wage equal to or greater than the most recent MIT Living Wage Index for one adult in the state of Maryland, and/or leads to a position that pays at least the median hourly or annual wage for the DC-VA-MD-WV Metropolitan Statistical Area (MSA). <i>Note: A 25th percentile hourly wage of \$24.74 or greater is required to meet this definition.</i>	Standard Occupational Code: 49-3023: Automotive Service Technicians Hourly Wage/Annual Salary: 25 th Percentile: \$19.54/\$40,643 50 th Percentile: \$27.67/\$57,554 75 th Percentile: \$36.38/\$75,670
High Skill	Those occupations located within the DC-VA-MD-WV Metropolitan Statistical Area (MSA) with the following education or training requirements: completion of an apprenticeship program; completion of an industry-recognized certification or credential; associate's degree, bachelor's degree, or higher.	Typical Entry-Level Education: While there are several organized training programs in the region, there is no formal post-secondary training necessary to enter the workforce for students who have completed this program.
In-Demand	Annual growth plus replacement, across all Maryland occupations, is <u>405</u> openings between 2024-2029.	Annual Openings 1,277

Lightcast Data Updated August 2025

¹ Living Wage Calculator: <https://livingwage.mit.edu/states/24>

Labor Market Information Data Source

Lightcast occupation employment data are based on final Lightcast industry data and final Lightcast staffing patterns. Wage estimates are based on Occupational Employment Statistics (QCEW and Non-QCEW Employees classes of worker) and the American Community Survey (Self-Employed and Extended Proprietors). Occupational wage estimates are also affected by county-level Lightcast earnings by industry. Foundational data for the state of Maryland is collected and reported by the Maryland Department of Labor.

Methodology for High Wage Calculations

To combine labor market data across multiple Standard Occupational Classifications (SOCs), a weighted average approach was used to ensure accurate representation of the marketplace. Median wages for each SOC were weighted based on their respective employment levels, reflecting the relative demand for each occupation. This method ensures that occupations with higher employment contribute proportionately to the overall wage calculation. Additionally, job openings from all relevant SOCs were summed to determine the total projected demand. For example, if Mechanical Engineers account for 67% of total employment and Electrical Engineers for 33%, their respective wages are weighted accordingly, and job openings are aggregated to provide a comprehensive view of labor market opportunities. This approach delivers a balanced and accurate representation of both wages and employment demand for the program.

Methodology for In-Demand Calculations

The baseline for annual job openings, taking into account new positions and replacement positions, was determined by taking the average of all annual job openings between 2024 and 2029 across all 797 career sectors at the 5-digit SOC code level. For the 2024-2029 period, average job openings (growth + replacement) is 405.

Course Standards: Automotive Basics

1. GENERAL REQUIREMENTS This course is recommended for students in Grades 9-12.

2. INTRODUCTION

- A. Career and Technical Education (CTE) instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
- B. The Supply Chain & Transportation Career Cluster focuses on planning, management, and movement of people, materials, and goods by road, pipeline, air, rail, and water and related professional support services such as transportation infrastructure planning and management, logistics services, mobile equipment, and facility maintenance.
- C. Automotive Basics includes knowledge of the basic automotive systems and the theory and principles of the components that make up each system and how to service these systems. Automotive Basics includes applicable safety and environmental rules and regulations. In Automotive Basics, students will gain knowledge and skills in the repair, maintenance, and servicing of vehicle systems. This study allows students to reinforce, apply, and transfer academic knowledge and skills to a variety of interesting and relevant activities, problems, and settings. The focus of this course is to teach safety, tool identification, proper tool use, and employability.
- D. Students will participate in at least two Career Exploration Work-Based Learning experiences in this course, which might include guest speakers and work-place tours relevant to the program of study.
- E. Students are encouraged to participate in extended learning experiences through aligned Career and Technical Student Organizations (CTSOs). CTSOs are a cocurricular requirement in the Carl D. Perkins Act, and alignment to CTSO activities is an expectation for CTE programs in the state of Maryland.

3. KNOWLEDGE AND SKILLS

- A. **The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:**
 - 1. Demonstrate knowledge of the technical knowledge and skills related to health and safety in the workplace such as wearing safety glasses and other personal protective equipment (PPE) and maintaining safety data sheets (SDS).
 - 2. Identify career and employment opportunities, including entrepreneurship opportunities, internships, and industry-recognized certification requirements for the field of automotive technology.
 - 3. Demonstrate the principles of group participation, team concept, and leadership related to citizenship and career preparation.
 - 4. Apply competencies related to resources, information, interpersonal skills, problem solving, critical thinking, and systems of operation in the automotive technology industry.
 - 5. Discuss certification opportunities.
 - 6. Discuss response plans to emergency situations.
 - 7. Identify employers' expectations and appropriate work habits, ethical conduct, legal responsibilities, and good citizenship skills.
 - 8. Develop personal goals, objectives, and strategies as part of a plan for future career and educational opportunities.

- B. The student demonstrates appropriate personal and communication skills. The student is expected to:**
1. Describe, demonstrate, and apply ethical and legal responsibilities for appropriate workplace conduct.
 2. Demonstrate proper etiquette and behavior.
 3. Demonstrate appropriate personal appearance and hygiene.
 4. Demonstrate effective written and oral communication skills and employ effective listening skills.
 5. Demonstrate advanced technical writing and preparation skills.
 6. Demonstrate effective speaking skills through prepared and extemporaneous oral presentations.
- C. The student demonstrates academic skills related to the requirements of automotive technology. The student is expected to:**
1. Demonstrate effective oral communication skills with individuals from various cultures such as fellow students, coworkers, and customers.
 2. Demonstrate effective written communication skills, including documenting on a repair order the customer concern/complaint, root cause of the failure, and corrective action to complete the repair.
 3. Demonstrate mathematical skills in performing addition, subtraction, multiplication, division, and measurements using decimals and fractions in the metric and U.S. standard systems as appropriate.
- D. The student understands the technical knowledge and skills of basic automotive systems. The student is expected to:**
1. Describe the eight major vehicle systems.
 2. Locate, read, and interpret vehicle maintenance and service information.
 3. Describe the basic and emerging vehicle power systems.
- E. The student knows the functions and applications of the tools, equipment, technologies, and materials used in automotive services. The student is expected to:**
1. Demonstrate the proper way to safely use hand and power tools and equipment commonly employed in the maintenance and repair of vehicles.
 2. Discuss the proper handling and disposal of environmentally hazardous materials used in servicing vehicles.
 3. Identify diagnostic tools and equipment.
 4. Identify hand and shop tools and describe their proper usage.
- F. The student applies technical knowledge and skills in simulated or actual work situations. The student is expected to:**
1. Demonstrate the procedures for ordering and locating parts.
 2. Demonstrate an understanding of the operation theory of internal combustion engines.
 3. Identify brake system components, including drum, disc, power assist, and anti-lock braking system (ABS).
 4. Demonstrate an understanding of basic concepts related to hydraulic brakes systems, including Pascal's Theory of Hydraulics.

5. Demonstrate an understanding of basic concepts related to electrical and electronic systems such as Ohm's law, voltage drop, resistance, amperage, voltage, and wiring diagram symbols.
6. Identify air-conditioning, heating, and accessory system components.
7. Inspect and identify chassis and power train components and systems.
8. Identify cooling and lubrication system components.
9. Identify steering and suspension components, including power steering.
10. Identify and interpret tire sidewall data information such as Department of Transportation (DOT) production date information, tire load capacity, inflation pressures, sizing description, and speed rating.
11. Compare the preventative maintenance schedules for a variety of vehicles based on their use.
12. Perform a preventative maintenance inspection.
13. Explain and perform a "jump-start" of a vehicle using jumper cables and a booster battery or an auxiliary power supply according to manufacturer recommended procedures.
14. Perform regular audits and inspections to maintain compliance with safety, health, and environmental regulations.

G. The student develops technology skills. The student is expected to:

1. Use technology as a tool to research, organize, evaluate, and communicate information.
2. Use digital technologies (computers, PDAs, media players, GPSs, etc.); communication/networking tools, and social networks appropriately to access, manage; integrate, evaluate, and create information to successfully function in a knowledge economy.
3. Demonstrate using current and new technologies specific to the program of study, course; and/or industry.
4. Apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information technologies.

Course Standards: Automotive Technology I

1. GENERAL REQUIREMENTS. This course is recommended for students in Grades 10-12. Prerequisite: Automotive Basics. Students shall be awarded one credit for successful completion of this course.

2. INTRODUCTION.

- A. Career and Technical Education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
- B. The Supply Chain and Transportation Career Cluster focuses on planning, management, and movement of people, materials, and goods by road, pipeline, air, rail, and water and related professional support services such as transportation infrastructure planning and management, logistics services, mobile equipment, and facility maintenance.
- C. Automotive Technology I: Maintenance and Light Repair includes knowledge of the major automotive systems and the principles of diagnosing and servicing these systems. This course includes applicable safety and environmental rules and regulations. In Automotive Technology I: Maintenance and Light Repair, students will gain knowledge and skills in the repair, maintenance, and diagnosis of vehicle systems. This study will allow students to reinforce, apply, and transfer academic knowledge and skills to a variety of interesting and relevant activities, problems, and settings. The focus of this course is to teach safety, tool identification, proper tool use, and employability.
- D. Students will participate in at least two Career Awareness Work-Based Learning experiences in this course, which might include informational interviews or job shadowing relevant to the program of study.
- E. Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

3. KNOWLEDGE AND SKILLS.

- A. **The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:**
 - 1. Demonstrate knowledge of the technical knowledge and skills related to health and safety in the workplace such as wearing safety glasses and other personal protective equipment (PPE) and maintaining safety data sheets (SDS).
 - 2. Identify career and employment opportunities, including entrepreneurship opportunities, and internships and industry-recognized certification requirements for the field of automotive technology.
 - 3. Demonstrate the principles of group participation, team concept, and leadership related to citizenship and career preparation.
 - 4. Apply competencies related to resources, information, interpersonal skills, problem solving, critical thinking, and systems of operation in the automotive technology industry.
 - 5. Discuss certification opportunities.
 - 6. Discuss response plans to emergency situations.
 - 7. Identify employers' expectations and appropriate work habits, ethical conduct, legal responsibilities, and good citizenship skills.
 - 8. Develop personal goals, objectives, and strategies as part of a plan for future career and educational opportunities.

- B. The student demonstrates academic skills related to the requirements of automotive technology. The student is expected to:**
1. Demonstrate effective oral communication skills with individuals from various cultures such as fellow students, coworkers, and customers.
 2. Demonstrate effective written communication skills, including documenting on a repair order the customer concern/complaint, root cause of the failure, and corrective action to complete the repair.
 3. Demonstrate mathematical skills in performing addition, subtraction, multiplication, division, and measurements using decimals and fractions in the metric and U.S. standard systems as appropriate.
- C. The student demonstrates technical knowledge and skills related to the manufacturer preventative maintenance schedule. The student is expected to:**
1. Locate the manufacturer recommended preventative maintenance schedule.
 2. Perform a preventative maintenance inspection of vehicle systems, including engine, fuel, lubrication, cooling, electrical, suspension, drive train, and air-conditioning systems.
 3. Describe the function of the automotive chassis components, including braking, steering, transmission, drive train, and suspension systems.
 4. Locate, read, and interpret service repair information such as schematics, charts, diagrams, graphs, parts catalogs, and technical bulletins.
 5. Use published specifications to diagnose component wear and determine necessary repairs.
 6. Identify the appropriate oil viscosity and capacity.
 7. Verify operation of the instrument panel engine warning indicators.
 8. Inspect engine assembly and document findings of fuel, oil, coolant, and other leaks.
 9. Perform common fastener and thread repair, including removing broken bolt, restoring internal and external threads, and repairing internal threads with thread insert.
 10. Inspect, replace, and adjust drive belts, tensioners, and pulleys.
 11. Perform engine oil and filter change.
 12. Explain and perform a "jump-start" of a vehicle using jumper cables and a booster battery or an auxiliary power supply according to manufacturer recommended procedures.
- D. The student demonstrates the functions and applications of the tools, equipment, technologies, and materials used in automotive technology. The student is expected to:**
1. Demonstrate the proper use of hand and power tools and equipment commonly employed in the maintenance and repair of vehicles.
 2. Discuss the proper handling and disposal of environmentally hazardous materials used in servicing vehicles.
- E. The student applies the technical knowledge and skills related to brakes in simulated or actual work situations. The student is expected to:**
1. Explains Pascal's Theory of Hydraulics as it relates to the brake system.
 2. Inspect brake system components, including master cylinder, brake lines, wheel cylinders, calipers, and flexible hoses and fittings, for external leaks and proper operation.
 3. Inspect, measure, and refinish brake drum diameter to manufacturer specifications.
 4. Remove, clean, and inspect brake shoes, springs, pins, clips, levers, adjusters/self-adjusters, other related brake hardware, and backing support plates.
 5. Lubricate, reassemble, and pre-adjust brake shoes and parking brake.

6. Remove, inspect for damage or wear, clean, lubricate, and reassemble pads and retain hardware, caliper assembly, and mounting components such as slides and pins for proper operation.
7. Refinish a rotor on and off a vehicle and measure final rotor thickness with manufacturer specifications.
8. Retract and re-adjust caliper piston on an integral parking brake system.
9. Check brake pedal travel with, and without, engine running to verify proper power booster operation.
10. Check brake pedal travel with, and without, engine running to verify proper power booster operation.
11. Check vacuum supply from a manifold or auxiliary pump to vacuum-type brake power booster.
12. Describe the operation of a regenerative braking system.
13. Use a scan tool to retrieve and record anti-lock brake system (ABS) diagnostic trouble codes and observe wheel-speed sensor data; clear codes as applicable.
14. Measure brake rotor lateral runout and parallelism with appropriate tools and compare results to manufacturer specifications to determine serviceability.

F. The student applies the technical knowledge and skills related to electrical systems in simulated or actual work situations. The student is expected to:

1. Demonstrate knowledge of electrical/electronic series, parallel, and series-parallel circuits using principles of electricity as defined by Ohm's Law.
2. Demonstrate proper use of a digital multi-meter (DMM) when measuring source voltage, voltage drop, current flow, resistance, and ground circuits.
3. Use wiring diagrams to trace electrical/electronic circuits.
4. Demonstrate knowledge of the causes and effects from shorts, grounds, opens, and resistance problems in electrical/electronic circuits.
5. Confirm proper battery capacity for vehicle application and perform battery capacity test.
6. Perform battery state-of-charge test.
7. Inspect and clean the battery, fill battery cells, and check battery cables, connectors, clamps, and holddowns.
8. Perform starter current draw test.
9. Inspect and test fusible links, circuit breakers, fuses, and relays.
10. Perform charging system output test.
11. Inspect, adjust, or replace generator/alternator drive belts and check pulleys and tensioners for wear and belt alignment.
12. Verify operation of instrument panel gauges and warning/indicator lights, and reset maintenance indicators.
13. Inspect interior and exterior lamps and sockets, including headlights and auxiliary light such as fog and driving lights and replace as needed.
14. Verify windshield wiper and washer operation and replace wiper blades as needed.

G. The student applies the technical knowledge and skills related to heating and air conditioning (A/C) in simulated or actual work situations. The student is expected to:

1. Identify refrigerant type and the safety and environmental concerns related to handling and storage.
2. Inspect engine cooling and heater systems hoses.
3. Inspect A/C-heater ducts, doors, hoses, cabin filters, and outlets.

4. Inspect A/C condenser for airflow restrictions.
5. Identify hybrid vehicle A/C system electrical circuits and the service/safety precautions.
6. Connect a manifold gauge set to perform basic static and running pressure readings; compare to manufacturer specifications.
7. Measure A/C outlet air temperature under specified conditions and compare to manufacturer specifications.

H. The student applies the technical knowledge and skills related to manual and automatic drive train and axles in simulated or actual work situations. The student is expected to:

1. Identify the different fluid types used in both an automatic and manual transmission/transaxle.
2. Identify the fluid types and capacity required by application using service information.
3. Check fluid level in a transmission or a transaxle equipped with a dipstick.
4. Check fluid level in a transmission or a transaxle not equipped with a dipstick.
5. Check fluid condition and inspect for leaks.
6. Drain and replace fluid and filter or filters in an automatic transmission/transaxle.
7. Drain and replace fluid in a manual transmission/transaxle.
8. Inspect power train mounts.
9. Inspect and service transmission/transaxle external cooler and lines for leaks, restrictions, or damage.
10. Inspect, adjust, or replace shift linkage/cables; verify manual range selector operation per service information.
11. Verify operation of transmission range (neutral safety) and back-up lamp circuits.
12. Use service information to retrieve and record transmission/transaxle (TCM/PCM) diagnostic trouble codes and related freeze-frame data; clear codes as applicable.

I. The student applies the technical knowledge and skills related to engine performance in simulated or actual work situations. The student is expected to:

1. Inspect and explain the electrical/electronic components, sensors and circuits on an on board diagnostics (OBD) controlled engine.
2. Perform engine absolute manifold pressure tests such as vacuum or boost.
3. Verify engine operating temperature.
4. Remove and replace spark plugs and inspect secondary ignition components for wear and damage.
5. Describe the importance of operating all OBD II monitors for repair verification.
6. Retrieve and record diagnostic trouble codes, OBD II monitor status, and freeze frame data and clear codes when applicable.
7. Inspect, service, or replace air filters, filter housings, and intake duct work.
8. Replace fuel filter or filters.
9. Inspect integrity of the exhaust manifolds, exhaust pipes, mufflers, catalytic converters, resonators, tail pipes, and heat shields.
10. Inspect, test, and service positive crankcase ventilation (PCV) system and its components such as the filter/breather cap, valve, tubes, orifices, and hoses.
11. Measure and compare fuel pressure and fuel pump volume to manufacturer specifications.
12. Use a scan tool to view and interpret live data (e.g., STFT/LTFT, O₂ sensor output, MAF/MAP) to identify simple faults.
13. Check for engine vacuum leaks using approved methods and service information.

- J. **The student applies the technical knowledge and skills related to suspension systems and simulated or actual work situations. The student is expected to:**
1. Identify and interpret tire sidewall data information such as Department of Transportation (DOT) production date information, tire load capacity, inflation pressures, sizing description, and speed rating.
 2. Demonstrate tire tread depth measuring procedures using industry standards such as common tread depth gauges.
 3. Demonstrate tire and wheel balance such as static and dynamic balance, and proper wheel weight selection.
 4. Demonstrate tire and wheel measurements such as radial and lateral run-out in tire and wheel assembly.
 5. Inspect steering linkage components and mounts such as inner and outer tie-rod ends, pitman arm, idler arm, inner rack and pinion ends, rack and pinion mounts, upper and lower ball joints, power steering pump, and hoses for leaks.
 6. Remove, clean, inspect, and repack wheel bearings, properly install wheel seals, and adjust wheel bearing pre-load.
 7. Inspect shock absorbers and McPherson struts for leakage and performance using jounce and rebound tests.
 8. Demonstrate wheel stud replacement and installation of wheel and tire assembly with proper torquing procedure.
 9. Identify and test the Tire Pressure Monitoring Systems (TPMS), both the direct and indirect, for proper operation.
 10. Dismount and mount a tire on a wheel and reinstall the assembly, including torquing the lug nuts.
 11. Rotate tires according to manufacturer recommendations.
- K. **The student develops technology skills. The student is expected to:**
1. Use technology as a tool to research, organize, evaluate, and communicate information.
 2. Use digital technologies (computers, PDAs, media players, GPSs, etc.); communication/networking tools, and social networks appropriately to access, manage; integrate, evaluate, and create information to successfully function in a knowledge economy.
 3. Demonstrate using current and new technologies specific to the program of study, course; and/or industry.
 4. Apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information technologies.

Course Standards: Automotive Technology II

1. GENERAL REQUIREMENTS. This course is recommended for students in Grades 11 and 12.

Prerequisite: Automotive Technology I: Maintenance and Light Repair. Students shall be awarded one credit for successful completion of this course.

2. INTRODUCTION.

- A. Career and Technical Education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
- B. The Supply Chain and Transportation Career Cluster focuses on planning, management, and movement of people, materials, and goods by road, pipeline, air, rail, and water and related professional support services such as transportation infrastructure planning and management, logistics services, mobile equipment, and facility maintenance.
- C. Automotive Technology II: Automotive Service includes knowledge of the major automotive systems and the principles of diagnosing and servicing these systems. Automotive Technology II: Automotive Service includes applicable safety and environmental rules and regulations. In this course, students will gain knowledge and skills in the repair, maintenance, and diagnosis of vehicle systems. This study will allow students to reinforce, apply, and transfer academic knowledge and skills to a variety of interesting and relevant activities, problems, and settings. The focus of this course is to teach safety, tool identification, proper tool use, and employability.
- D. Students will participate in a Career Preparation Work-Based Learning experience in this course, which might include paid or unpaid internship experiences relevant to the program of study.
- E. Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

3. KNOWLEDGE AND SKILLS.

- A. **The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:**
 - 1. Demonstrate knowledge of the technical knowledge and skills related to health and safety in the workplace such as wearing safety glasses and other personal protective equipment (PPE) and maintaining safety data sheets (SDS).
 - 2. Identify employment opportunities, including entrepreneurship opportunities and internships, and industry-recognized certification requirements for the field of automotive technology.
 - 3. Demonstrate the principles of group participation, team concept, and leadership related to citizenship and career preparation.
 - 4. Apply competencies related to resources, information, interpersonal skills, problem solving, critical thinking, and systems of operation in the automotive technology industry.
 - 5. Discuss certification opportunities.
 - 6. Discuss response plans to emergency situations.
 - 7. Identify employers' expectations and appropriate work habits, ethical conduct, legal responsibilities, and good citizenship skills.
 - 8. Develop personal goals, objectives, and strategies as part of a plan for future career and educational opportunities.

B. The student relates core academic skills to the requirements of automotive technology.**The student is expected to:**

1. Demonstrate effective written communication skills throughout the course, including documenting on a repair order customer concern/complaint, root cause of the failure, and corrective action to complete the repair.
2. Estimate the cost of parts and labor operations on repair orders throughout the course, including the flat rate system.
3. Demonstrate mathematical skills in performing addition, subtraction, multiplication, division, and measurements using decimals and fractions in the metric and U.S. standard systems as appropriate.
4. Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins.

C. The student demonstrates the technical knowledge and skills that form the core of knowledge of automotive service. The student is expected to:

1. Diagnose the major components of powered vehicles.
2. Diagnose automotive chassis and driveline components.
3. Locate, read, and interpret documents such as schematics, charts, diagrams, graphs, parts catalogs, and service-repair information and technical bulletins.
4. Locate the manufacturer recommended preventative maintenance schedule.
5. Perform a preventative maintenance inspection.
6. Perform common fastener and thread repair, including removing broken bolt, restoring internal and external threads, and repairing internal threads with thread insert.
7. Perform precision measurements and use published specifications to diagnose component wear and determine necessary repairs.
8. Employ critical-thinking skills and structured problem-solving skills to diagnose vehicle malfunctions, solve problems, and make decisions.

D. The student knows the functions and applications of the tools, equipment, technologies, and materials used in automotive technology. The student is expected to:

1. Demonstrate the proper and safe use of hand and power tools and equipment commonly employed in the maintenance and repair of vehicles.
2. Discuss and demonstrate the proper handling and disposal of environmentally hazardous materials used in servicing vehicles,
3. Demonstrate proper use of diagnostic tools and equipment.
4. Locate, read, and interpret service repair information such as schematics, charts, diagrams, graphs, parts catalogs, and service-repair bulletins.

E. The student applies the technical knowledge and skills related to suspension in simulated or actual work situations. The student is expected to:

1. Inspect and replace power steering hoses and fittings.
2. Remove, clean, inspect, repack, and install wheel bearings.
3. Replace seals; install hubs; and adjust bearings.
4. Replace wheel bearing and race.
5. Disable and enable supplemental restraint system (SRS).
6. Inspect, remove, and replace shock absorbers and struts and inspect mounts and bushings.
7. Dismount, inspect, and remount tire on wheel equipped with tire pressure monitoring system (TPMS).

8. Inspect rear suspension system lateral links/arms, trailing arms, leaf springs, spring insulators, shackles, brackets, center pins, and mounting bolts.
9. Inspect tire condition and wear patterns, check for correct size and application based on load and speed rating, and adjust air pressure.
10. Perform pre-alignment inspection and measure vehicle ride height.
11. Inspect tire and wheel assembly for air loss.
12. Identify and test indirect and direct TPMSs and operation of the instrument panel lamps.
13. Demonstrate knowledge of steps required to remove and replace sensors in a TPMS.
14. Inspect, remove, and replace front wheel drive (FWD) bearings, hubs, seals, shafts, boots, and universal/constant velocity (CV) joints.

F. The student applies the technical knowledge and skills related to electrical systems in simulated or actual work situations. The student is expected to:

1. Demonstrate knowledge of the causes and effects from shorts, opens, and resistance in electrical/electronic circuits.
2. Measure key-off battery drain/parasitic draw.
3. Perform solder repair of electrical wiring.
4. Replace electrical connectors and terminal ends.
5. Demonstrate the ability to maintain or restore electronic memory functions.
6. Perform slow and fast battery charges according to manufacturer recommendations.
7. Identify electronic modules, security systems, radios, and other accessories that require re-initialization or code entry after reconnecting a vehicle battery.
8. Perform starter current draw test and starter circuit voltage drop tests and inspect and test starter relays and solenoids.
9. Remove and install a starter in a vehicle.
10. Inspect and test switches, connectors, and wires of starter control circuits.
11. Perform charging system output test.
12. Remove, inspect, and re-install alternator.
13. Identify system voltage and safety precautions associated with high-intensity discharge headlights.
14. Disable and enable airbag system for vehicle service and verify indicator lamp operation.
15. Remove and reinstall a door panel.
16. Describe the operation of keyless entry and remote-start systems.

G. The student applies the technical knowledge and skills related to brakes in simulated or actual work situations. The student is expected to:

1. Describe procedure for performing a road test to check brake system operation, including an anti-lock brake system (ABS).
2. Measure brake pedal height, reserve distance, travel, and free play.
3. Identify components of brake warning light system
4. Bleed and flush brake system.
5. Identify and check the operation of brake stop light system.
6. Identify traction control and vehicle stability control system components.

H. The student applies the technical knowledge and skills related to engine performance in simulated or actual work situations. The student is expected to:

1. Describe the importance of operating all on board diagnostics II (OBDII) monitors for repair verification.

2. Perform cylinder power balance test.
 3. Perform cylinder cranking and running compression tests.
 4. Perform cylinder leakage test.
 5. Verify engine operating temperature.
 6. Remove and replace spark plugs and inspect secondary ignition components for wear and damage.
 7. Retrieve and record diagnostic trouble codes and OBD II monitor status, freeze frame data, and clear trouble codes when applicable.
- I. **The student applies the technical knowledge and skills related to engines in simulated or actual work situations. The student is expected to:**
1. Install engine covers using gaskets, seals, and sealers as required.
 2. Remove and replace timing belt and verify correct camshaft timing.
 3. Perform cooling system pressure and dye tests to identify leaks, check coolant condition and level, and inspect and test radiator, pressure cap, coolant recovery tank, and heater core.
 4. Remove, inspect, and replace thermostat and gasket or seal.
- J. **The student applies the technical knowledge and skills related to heating ventilation and air conditioning (HVAC) in simulated or actual work situations. The student is expected to:**
1. Identify, locate, and replace cabin air filters.
 2. Inspect air conditioning (A/C) condenser for airflow restrictions.
 3. Identify the source of A/C system odors.
 4. Identify hybrid vehicle A/C system electrical circuits and safety precautions.
- K. **The student develops technology skills. The student is expected to:**
1. Use technology as a tool to research, organize, evaluate, and communicate information.
 2. Use digital technologies (computers, PDAs, media players, GPSs, etc.); communication/networking tools, and social networks appropriately to access, manage; integrate, evaluate, and create information to successfully function in a knowledge economy.
 3. Demonstrate using current and new technologies specific to the program of study, course, and/or industry.
 4. Apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information technologies.