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Part 153: Mississippi Secondary Curriculum Frameworks in Career and Technical Education, Transportation, Distribution, and Logistics, Diesel Service Technician



## 2023 Diesel Service Technician

Program CIP: 47.0605 — Diesel Mechanics Technology/Technician

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The Research and Curriculum Unit (RCU), located in Starkville, as part of Mississippi State University (MSU), was established to foster educational enhancements and innovations. In keeping with the land–grant mission of MSU, the RCU is dedicated to improving the quality of life for Mississippians. The RCU enhances intellectual and professional development of Mississippi students and educators while applying knowledge and educational research to the lives of the people of the state. The RCU works within the contexts of curriculum development and revision, research, assessment, professional development, and industrial training.

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# Acknowledgments

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# Standards

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Standards and alignment crosswalks are referenced in the appendix. Depending on the curriculum, these crosswalks should identify alignment to the standards mentioned below, as well as possible related academic topics as required in the Subject Area Testing Program in Algebra I, Biology I, English II, and U.S. History from 1877, which could be integrated into the content of the units. Mississippi’s CTE diesel service technician curriculum is aligned to the following standards:

## **Automotive Service Excellence (ASE), Education Foundation Standards**

The ASE Education Foundation is a nonprofit organization that evaluates and accredits entry-level automotive technology education programs against standards developed by the automotive service industry. It also develops career-readiness education for students that fuse local partnerships, rigorous standard-based education, workplace experience, and mentorship together. [aseeducationfoundation.org](http://aseeducationfoundation.org)

# Preface

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Secondary CTE programs in Mississippi face many challenges resulting from sweeping educational reforms at the national and state levels. Schools and teachers are increasingly being held accountable for providing applied learning activities to every student in the classroom. This accountability is measured through increased requirements for mastery and attainment of competency as documented through both formative and summative assessments. This document provides information, tools, and solutions that will aid students, teachers, and schools in creating and implementing applied, interactive, and innovative lessons. Through best practices, alignment with national standards and certifications, community partnerships, and a hands-on, student-centered concept, educators will be able to truly engage students in meaningful and collaborative learning opportunities.

The courses in this document reflect the statutory requirements as found in Section 37–3–49, *Mississippi Code of 1972*, as amended (Section 37–3–46). In addition, this curriculum reflects guidelines imposed by federal and state mandates (Laws, 1988, Ch. 487, §14; Laws, 1991, Ch. 423, §1; Laws, 1992, Ch. 519, §4 eff. from and after July 1, 1992; Strengthening Career and Technical Education for the 21st Century Act, 2019 [Perkins V]; and Every Student Succeeds Act, 2015).

# Mississippi Teacher Professional Resources

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The following are resources for Mississippi teachers:

Curriculum, Assessment, Professional Learning

Program resources can be found at the RCU's website, [rcu.msstate.edu](http://rcu.msstate.edu).

Learning Management System: An Online Resource

Learning management system information can be found at the RCU's website, under Professional Learning.

Should you need additional instructions, contact the RCU at 662.325.2510 or [helpdesk@rcu.msstate.edu](mailto:helpdesk@rcu.msstate.edu).



# Executive Summary

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## **Pathway Description**

Diesel Service Technician is a pathway in the transportation career cluster. This pathway is designed for students who wish to diagnose and repair the systems and components related to diesel engines. The pathway emphasizes the techniques and tools used in servicing diesel systems and components. Both theoretical learning and activity-based learning are provided for students who wish to develop and enhance their competencies and skills. The courses focus on the following basic areas of diesel engine components: cab; brakes; suspension and steering systems; drive trains; heating, ventilation, and air conditioning (HVAC); electrical and electronic systems; and hydraulics.

## **College, Career, and Certifications**

The Diesel Service Technician pathway is designed as a secondary program for preparation to enter the field of diesel inspection, maintenance, and minor repair. The purpose of the course is to prepare students to continue study in a postsecondary automotive repair program or to begin work as an entry-level diesel services technician. The diesel units in this curriculum are written to the National Institute for ASE Inspection, Maintenance, and Minor Repair (IMMR) credentialing standards in conjunction with the ASE Education Foundation.

## **Grade Level and Class Size Recommendations**

It is recommended that students enter this program as 10th graders. Exceptions to this are a district-level decision based on class size, enrollment numbers, student maturity, and CTE delivery method. This is a hands-on, lab- or shop-based course. Therefore, a maximum of 15 students is recommended per class with only one class with the teacher at a time. This is a classroom-based course.

## **Student Prerequisites**

For students to experience success in the program, the following student prerequisites are suggested:

1. C or higher in English (the previous year)
  2. C or higher in high school-level math (last course taken or the instructor can specify the level of math instruction needed)
  3. Instructor approval and TABE reading score (eighth grade or higher)
- or**
1. TABE reading and math score (eighth grade or higher)
  2. Instructor approval
- or**
1. Instructor approval

## **Assessment**

The latest assessment blueprint for the curriculum can be found at [rcu.msstate.edu/curriculum/curriculumdownload](http://rcu.msstate.edu/curriculum/curriculumdownload).

**Applied Academic Credit**

The latest academic credit information can be found at [mdek12.org/ese/approved-course-for-the-secondary-schools](http://mdek12.org/ese/approved-course-for-the-secondary-schools).

**Teacher Licensure**

The latest teacher licensure information can be found at [mdek12.org/oel/apply-for-an-educator-license](http://mdek12.org/oel/apply-for-an-educator-license).

**Professional Learning**

If you have specific questions about the content of any training sessions provided, please contact the RCU at 662.325.2510 or [helpdesk@rcu.msstate.edu](mailto:helpdesk@rcu.msstate.edu).

# Course Outlines

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## Option 1 — Four 1-Carnegie Unit Courses

This curriculum consists of four 1-credit courses that should be completed in the following sequence:

1. **Fundamentals of Diesel Systems and Components—Course Code: 997202**
2. **Applications of Diesel Electrical/Electronic Systems—Course Code: 997203**
3. **Theory of Diesel Engine Performance—Course Code: 997204**
4. **Advanced Skills of Diesel Auxiliary Components and Systems—Course Code: 997205**

### **Course Description: Fundamentals of Diesel Systems and Components**

This course contains an introduction to shop operations, safety, tools, and equipment, and preparing the vehicle for both service and the customer. The engine repair unit focuses on the overall internal combustion engine, cylinder head and valve train, and lubrication and cooling systems. It also contains an introduction to air induction, exhaust systems, and fuel systems. This is a 1-Carnegie Unit course.

### **Course Description: Applications of Diesel Electrical/Electronic Systems**

This course contains an introduction to electrical/electronic information and terminology including electrical/electronic system theory, battery systems, starting systems, and charging systems. The electrical/electronic systems unit contains information on lighting systems, concepts of gauges, warning devices, driver information systems, battery systems and testing/charging components, and starting systems. This course also includes information for the service and maintenance to the cab and hydraulic systems and should only be taken after students successfully pass Fundamentals of Diesel Systems and Components.

### **Course Description: Theory of Diesel Engine Performance**

This course contains a review on shop operations, safety, tools, and equipment, and preparing the vehicle for both service and the customer. Students will learn concepts on general suspension/steering theory; steering system inspection, diagnosis, and repair; concepts of steering columns, and steering pump and gear units. This course contains information related to brake systems including air brakes, hydraulic brakes, power assist systems, and wheel bearings and should only be taken after students successfully pass Applications of Diesel Electrical/Electronic Systems.

### **Course Description: Advanced Skills of Diesel Auxiliary Components and Systems**

This course contains an introduction to the service and maintenance of drivetrain components. It also covers heating, ventilation, and engine cooling systems. In addition, it also completes the coverage of concepts regarding suspension and steering systems such as wheel alignment, wheels and tires, and frame coupling. This 1-Carnegie Unit course should only be taken after students successfully pass Theory of Diesel Engine Performance.

**Fundamentals of Diesel Systems and Components — Course Code: 997202**

<b>Unit</b>	<b>Unit Title</b>	<b>Hours</b>
1	Orientation	10
2	Workplace Employability Skills	10
3	Automotive Shop and Personal Safety	10
4	Tools and Equipment	10
5	Preparing a Vehicle for Service	10
6	Diesel Engines – General	20
7	Diesel Engines – Cylinder Head and Valve Train	10
8	Diesel Engines – Engine Block	10
9	Diesel Engines – Lubrication Systems	10
10	Diesel Engines – Cooling Systems	15
11	Diesel Engines – Air Induction and Exhaust Systems	10
12	Diesel Engines – Fuel Systems	15
<b>Total</b>		<b>140</b>

**Applications of Diesel Electrical/Electronic Systems — Course Code: 997203**

<b>Unit</b>	<b>Unit Title</b>	<b>Hours</b>
13	Diesel Engines – Engine Brakes	10
14	Electrical/Electronic Systems – General	25
15	Electrical/Electronic Systems – Battery System	10
16	Electrical/Electronic Systems – Starting System	10
17	Electrical/Electronic Systems – Charging System	10
18	Electrical/Electronic Systems – Lighting Systems	10
19	Electrical/Electronic Systems – Instrument Cluster and Driver Information Systems	10
20	CAB – General	10
21	CAB – Instruments and Controls	10
22	CAB – Safety Equipment	10
23	CAB – Hardware	15
24	Hydraulics – General	10
<b>Total</b>		<b>140</b>

**Theory of Diesel Engine Performance — Course Code: 997204**

<b>Unit</b>	<b>Unit Title</b>	<b>Hours</b>
25	Orientation – Review and Reinforcement	5
26	Brakes – General	10
27	Brakes – Air Brakes: Air Supply and Service Systems	10
28	Brakes – Air Brakes: Mechanical/Foundation Brake System	15
29	Brakes – Air Brakes: Parking Brake System	10
30	Brakes – Hydraulic Brakes: Hydraulic System	10
31	Brakes – Hydraulic Brakes: Mechanical/Foundation Brake System	10
32	Brakes – Hydraulic Brakes: Parking Brake System	10
33	Brakes – Power Assist Systems	10
34	Brakes – Vehicle Dynamic Brake Systems (Air and Hydraulic): Antilock Brake System (ABS), Automatic Traction Control (ATC) System, and Electronic Stability Control (ESC) System	10
35	Brakes – Wheel Bearings	10
36	Suspension and Steering Systems – General	10
37	Suspension and Steering Systems – Steering Column	10
38	Suspension and Steering Systems – Steering Pump and Gear Units	10
<b>Total</b>		<b>140</b>

**Advanced Skills of Diesel Auxiliary Components and Systems — Course Code: 997205**

<b>Unit</b>	<b>Unit Title</b>	<b>Hours</b>
39	Suspension and Steering Systems – Steering Linkage	10
40	Suspension and Steering Systems – Suspension Systems	10
41	Suspension and Steering Systems – Wheel Alignment	10
42	Suspension and Steering Systems – Wheels and Tires	10
43	Suspension and Steering Systems – Frame and Coupling Devices	10
44	Drive Train – General	10
45	Drive Train – Clutch	10
46	Drive Train – Transmission	10
47	Drive Train – Driveshaft and Universal Joints	10
48	Drive Train – Drive Axles	10
49	Heating, Ventilation, and Air Conditioning (HVAC) – General	10
50	Heating, Ventilation, and Air Conditioning (HVAC) – Refrigeration System Components	10
51	Heating, Ventilation, and Air Conditioning (HVAC) – Heating, Ventilation, and Engine Cooling Systems	10
52	Heating, Ventilation, and Air Conditioning (HVAC) – Operating Systems and Related Controls	10
<b>Total</b>		<b>140</b>

## Option 2 — Two 2-Carnegie Unit Courses

This curriculum consists of two 2–credit courses that should be completed in the following sequence:

1. **Diesel Service Technician I—Course Code: 997200**
2. **Diesel Service Technician II—Course Code: 997201**

### Course Description: Diesel Service Technician I

This course contains an introduction to shop operations, safety, tools, and equipment, and preparing the vehicle for both service and the customer. The engine repair unit focuses on the overall internal combustion engine, cylinder head and valve train, and lubrication and cooling systems. An introduction to air induction, exhaust systems, and fuel systems are included in this course. It also contains an introduction to electrical/electronic information and terminology including electrical/electronic system theory, battery systems, starting systems, and charging systems. The electrical/electronic systems unit contains information on lighting systems, concepts of gauges, warning devices, driver information systems, battery systems and testing/charging components, and starting systems. It includes information for the service and maintenance to the cab and hydraulic systems. This is a 2-Carnegie Unit course.

### Course Description: Diesel Service Technician II

This course contains a review on shop operations, safety, tools, and equipment, and preparing the vehicle for both service and the customer. It contains general suspension/steering theory; steering system inspection, diagnosis, and repair; concepts of steering columns, and steering pump and gear units. Introductions to brake systems including air brakes, hydraulic brakes, power assist systems, and wheel bearings are also covered in this course. It contains an introduction to the service and maintenance of drivetrain components. Additionally, this course covers heating, ventilation, and engine cooling systems and completes the introduction of concepts regarding suspension and steering systems such as wheel alignment, wheels and tires, and frame coupling. This 2-Carnegie Unit course should only be taken after students successfully pass the diesel service technician I course.

### Diesel Service Technician I — Course Code: 997200

Unit	Unit Title	Hours
1	Orientation	10
2	Workplace Employability Skills	10
3	Automotive Shop and Personal Safety	10
4	Tools and Equipment	10
5	Preparing a Vehicle for Service	10
6	Diesel Engines – General	20
7	Diesel Engines – Cylinder Head and Valve Train	10
8	Diesel Engines – Engine Block	10
9	Diesel Engines – Lubrication Systems	10
10	Diesel Engines – Cooling Systems	15
11	Diesel Engines – Air Induction and Exhaust Systems	10
12	Diesel Engines – Fuel Systems	15

13	Diesel Engines – Engine Brakes	10
14	Electrical/Electronic Systems – General	25
15	Electrical/Electronic Systems – Battery System	10
16	Electrical/Electronic Systems – Starting System	10
17	Electrical/Electronic Systems – Charging System	10
18	Electrical/Electronic Systems – Lighting Systems	10
19	Electrical/Electronic Systems – Instrument Cluster and Driver Information Systems	10
20	CAB – General	10
21	CAB – Instruments and Controls	10
22	CAB – Safety Equipment	10
23	CAB – Hardware	15
24	Hydraulics – General	10
<b>Total</b>		<b>140</b>

### Diesel Service Technician II — Course Code: 997201

Unit	Unit Title	Hours
25	Orientation – Review and Reinforcement	5
26	Brakes – General	10
27	Brakes – Air Brakes: Air Supply and Service Systems	10
28	Brakes – Air Brakes: Mechanical/Foundation Brake System	15
29	Brakes – Air Brakes: Parking Brake System	10
30	Brakes – Hydraulic Brakes: Hydraulic System	10
31	Brakes – Hydraulic Brakes: Mechanical/Foundation Brake System	10
32	Brakes – Hydraulic Brakes: Parking Brake System	10
33	Brakes – Power Assist Systems	10
34	Brakes – Vehicle Dynamic Brake Systems (Air and Hydraulic): Antilock Brake System (ABS), Automatic Traction Control (ATC) System, and Electronic Stability Control (ESC) System	10
35	Brakes – Wheel Bearings	10
36	Suspension and Steering Systems – General	10
37	Suspension and Steering Systems – Steering Column	10
38	Suspension and Steering Systems – Steering Pump and Gear Units	10
39	Suspension and Steering Systems – Steering Linkage	10
40	Suspension and Steering Systems – Suspension Systems	10
41	Suspension and Steering Systems – Wheel Alignment	10
42	Suspension and Steering Systems – Wheels and Tires	10
43	Suspension and Steering Systems – Frame and Coupling Devices	10
44	Drive Train – General	10
45	Drive Train – Clutch	10
46	Drive Train – Transmission	10
47	Drive Train – Driveshaft and Universal Joints	10
48	Drive Train – Drive Axles	10
49	Heating, Ventilation, and Air Conditioning (HVAC) – General	10

50	Heating, Ventilation, and Air Conditioning (HVAC) – Refrigeration System Components	10
51	Heating, Ventilation, and Air Conditioning (HVAC) – Heating, Ventilation, and Engine Cooling Systems	10
52	Heating, Ventilation, and Air Conditioning (HVAC) – Operating Systems and Related Controls	10
<b>Total</b>		<b>140</b>



# Career Pathway Outlook

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## Overview

Diesel engines are installed in all types of equipment that are vital to the economy of Mississippi and around the world. Some examples of these are pavers and rollers that are used to pave the roads that connect factories to distributors to consumers; semi-trucks that transport goods, cargo, and grain to local markets and ports; agriculture tractors and combines that produce the grain the world's population consumes; construction dozers and excavators that build the infrastructure; forestry skidders and log loaders of trees for furniture, lumber, and paper products; mining dump trucks and shovels for coal for electricity; railroad locomotives that transport materials and supplies across nations; and cargo ships and airplanes for transportation around the world. There are also numerous types of applications that use diesel engines: generators, boats, lawn mowers, etc. These pieces of equipment are used to support the large equipment or are used in recreation or emergency situations. Diesel engines are an integral part of everyday life and pertinent to the global society. To keep these machines operating requires a highly skilled technician. The diesel service technician services and repairs all components to include the diesel engine, electrical/electronic systems, hydraulics, steering/suspensions, and brakes.

## Needs of the Future Workforce

Data for this synopsis were compiled from the Mississippi Department of Employment Security (2022). Employment opportunities for each of the occupations are listed below:

Table 1.1: Current and Projected Occupation Report

Description	Jobs, 2018	Projected Jobs, 2028	Change (Number)	Change (Percent)	Average Hourly Earnings, Year
Bus and Truck Mechanics and Diesel Engine Specialists	2,730	2,840	110	4.0%	\$20.41, 2021
Mobile Heavy Equipment Mechanics, Except Engines	1,610	1,650	40	2.5%	\$25.51, 2021
Farm Equipment Mechanics and Service Technicians	710	720	10	1.4%	\$19.84, 2021
Agricultural Equipment Operators	860	930	70	8.1%	\$11.50, 2021
Paving, Surfacing, and Tamping Equipment Operators	810	880	70	8.6%	\$19.77, 2021
Operating Engineers and Other Construction Equipment Operators	2,810	3,060	250	8.9%	\$18.47, 2021

Source: Mississippi Department of Employment Security; mdes.ms.gov (2022).

### **Perkins V Requirements and Academic Infusion**

The diesel service technician curriculum meets Perkins V requirements of introducing students to and preparing them for high-skill, high-wage occupations in transportation fields. It also offers students a program of study, including secondary, postsecondary, and institutions of higher learning courses, that will further prepare them for transportation industry careers. Additionally, this curriculum is integrated with academic college- and career-readiness standards. Lastly, it focuses on ongoing and meaningful professional development for teachers as well as relationships with industry.

### **Transition to Postsecondary Education**

The latest articulation information for secondary to postsecondary can be found at the Mississippi Community College Board website, [mccb.edu](http://mccb.edu).

## **Best Practices**

### *Innovative Instructional Technologies*

Classrooms should be equipped with tools that will teach today's digital learners through applicable and modern practices. The diesel service technician educator's goal should be to include teaching strategies that incorporate current technology. To make use of the latest online communication tools—wikis, blogs, podcasts, and social media platforms, for example—the classroom teacher is encouraged to use a learning management system that introduces students to education in an online environment and places more of the responsibility of learning on the student.

### *Differentiated Instruction*

Students learn in a variety of ways, and numerous factors—students' background, emotional health, and circumstances, for example—create unique learners. By providing various teaching and assessment strategies, students with various learning preferences can have more opportunity to succeed.

### *CTE Student Organizations*

Teachers should investigate opportunities to sponsor a student organization. There are several here in Mississippi that will foster the types of learning expected from the Diesel Service Technician curriculum. SkillsUSA is an example of a student organization with many outlets for diesel services. Student organizations provide participants and members with growth opportunities and competitive events. They also open the doors to the world of diesel services technician careers and scholarship opportunities.

### *Cooperative Learning*

Cooperative learning can help students understand topics when independent learning cannot. Therefore, you will see several opportunities in the Diesel Service Technician curriculum for group work. To function in today's workforce, students need to be able to work collaboratively with others and solve problems without excessive conflict. The Diesel Service Technician curriculum provides opportunities for students to work together and help each other complete complex tasks. There are many field experiences within the diesel services curriculum that will allow and encourage collaboration with professionals currently in the diesel services field.

### *Work-Based Learning*

Work-based learning (WBL) is an extension of understanding competencies taught in the diesel services technician classroom. This curriculum is designed in a way that necessitates active involvement by the students in the community around them and the global environment. These real-world connections and applications link all types of students to knowledge, skills, and professional dispositions. WBL should encompass ongoing and increasingly more complex involvement with local companies and industry professionals. Thus, supervised collaboration and immersion into the industry around the students are keys to students' success, knowledge, and skills development.

# Professional Organizations

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Association for Career and Technical Education (ACTE)  
[acteonline.org](http://acteonline.org)

Association of Diesel Specialists (ADS)  
[diesel.org](http://diesel.org)

National Institute for Automotive Service Excellence (ASE)  
[aseeducationfoundation.org](http://aseeducationfoundation.org)

SkillsUSA  
[skillsusa.org](http://skillsusa.org)

# Using This Document

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## **Competencies and Suggested Objectives**

A competency represents a general concept or performance that students are expected to master as a requirement for satisfactorily completing a unit. Students will be expected to receive instruction on all competencies. The suggested objectives represent the enabling and supporting knowledge and performances that will indicate mastery of the competency at the course level.

## **Teacher Resources**

All teachers should request to be added to the Canvas Resource Guide for their course. For questions or to be added to the guide, send a Help Desk ticket to the RCU by emailing [helpdesk@rcu.msstate.edu](mailto:helpdesk@rcu.msstate.edu).

## **Perkins V Quality Indicators and Enrichment Material**

Some of the units may include an enrichment section at the end. This material will greatly enhance the learning experiences of students. If the Diesel Service Technician program is using a national certification, work-based learning, or another measure of accountability that aligns with Perkins V as a quality indicator, this material could very well be assessed on that quality indicator. It is the responsibility of the teacher to ensure all competencies for the selected quality indicator are covered throughout the year.

# Unit 1: Orientation

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<b>Competencies and Suggested Objectives</b>	
1. Describe local program and career and technical center policies and procedures. <sup>DOK1</sup>	a. Describe local program and career and technical center policies and procedures including dress code, attendance, academic requirements, discipline, and transportation regulations.
2. Describe employment opportunities and responsibilities. <sup>DOK1</sup>	a. Describe employment opportunities including potential earnings, employee benefits, job availability, and place of employment, working conditions, and educational requirements. b. Describe basic employee responsibilities. c. Explain automotive industry pay scales including flat rate, salary, and hourly. d. Describe Automotive Service Excellence (ASE) certifications related to the automotive industry.
3. Explore leadership skills and personal development opportunities provided by the student organization SkillsUSA. <sup>DOK2</sup>	a. Demonstrate effective team building and leadership skills. b. Practice appropriate work ethics. c. Explain the purpose, mission, objectives, motto, colors, official dress, and other distinguishing characteristics of SkillsUSA. d. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth, and development. e. Explore the local, state, and national opportunities available to students through participation in SkillsUSA including, but not limited to, conferences, competitions, community service, philanthropy, and other activities.

## Unit 2: Workplace Employability Skills

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### Competencies and Suggested Objectives

1. Demonstrate the high-quality personal standards expected in the workforce. <sup>DOK1</sup>
  - a. Report to work on time daily, ready to take directions and demonstrate motivation to accomplish the task at hand.
  - b. Dress appropriately and use language and manners suitable for the workplace.
  - c. Maintain appropriate personal hygiene.
  - d. Meet and maintain employment eligibility criteria such as drug/alcohol-free status, clean driving record, and so forth.
  - e. Demonstrate honesty, integrity, and reliability.
2. Demonstrate the ability to follow verbal and written instructions and communicate effectively in on-the-job situations. <sup>DOK2</sup>
  - a. Comply with workplace policies/laws.
  - b. Contribute to the success of the team, assist others, and request help when needed.
  - c. Work well with all customers and coworkers.
  - d. Negotiate solutions to interpersonal and workplace conflicts.
  - e. Contribute ideas and demonstrate initiative.
  - f. Follow directions.
  - g. Communicate (written and verbally) effectively with customers and coworkers.
  - h. Read and interpret workplace documents. Write clearly and concisely.
  - i. Analyze and resolve problems that arise in completing assigned tasks.
  - j. Organize and implement a productive plan of work.
  - k. Use scientific, technical, engineering, and mathematics principles and reasoning to accomplish assigned tasks.
  - l. Identify and address the needs of all customers. Provide helpful, courteous, and knowledgeable service and advice as needed.
  - m. Communicate effectively with customers, colleagues, and employers to include conflict resolution.

## Unit 3: Automotive Shop and Personal Safety

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### Competencies and Suggested Objectives

1. Identify and describe general safety rules. <sup>DOK1</sup>
  - 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 working 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.
  - h. Demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment.
  - i. Identify the location and use of eyewash stations.
  - j. Identify the location of the posted evacuation routes.
  - k. Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities.
  - l. Identify and wear appropriate clothing for lab/shop activities.
  - m. Secure hair and jewelry for lab/shop activities.
  - n. Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high-voltage circuits.
  - o. Demonstrate awareness of the safety aspects of high-voltage circuits (e.g., high-intensity discharge [HID] lamps, ignition systems, injection systems, etc.).
  - p. Locate and demonstrate knowledge of safety data sheets (SDS).
  - q. Identify and explain the procedures for lifting heavy objects.

**Note:** Safety is to be taught as an ongoing part of the program. Students are required to complete a written safety test with 100% accuracy before entering the shop for lab simulations and projects. This test should be documented in each student's file.

**Note:** This unit will be ongoing throughout the year. Time allotted for this unit will be distributed over the entire year.



## Unit 4: Tools and Equipment

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### Competencies and Suggested Objectives

1. Explore tools and equipment used in the automotive service industry. <sup>DOK2</sup>
  - 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.
  - e. Demonstrate proper use of precision measuring tools (e.g., micrometer, dial indicator, dial caliper).

## Unit 5: Preparing a Vehicle for Service

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### Competencies and Suggested Objectives

1. Explore the procedures for preparing a vehicle for automotive service. <sup>DOK2</sup>
  - a. Identify information needed and the service requested on a repair order.
  - b. Identify purpose and demonstrate proper use of fender covers and mats.
  - c. Demonstrate use of the three C's (i.e., concern, cause, and correction).
  - d. Review the vehicle's service history.
  - e. Complete a work order to include customer information, vehicle-identifying information, customer concern, related service history, problem causes, and corrections.
  - f. Ensure the vehicle is prepared to return to customer per school/company policy (i.e., floor mats, steering wheel cover, etc.).

## Unit 6: Diesel Engines – General

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### Competencies and Suggested Objectives

1. Inspect, analyze, and perform service to diesel engine systems and components. <sup>DOK3</sup>
  - a. Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins.
  - b. Inspect level and condition of fuel, oil, diesel exhaust fluid (DEF), and coolant.
  - c. Inspect engine assembly for fuel, oil, coolant, air, and other leaks.
  - d. Check engine operation (starting and running), including: noise, vibration, smoke, etc.
  - e. Use appropriate electronic service tool(s) and procedures to check, record, and clear diagnostic codes; check and record trip/operational data; reset maintenance monitor (if applicable); interpret digital multimeter (DMM) readings.
  - f. Identify system components, configurations, and types of the following: cylinder head(s), valve train, engine block, engine lubrication, engine cooling, air induction, exhaust, fuel, and engine braking.

**Note:** For every task in the diesel engines competencies and suggested objectives, the following safety tasks must be strictly enforced:

1. Comply with personal and environmental safety practices associated with eye/foot/hand/hearing protection, clothing, hand tools, power equipment, lifting practices, and ventilation.
2. Handle, store, and dispose of fuels/chemicals/materials in accordance with federal, state, and local regulations.

**Note:** The first tasks within the diesel engines competencies and suggested objectives are as follows: listen to and verify the operator's concern, review past maintenance and repair documents, and determine necessary action.

**Note:** Diesel engines on engine stands that the students work with are not required to run. A vehicle with a working diesel engine could be used to complete the tasks. Some tasks could be taught by using topically relevant videos. Ideally, a running diesel vehicle would be readily available for all tasks within the diesel engine competencies and suggested objectives. If a working diesel vehicle is not available, the teacher could return to this section of the course to demonstrate these tasks once a working vehicle is becomes available.

# Unit 7: Diesel Engines – Cylinder Head and Valve Train

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<b>Competencies and Suggested Objectives</b>
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| <ol style="list-style-type: none"><li>1. Analyze, diagnose, and perform skills related to cylinder head and valve train. <sup>DOK3</sup><ol style="list-style-type: none"><li>a. Inspect electronic wiring harness and brackets for wear, bending, cracks, and looseness.</li></ol></li></ol> |
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## Unit 8: Diesel Engines – Engine Block

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<b>Competencies and Suggested Objectives</b>
<ol style="list-style-type: none"><li>1. Inspect, determine correct procedures, and perform the repair technique(s) related to an engine block. <sup>DOK3</sup><ol style="list-style-type: none"><li>a. Inspect crankshaft vibration damper; inspect engine mounts.</li></ol></li></ol>

## Unit 9: Diesel Engines – Lubrication Systems

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<b>Competencies and Suggested Objectives</b>
<ol style="list-style-type: none"><li>1. Identify, inspect, determine the action, and perform the procedure as it pertains to lubrication systems. <sup>DOK3</sup><ol style="list-style-type: none"><li>a. Test engine oil pressure and check operation of pressure sensor, gauge, and/or sending unit; test engine oil temperature and check operation of temperature sensor.</li><li>b. Check engine oil level, condition, and consumption; take engine oil sample.</li><li>c. Determine proper lubricant; perform oil and filter service.</li></ol></li></ol>

## Unit 10: Diesel Engines – Cooling Systems

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### Competencies and Suggested Objectives

1. Identify, inspect, determine the action, and perform the procedure as it pertains to cooling systems. <sup>DOK3</sup>
  - a. Check engine coolant type, level, condition, and test coolant for freeze protection and additive package concentration.
  - b. Verify coolant temperature; check operation of temperature and level sensors, gauge, and/or sending unit.
  - c. Inspect and reinstall/replace pulleys, tensioners and drive belts; adjust drive belts and check alignment.
  - d. Recover coolant, flush, and refill with recommended coolant/additive package; bleed cooling system.
  - e. Inspect coolant conditioner/filter assembly for leaks; inspect valves, lines, and fittings; replace as needed.
  - f. Inspect water pump, hoses, and clamps.
  - g. Inspect, and pressure test cooling system(s); pressure test cap, tank(s), and recovery systems; inspect radiator and mountings.
  - h. Inspect thermostatic cooling fan system (hydraulic, pneumatic, and electronic) and fan shroud.
  - i. Identify engine block heater(s).

# Unit 11: Diesel Engines – Air Induction and Exhaust Systems

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## Competencies and Suggested Objectives

1. Identify, inspect, determine the action, and perform the procedure as it pertains to air induction, and exhaust systems. <sup>DOK3</sup>
  - a. Inspect turbocharger(s), wastegate(s), and piping systems.
  - b. Check air induction system, including: cooler assembly, piping, hoses, clamps, and mountings; replace air filter as needed; reset restriction indicator (if applicable).
  - c. Inspect intake manifold, gaskets, and connections.
  - d. Inspect engine exhaust system, exhaust gas recirculation (EGR) system, and exhaust aftertreatment system for leaks, mounting, proper routing, and damaged or missing components.
  - e. Inspect crankcase ventilation system; service as needed.



## Unit 12: Diesel Engines – Fuel Systems

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### Competencies and Suggested Objectives

1. Identify, inspect, determine the action, and perform the procedure as it pertains to fuel systems. <sup>DOK3</sup>
  - a. Check fuel level and condition.
  - b. Inspect fuel tanks, vents, caps, mounts, valves, screens, crossover system, hoses, lines, and fittings.
  - c. Inspect low pressure fuel system components (fuel pump, pump drives, screens, fuel/water separators/indicators, hoses, lines, filters, heaters, coolers, ECM cooling plates, check valves, pressure regulator valves, restrictive fittings, and mounting hardware).
  - d. Replace fuel filter; prime and bleed fuel system.
  - e. Inspect high pressure fuel system components (fuel pump, pump drives, hoses, injection lines, filters, hold-downs, fittings, seals, and mounting hardware).

# Unit 13: Diesel Engines – Engine Brakes

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<b>Competencies and Suggested Objectives</b>
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| <ol style="list-style-type: none"><li>1. Identify and inspect engine brake systems. <sup>DOK2</sup><ol style="list-style-type: none"><li>a. Inspect engine compression and/or exhaust brake housing, valves, seals, lines, and fittings.</li></ol></li></ol> |
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## Unit 14: Electrical/Electronic Systems – General

### Competencies and Suggested Objectives

1. Identify, analyze, and perform repair procedures to general electrical systems. <sup>DOK3</sup>
  - a. Research vehicle service information, including 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 test equipment when measuring source voltage, voltage drop (including grounds), current flow, continuity, and resistance.
  - d. Demonstrate knowledge of the causes and effects of shorts, grounds, opens, and resistance problems in electrical/electronic circuits.
  - e. Use wiring diagrams to trace electrical/electronic circuits.
  - f. Measure parasitic (key-off) battery drain.
  - g. Demonstrate knowledge of the function, operation, and testing of fusible links, circuit breakers, relays, solenoids, diodes, and fuses.
  - h. Inspect, repair (including solder repair), and/or replace connectors, seals, terminal ends, and wiring; verify proper routing and securement.
  - i. Use appropriate electronic service tool(s) and procedures to check, record, and clear diagnostic codes; interpret digital multimeter (DMM) readings.
  - j. Check for malfunctions caused by faults in the data bus communications network.
  - k. Identify electrical/electronic system components and configuration.

**Note:** For every task in the electrical/electronic systems competencies and suggested objectives, the following safety tasks must be strictly enforced:

1. Comply with personal and environmental safety practices associated with eye/foot/hand/hearing protection, clothing, hand tools, power equipment, lifting practices, and ventilation.
2. Handle, store, and dispose of fuels/chemicals/materials in accordance with federal, state, and local regulations.

**Note:** The first tasks in the electrical/electronic systems competencies and suggested objectives are as follows: listen to and verify the operator’s concern, review past maintenance and repair documents and determine necessary action.

**Note:** Trainers and workstations can be built to fit the needs of the course. There are many electrical trainers that can be used. Trainers can range from simple circuit construction up to and including every individual system on a diesel truck. It is recommended to begin by building or obtaining trainers for simple circuits and components.

# Unit 15: Electrical/Electronic Systems – Battery System

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## Competencies and Suggested Objectives

1. Service and analyze battery systems. <sup>DOK3</sup>
  - a. Identify battery type and system configuration.
  - b. Confirm proper battery capacity for application; perform battery state-of-charge test; perform battery capacity test, determine needed action.
  - c. Inspect battery, battery cables, connectors, battery boxes, mounts, and hold-downs; determine needed action.
  - d. Charge battery using appropriate method for battery type.
  - e. Jump-start vehicle using a booster battery and jumper cables or using an appropriate auxiliary power supply.
  - f. Identify low voltage disconnect (LVD) systems.

# Unit 16: Electrical/Electronic Systems – Starting System

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<b>Competencies and Suggested Objectives</b>
<ol style="list-style-type: none"><li>1. Inspect and analyze starting systems. <sup>DOK3</sup><ol style="list-style-type: none"><li>a. Demonstrate understanding of starter system operation.</li><li>b. Perform starter circuit cranking voltage and voltage drop tests.</li><li>c. Inspect starter control circuit switches, relays, connectors, terminals, wires, and harnesses (including over-crank protection).</li></ol></li></ol>

# Unit 17: Electrical/Electronic Systems – Charging System

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<b>Competencies and Suggested Objectives</b>
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| <ol style="list-style-type: none"><li>1. Explore and analyze charging systems. <sup>DOK3</sup><ol style="list-style-type: none"><li>a. Identify and understand operation of the generator (alternator).</li><li>b. Check instrument panel mounted voltmeters and/or indicator lamps.</li><li>c. Inspect generator (alternator) drive belt condition; check pulleys and tensioners for wear; check fans and mounting brackets; verify proper belt alignment.</li><li>d. Inspect cables, wires, and connectors in the charging circuit.</li><li>e. Perform charging system voltage and amperage output tests; perform AC ripple test.</li></ol></li></ol> |
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# Unit 18: Electrical/Electronic Systems – Lighting Systems

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<b>Competencies and Suggested Objectives</b>
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| <ol style="list-style-type: none"><li>1. Examine lighting systems. <sup>DOK2</sup><ol style="list-style-type: none"><li>a. Inspect for brighter-than-normal, intermittent, dim, or no-light operation; determine needed action.</li><li>b. Test, replace, and aim headlights.</li><li>c. Inspect cables, wires, and connectors in the lighting systems.</li><li>d. Inspect tractor-to-trailer multi-wire connectors, cables, and holders.</li></ol></li></ol> |
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# Unit 19: Electrical/Electronic Systems – Instrument Cluster and Driver Information Systems

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<b>Competencies and Suggested Objectives</b>
<ol style="list-style-type: none"><li>1. Classify instrument cluster and driver information systems. <sup>DOK2</sup><ol style="list-style-type: none"><li>a. Check gauge and warning indicator operation.</li><li>b. Identify the sensor/sending units, gauges, switches, relays, bulbs/LEDs, wires, terminals, connectors, sockets, printed circuits, and control components/modules of the instrument cluster, driver information system, and warning systems.</li></ol></li></ol>



## Unit 20: CAB – General

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### Competencies and Suggested Objectives

1. Explore and analyze passenger compartment. <sup>DOK3</sup>
  - a. Research vehicle service information including vehicle service history, service precautions, and technical service bulletins.
  - b. Use appropriate electronic service tool(s) and procedures to check, record, and clear diagnostic codes; check and record trip/operational data; reset maintenance monitor (if applicable); interpret digital multimeter (DMM) readings.

**Note:** For every task in the CAB competencies and suggested objectives, the following safety tasks must be strictly enforced:

1. Comply with personal and environmental safety practices associated with eye/foot/hand/hearing protection, clothing, hand tools, power equipment, lifting practices, and ventilation.
2. Handle, store, and dispose of fuels/chemicals/materials in accordance with federal, state, and local regulations.

**Note:** The first tasks in the CAB competencies and suggested objectives are as follows: listen to and verify the operator's concern, review past maintenance and repair documents, and record the condition on an appropriate document.

**Note:** CAB tasks within the competencies and suggested objectives must be taught using a vehicle.

## Unit 21: CAB – Instruments and Controls

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### Competencies and Suggested Objectives

1. Analyze instruments and control systems. <sup>DOK4</sup>
  - a. Inspect mechanical key condition; check operation of ignition switch; check operation of indicator lights, warning lights and/or alarms; check instruments; record oil pressure and system voltage; check operation of electronic power take-off (PTO) and engine idle speed controls (if applicable).
  - b. Check operation of all accessories.
  - c. Understand operation of auxiliary power unit (APU)/electric power unit (EPU).

## Unit 22: CAB – Safety Equipment

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<b>Competencies and Suggested Objectives</b>
<ol style="list-style-type: none"><li>1. Examine safety equipment related to passenger compartments. <sup>DOK3</sup><ol style="list-style-type: none"><li>a. Check operation of horns (electric and air); check warning device operation (reverse, air pressure, etc.); check condition of spare fuses, safety triangles, fire extinguisher, and all required decals; inspect seat belts and sleeper restraints; inspect condition of wiper blades and arms.</li></ol></li></ol>

## Unit 23: CAB – Hardware

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### Competencies and Suggested Objectives

1. Service the components related to passenger compartment systems. <sup>DOK3</sup>
  - a. Check operation of wipers and washer; inspect windshield glass for cracks or discoloration; check sun visor; check seat condition, operation, and mounting; check door glass and window operation; verify operation of door and cab locks; inspect steps and grab handles; inspect mirrors, mountings, brackets, and glass.
  - b. Record all physical damage.
  - c. Lubricate all cab grease fittings; inspect and lubricate door and hood hinges, latches, strikers, lock cylinders, safety latches, linkages, and cables.
  - d. Inspect cab mountings, hinges, latches, linkages, and ride height.
  - e. Inspect quarter fender, mud flaps, and brackets.

## Unit 24: Hydraulics – General

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### Competencies and Suggested Objectives

1. Explore and analyze hydraulic system, theories, and components. <sup>DOK3</sup>
  - a. Research vehicle service information, including vehicle service history, service precautions, fluid type, and technical service bulletins.
  - b. Verify placement of equipment/component safety labels and placards; determine needed action.
  - c. Identify hydraulic system components; locate filtration system components; service filters and breathers.
  - d. Check fluid level and condition; take a hydraulic fluid sample for analysis.
  - e. Inspect hoses and connections for leaks, proper routing, and proper protection; determine needed action.

**Note:** For every task in the hydraulics competencies and suggested objectives, the following safety tasks must be strictly enforced:

1. Comply with personal and environmental safety practices associated with eye/foot/hand/hearing protection, clothing, hand tools, power equipment, lifting practices, and ventilation.
2. Handle, store, and dispose of fuels/chemicals/materials in accordance with federal, state, and local regulations.

**Note:** The first tasks in the hydraulics competencies and suggested objectives are as follows: listen to and verify the operator's concern, review past maintenance and repair documents, and determine necessary action.

**Note:** Some of the hydraulics system tasks will need either a vehicle or piece of equipment with that includes a hydraulics system. However, a hydraulics training workstation could also be used to teach this competency.

## Unit 25: Orientation – Review and Reinforcement

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<b>Competencies and Suggested Objectives</b>	
1. Examine local program and career and technical center policies and procedures. <sup>DOK3</sup>	a. Investigate local program and career and technical center policies and procedures including dress code, attendance, academic requirements, discipline, and transportation regulations.
2. Analyze employment opportunities and responsibilities. <sup>DOK3</sup>	a. Categorize employment opportunities including potential earnings, employee benefits, job availability, and place of employment, working conditions, and educational requirements. b. Point out basic employee responsibilities. c. Compare multiple automotive industry pay scales including flat rate, salary, and hourly. d. Classify ASE certifications related to the automotive industry.
3. Investigate leadership skills and personal development opportunities provided by the student organization SkillsUSA. <sup>DOK3</sup>	a. Role play effective team building and leadership skills. b. Point out appropriate work ethics. c. Reexamine the purpose, mission, objectives, motto, colors, official dress, and other distinguishing characteristics of SkillsUSA. d. Consider how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth, and development. e. Investigate the local, state, and national opportunities available to students through participation in SkillsUSA including, but not limited to, conferences, competitions, community service, philanthropy, and other activities.

## Unit 26: Brakes – General

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### Competencies and Suggested Objectives

1. Identify and interpret brake systems. <sup>DOK2</sup>
  - a. Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins.
  - b. Identify brake system components and configurations (including air and hydraulic systems, parking brake, power assist, and vehicle dynamic brake systems).
  - c. Identify brake performance problems caused by the mechanical/foundation brake system (air and hydraulic).

**Note:** For every task in the brakes competencies and suggested objectives, the following safety tasks must be strictly enforced:

1. Comply with personal and environmental safety practices associated with eye/foot/hand/hearing protection, clothing, hand tools, power equipment, lifting practices, and ventilation.
2. Handle, store, and dispose of fuels/chemicals/materials in accordance with federal, state, and local regulations.

**Note:** The first tasks in the brakes competencies and suggested objectives are as follows: listen to and verify the operator’s concern, review past maintenance and repair documents, and determine necessary action.

**Note:** A vehicle equipped with air brakes can be used. However, air brake trainers can also be used for these tasks. The rear half of a drive axle trainer works well as a wheel end trainer. Wheel end trainers could be built or purchased to ensure the successful completion and comprehension of these tasks. Hydraulic brakes can be taught either on a vehicle equipped with hydraulic brakes or by incorporating purchased trainers along with ABS/ATC/ESC systems. Wheel bearing trainers can be easily made by obtaining older, used steering knuckles and by mounting them on a stand or in bench vice.

# Unit 27: Brakes – Air Brakes: Air Supply and Service Systems

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## Competencies and Suggested Objectives

1. Explore and analyze air brake systems. <sup>DOK3</sup>
  - a. Inspect air supply system components such as compressor, governor, air drier, tanks, and lines; inspect service system components such as lines, fittings, mountings, and valves (hand brake/trailer control, brake relay, quick release, tractor protection, emergency/spring brake control/modulator, pressure relief/safety).
  - b. Verify proper gauge operation and readings; verify low pressure warning alarm operation; perform air supply system tests such as pressure build-up, governor settings, and leakage; drain air tanks and check for contamination.



# Unit 28: Brakes – Air Brakes: Mechanical/Foundation Brake System

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## Competencies and Suggested Objectives

1. Explore and analyze mechanical and foundation brake systems. <sup>DOK3</sup>
  - a. Inspect service brake chambers, diaphragms, clamps, springs, pushrods, clevises, and mounting brackets; determine needed action.
  - b. Identify slack adjuster type; inspect slack adjusters; determine needed action.
  - c. Check camshafts (S-cams), tubes, rollers, bushings, seals, spacers, retainers, brake spiders, shields, anchor pins, and springs; determine needed action.
  - d. Inspect rotor and mounting surface; measure rotor thickness, thickness variation, and lateral runout; determine needed action.
  - e. Inspect, clean, and adjust air disc brake caliper assemblies; inspect and measure disc brake pads; inspect mounting hardware; perform needed action.
  - f. Remove brake drum; clean and inspect brake drum and mounting surface; measure brake drum diameter; measure brake lining thickness; inspect brake lining condition; determine needed action.

## Unit 29: Brakes – Air Brakes: Parking Brake System

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### Competencies and Suggested Objectives

1. Explore and analyze parking brake systems. <sup>DOK3</sup>
  - a. Inspect and check parking (spring) brake chamber for leaks; determine needed action.
  - b. Inspect and test parking (spring) brake; check valves, lines, hoses, and fittings; determine needed action.
  - c. Inspect and test parking (spring) brake application and release valve; determine needed action.
  - d. Manually release (cage) and reset (uncage) parking (spring) brakes.

# Unit 30: Brakes – Hydraulic Brakes: Hydraulic System

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<b>Competencies and Suggested Objectives</b>
<ol style="list-style-type: none"><li>1. Inspect and analyze hydraulic brake systems. <sup>DOK3</sup><ol style="list-style-type: none"><li>a. Check master cylinder fluid level and condition; determine proper fluid type for application.</li><li>b. Inspect hydraulic brake system components for leaks and damage.</li><li>c. Check hydraulic brake system operation including pedal travel, pedal effort, and pedal feel.</li></ol></li></ol>

## Unit 31: Brakes – Hydraulic Brakes: Mechanical/Foundation Brake System

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### Competencies and Suggested Objectives

1. Inspect and analyze hydraulic mechanical and foundation brake systems. <sup>DOK3</sup>
  - a. Inspect rotor and mounting surface; measure rotor thickness, thickness variation, and lateral runout; determine needed action.
  - b. Inspect and clean disc brake caliper assemblies; inspect and measure disc brake pads; inspect mounting hardware; determine needed action.
  - c. Remove brake drum; clean and inspect brake drum and mounting surface; measure brake drum diameter; measure brake lining thickness; inspect brake lining condition; inspect wheel cylinders; determine needed action.

## Unit 32: Brakes – Hydraulic Brakes: Parking Brake System

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<b>Competencies and Suggested Objectives</b>
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| <ol style="list-style-type: none"><li>1. Inspect and analyze hydraulic parking brake systems. <sup>DOK3</sup><ol style="list-style-type: none"><li>a. Check parking brake operation; inspect parking brake application and holding devices.</li></ol></li></ol> |
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## Unit 33: Brakes – Power Assist Systems

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<b>Competencies and Suggested Objectives</b>
<ol style="list-style-type: none"><li>1. Inspect and analyze brake power assist systems. <sup>DOK3</sup><ol style="list-style-type: none"><li>a. Check brake assist/booster system (vacuum or hydraulic) hoses and control valves; check fluid level and condition (if applicable).</li><li>b. Check operation of emergency (back-up/reserve) brake assist system.</li></ol></li></ol>

# Unit 34: Brakes – Vehicle Dynamic Brake Systems (Air and Hydraulic): Antilock Brake System (ABS), Automatic Traction Control (ATC) System, and Electronic Stability Control (ESC) System

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<b>Competencies and Suggested Objectives</b>
<ol style="list-style-type: none"><li>1. Inspect and analyze Vehicle Dynamic Brake Systems (Air and Hydraulic): Antilock Brake System (ABS), Automatic Traction Control (ATC) System, and Electronic Stability Control (ESC) System. <sup>DOK2</sup><ol style="list-style-type: none"><li>a. Observe antilock brake system (ABS) warning light operation including trailer and dash mounted trailer ABS warning light.</li><li>b. Observe automatic traction control (ATC) and electronic stability control (ESC) warning light operation.</li></ol></li></ol>

## Unit 35: Brakes – Wheel Bearings

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### Competencies and Suggested Objectives

1. Identify, inspect, and assemble wheel bearings. <sup>DOK3</sup>
  - a. Clean, inspect, lubricate, and/or replace wheel bearings and races/cups; replace seals and wear rings; inspect spindle/tube; inspect and replace retaining hardware; adjust wheel bearings; check hub assembly fluid level and condition; verify end play with dial indicator method.
  - b. Identify, inspect, and/or replace unitized/preset hub bearing assemblies.



## Unit 36: Suspension and Steering Systems – General

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### Competencies and Suggested Objectives

1. Identify and inspect suspension and steering systems. <sup>DOK2</sup>
  - a. Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins.
  - b. Disable and enable supplemental restraint system (SRS); verify indicator lamp operation.
  - c. Identify suspension and steering system components and configurations.

**Note:** For every task in the suspension and steering competencies and suggested objectives, the following safety tasks must be strictly enforced:

1. Comply with personal and environmental safety practices associated with eye/foot/hand/hearing protection, clothing, hand tools, power equipment, lifting practices, and ventilation.
2. Handle, store, and dispose of fuels/chemicals/materials in accordance with federal, state, and local regulations.

**Note:** The first tasks in the suspension and steering competencies and suggested objectives are as follows: listen to and verify the operator’s concern, review past maintenance and repair documents, and determine necessary action.

**Note:** Suspension and steering tasks are ideally taught on a vehicle. However, having some older, used steering and suspension components along with tires could be helpful for students to identify and operate these components. Multiple workstations can be set up using older, used components.

# Unit 37: Suspension and Steering Systems – Steering Column

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<b>Competencies and Suggested Objectives</b>
<ol style="list-style-type: none"><li>1. Inspect steering columns. <sup>DOK3</sup><ol style="list-style-type: none"><li>a. Check steering wheel for free play, binding, and proper centering; inspect and service steering shaft U-joint(s), slip joint(s), bearings, bushings, and seals; phase steering shaft.</li><li>b. Check operation of tilt and telescoping steering column.</li><li>c. Check cab mounting.</li></ol></li></ol>

# Unit 38: Suspension and Steering Systems – Steering Pump and Gear Units

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<b>Competencies and Suggested Objectives</b>
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| <ol style="list-style-type: none"><li>1. Service power steering systems. <sup>DOK3</sup><ol style="list-style-type: none"><li>a. Check power steering pump and gear operation, mountings, lines, and hoses; check fluid level and condition; service filter; inspect system for leaks.</li><li>b. Flush and refill power steering system; purge air from system.</li></ol></li></ol> |
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# Unit 39: Suspension and Steering Systems – Steering Linkage

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<b>Competencies and Suggested Objectives</b>
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| <ol style="list-style-type: none"><li>1. Inspect steering linkages. <sup>DOK2</sup><ol style="list-style-type: none"><li>a. Inspect tie rod ends, ball joints, kingpins, pitman arms, idler arms, and other steering linkage components; lubricate as needed.</li></ol></li></ol> |
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# Unit 40: Suspension and Steering Systems – Suspension Systems

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<b>Competencies and Suggested Objectives</b>
<ol style="list-style-type: none"><li>1. Inspect suspension systems. <sup>DOK3</sup><ol style="list-style-type: none"><li>a. Inspect shock absorbers, bushings, brackets, and mounts; determine needed action.</li><li>b. Inspect leaf springs, center bolts, clips, pins, bushings, shackles, U-bolts, insulators, brackets, and mounts; determine needed action.</li><li>c. Inspect axle and axle aligning devices such as: radius rods, track bars, stabilizer bars, and torque arms; inspect related bushings, mounts, and shims.</li><li>d. Inspect tandem suspension equalizer components.</li><li>e. Inspect and test air suspension pressure regulator and height control valves, lines, hoses, dump valves, and fittings; check and record ride height.</li><li>f. Inspect air springs, mounting plates, springs, suspension arms, and bushings.</li></ol></li></ol>

# Unit 41: Suspension and Steering Systems – Wheel Alignment

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<b>Competencies and Suggested Objectives</b>
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| <ol style="list-style-type: none"><li>1. Explore and analyze wheel alignments. <sup>DOK2</sup><ol style="list-style-type: none"><li>a. Demonstrate understanding of alignment angles.</li></ol></li></ol> |
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# Unit 42: Suspension and Steering Systems – Wheels and Tires

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<b>Competencies and Suggested Objectives</b>
<ol style="list-style-type: none"><li>1. Inspect and service wheel assemblies. <sup>DOK3</sup><ol style="list-style-type: none"><li>a. Inspect tire condition; identify tire wear patterns; measure tread depth; verify tire matching (diameter and tread); inspect valve stem and cap; set tire pressure.</li><li>b. Identify wheel/tire vibration, shimmy, pounding, and hop (tramp) problems.</li><li>c. Check wheel mounting hardware; check wheel condition; remove and install wheel/tire assemblies (steering and drive axle); torque fasteners to manufacturer’s specification using torque wrench.</li></ol></li></ol>

# Unit 43: Suspension and Steering Systems – Frame and Coupling Devices

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<b>Competencies and Suggested Objectives</b>
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| <ol style="list-style-type: none"><li>1. Inspect frame and coupling devices. <sup>DOK2</sup><ol style="list-style-type: none"><li>a. Inspect, service, and/or adjust fifth wheel, pivot pins, bushings, locking mechanisms, mounting hardware, air lines, and fittings.</li><li>b. Inspect frame and frame members for cracks, breaks, corrosion, distortion, elongated holes, looseness, and damage.</li><li>c. Inspect frame hangers, brackets, and cross members.</li><li>d. Check pintle hook and mounting (if applicable).</li></ol></li></ol> |
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## Unit 44: Drive Train – General

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### Competencies and Suggested Objectives

1. Identify and inspect drive train components. <sup>DOK2</sup>
  - a. Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins.
  - b. Identify drive train components, transmission type, and configuration.

**Note:** For every task in the drive train competencies and suggested objectives, the following safety tasks must be strictly enforced:

1. Comply with personal and environmental safety practices associated with eye/foot/hand/hearing protection, clothing, hand tools, power equipment, lifting practices, and ventilation.
2. Handle, store, and dispose of fuels/chemicals/materials in accordance with federal, state, and local regulations.

**Note:** The first tasks in the drive train competencies and suggested objectives are as follows: listen to and verify the operator's concern, review past maintenance and repair documents, and determine necessary action.

**Note:** A vehicle equipped with a complete drive train to cover these tasks would be ideal. If a vehicle is not available there are alternatives that could aid in completing the tasks. The clutch related tasks will be difficult without the availability of a vehicle. A relevant video and a service information assignment would be useful until a vehicle becomes available and a proper inspection can be performed. Most of the transmission related tasks could be taught by using an older, used transmission. The driveshaft and universal joints related tasks could be taught using an older, used driveshaft assembly. Drive axles from the rear half of an older model used truck could work well and they will need to be set up on jack stands. These can also be used for some of the brake systems related tasks.

## Unit 45: Drive Train – Clutch

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<b>Competencies and Suggested Objectives</b>
<ol style="list-style-type: none"><li>1. Identify and inspect drive train clutch components. <sup>DOK3</sup><ol style="list-style-type: none"><li>a. Inspect and adjust clutch, clutch brake, linkage, cables, levers, brackets, bushings, pivots, springs, and clutch safety switch (includes push-type and pull-type); check pedal height and travel; determine needed action.</li><li>b. Inspect clutch master cylinder fluid level; check clutch master cylinder, slave cylinder, lines, and hoses for leaks and damage; determine needed action.</li></ol></li></ol>

## Unit 46: Drive Train – Transmission

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### Competencies and Suggested Objectives

1. Identify and inspect drive train transmission components. <sup>DOK3</sup>
  - a. Inspect transmission shifter and linkage; inspect transmission mounts, insulators, and mounting bolts.
  - b. Inspect transmission for leakage; determine needed action.
  - c. Replace transmission cover plates, gaskets, seals, and cap bolts; inspect seal surfaces and vents; determine needed action.
  - d. Check transmission fluid level and condition; determine needed action.
  - e. Inspect transmission breather; inspect transmission oil filters, coolers and related components; determine needed action.
  - f. Inspect speedometer components.
  - g. Inspect and test function of reverse light, neutral start, and warning device circuits.

# Unit 47: Drive Train – Driveshaft and Universal Joints

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<b>Competencies and Suggested Objectives</b>
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| <ol style="list-style-type: none"><li>1. Identify and inspect driveshaft and universal joint components. <sup>DOK2</sup><ol style="list-style-type: none"><li>a. Inspect, service, and/or replace driveshafts, slip joints, yokes, drive flanges, support bearings, universal joints, boots, seals, and retaining/mounting hardware; check phasing of all shafts.</li></ol></li></ol> |
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## Unit 48: Drive Train – Drive Axles

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### Competencies and Suggested Objectives

1. Explore and service drive axles. <sup>DOK3</sup>
  - a. Check for fluid leaks; inspect drive axle housing assembly, cover plates, gaskets, seals, vent/breather, and magnetic plugs.
  - b. Check drive axle fluid level and condition; check drive axle filter; determine needed action.
  - c. Inspect air-operated power divider (inter-axle differential) assembly including: diaphragms, seals, springs, yokes, pins, lines, hoses, fittings, and controls.
  - d. Inspect drive axle shafts; determine needed action.
  - e. Remove and replace wheel assembly; check rear wheel seal and axle flange for leaks; determine needed action.

# Unit 49: Heating, Ventilation, and Air Conditioning (HVAC) – General

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## Competencies and Suggested Objectives

1. Describe heating, ventilation, and air conditioning system components. <sup>DOK2</sup>
  - a. Research vehicle service information, including refrigerant/oil type, vehicle service history, service precautions, and technical service bulletins.
  - b. Identify heating, ventilation, and air conditioning (HVAC) components and configuration.
  - c. Use appropriate electronic service tool(s) and procedures to check, record, and clear diagnostic codes; interpret digital multimeter (DMM) readings.

**Note:** For every task in the heating, ventilation, and air conditioning (HVAC) competencies and suggested objectives, the following safety tasks must be strictly enforced:

1. Comply with personal and environmental safety practices associated with eye/foot/hand/hearing protection, clothing, hand tools, power equipment, lifting practices, and ventilation.
2. Handle, store, and dispose of fuels/chemicals/materials in accordance with federal, state, and local regulations.

**Note:** The first tasks in the heating, ventilation, and air conditioning (HVAC) competencies and suggested objectives are as follows: listen to and verify the operator’s concern, review past maintenance and repair documents and determine necessary action.

**Note:** All practices and procedures must be performed according to current mandates, standards, and regulations.

**Note:** Tasks related to the heating, ventilation, and air conditioning (HVAC) can be taught either on a vehicle or on a trainer.

# Unit 50: Heating, Ventilation, and Air Conditioning (HVAC) – Refrigeration System Components

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<b>Competencies and Suggested Objectives</b>
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| <ol style="list-style-type: none"><li>1. Examine and analyze refrigeration system components. <sup>DOK3</sup><ol style="list-style-type: none"><li>a. Inspect A/C compressor drive belts, pulleys, and tensioners; verify proper belt alignment.</li><li>b. Check A/C system operation including system pressures; visually inspect A/C components for signs of leaks; check A/C monitoring system (if applicable).</li><li>c. Inspect A/C condenser for airflow restrictions; determine needed action.</li></ol></li></ol> |
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# Unit 51: Heating, Ventilation, and Air Conditioning (HVAC) – Heating, Ventilation, and Engine Cooling Systems

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<b>Competencies and Suggested Objectives</b>
<ol style="list-style-type: none"><li>1. Inspect and diagnose issues regarding heating, ventilation, and engine cooling systems. DOK3<ol style="list-style-type: none"><li>a. Inspect engine cooling system and heater system hoses and pipes; determine needed action.</li><li>b. Inspect HVAC system-heater ducts, doors, hoses, cabin filters, and outlets; determine needed action.</li><li>c. Identify the source of A/C system odors.</li></ol></li></ol>



# Unit 52: Heating, Ventilation, and Air Conditioning (HVAC) – Operating Systems and Related Controls

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<b>Competencies and Suggested Objectives</b>
<ol style="list-style-type: none"><li>1. Identify operating systems and related controls. <sup>DOK3</sup><ol style="list-style-type: none"><li>a. Verify blower motor operation; confirm proper air distribution; confirm proper temperature control; determine needed action.</li></ol></li></ol>

# Student Competency Profile

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Student's Name: \_\_\_\_\_

This record is intended to serve as a method of noting student achievement of the competencies in each unit. It can be duplicated for each student, and it can serve as a cumulative record of competencies achieved in the course.

In the blank before each competency, place the date on which the student mastered the competency.

<b>Unit 1: Orientation</b>		
	1.	Describe local program and career and technical center policies and procedures.
	2.	Describe employment opportunities and responsibilities.
	3.	Explore leadership skills and personal development opportunities provided by the student organization SkillsUSA.
<b>Unit 2: Workplace Employability Skills</b>		
	1.	Demonstrate the high-quality personal standards expected in the workforce.
	2.	Demonstrate the ability to follow verbal and written instructions and communicate effectively in on-the-job situations.
<b>Unit 3: Automotive Shop and Personal Safety</b>		
	1.	Identify and describe general safety rules.
<b>Unit 4: Tools and Equipment</b>		
	1.	Explore tools and equipment used in the automotive service industry.
<b>Unit 5: Preparing a Vehicle for Service</b>		
	1.	Explore the procedures for preparing a vehicle for automotive service.
<b>Unit 6: Diesel Engines – General</b>		
	1.	Inspect, analyze, and perform service to diesel engine systems and components.
<b>Unit 7: Diesel Engines – Cylinder Head and Valve Train</b>		
	1.	Analyze, diagnose, and perform skills related to cylinder head and valve train.
<b>Unit 8: Diesel Engines – Engine Block</b>		
	1.	Inspect, determine correct procedures, and perform the repair technique(s) related to an engine block.
<b>Unit 9: Diesel Engines – Lubrication Systems</b>		
	1.	Identify, inspect, determine the action, and perform the procedure as it pertains to lubrication systems.
<b>Unit 10: Diesel Engines – Cooling Systems</b>		
	1.	Identify, inspect, determine the action, and perform the procedure as it pertains to cooling systems.

<b>Unit 11: Diesel Engines – Air Induction and Exhaust Systems</b>		
	1.	Identify, inspect, determine the action, and perform the procedure as it pertains to air induction, and exhaust systems.
<b>Unit 12: Diesel Engines – Fuel Systems</b>		
	1.	Identify, inspect, determine the action, and perform the procedure as it pertains to fuel systems.
<b>Unit 13: Diesel Engines – Engine Brakes</b>		
	1.	Identify and inspect engine brake systems.
<b>Unit 14: Electrical/Electronic Systems – General</b>		
	1.	Identify, analyze, and perform repair procedures to general electrical systems.
<b>Unit 15: Electrical/Electronic Systems – Battery System</b>		
	1.	Service and analyze battery systems.
<b>Unit 16: Electrical/Electronic Systems – Starting System</b>		
	1.	Inspect and analyze starting systems.
<b>Unit 17: Electrical/Electronic Systems – Charging System</b>		
	1.	Explore and analyze charging systems.
<b>Unit 18: Electrical/Electronic Systems – Lighting Systems</b>		
	1.	Examine lighting systems.
<b>Unit 19: Electrical/Electronic Systems – Instrument Cluster and Driver Information Systems</b>		
	1.	Classify instrument cluster and driver information systems.
<b>Unit 20: CAB – General</b>		
	1.	Explore and analyze passenger compartment.
<b>Unit 21: CAB – Instruments and Controls</b>		
	1.	Analyze instruments and control systems.
<b>Unit 22: CAB – Safety Equipment</b>		
	1.	Examine safety equipment related to passenger compartments.
<b>Unit 23: CAB – Hardware</b>		
	1.	Service the components related to passenger compartment systems.
<b>Unit 24: Hydraulics – General</b>		
	1.	Explore and analyze hydraulic system, theories, and components.
<b>Unit 25: Orientation – Review and Reinforcement</b>		
	1.	Examine local program and career and technical center policies and procedures.
	2.	Analyze employment opportunities and responsibilities.
	3.	Investigate leadership skills and personal development opportunities provided by the student organization SkillsUSA.

<b>Unit 26: Brakes – General</b>	
1.	Identify and interpret brake systems.
<b>Unit 27: Brakes – Air Brakes: Air Supply and Service Systems</b>	
1.	Explore and analyze air brake systems.
<b>Unit 28: Brakes – Air Brakes: Mechanical/Foundation Brake System</b>	
1.	Explore and analyze mechanical and foundation brake systems.
<b>Unit 29: Brakes – Air Brakes: Parking Brake System</b>	
1.	Explore and analyze parking brake systems.
<b>Unit 30: Brakes – Hydraulic Brakes: Hydraulic System</b>	
1.	Inspect and analyze hydraulic brake systems.
<b>Unit 31: Brakes – Hydraulic Brakes: Mechanical/Foundation Brake System</b>	
1.	Inspect and analyze hydraulic mechanical and foundation brake systems.
<b>Unit 32: Brakes – Hydraulic Brakes: Parking Brake System</b>	
1.	Inspect and analyze hydraulic parking brake systems.
<b>Unit 33: Brakes – Power Assist Systems</b>	
1.	Inspect and analyze brake power assist systems.
<b>Unit 34: Brakes – Vehicle Dynamic Brake Systems (Air and Hydraulic): Antilock Brake System (ABS), Automatic Traction Control (ATC) System, and Electronic Stability Control (ESC) System</b>	
1.	Inspect and analyze Vehicle Dynamic Brake Systems (Air and Hydraulic): Antilock Brake System (ABS), Automatic Traction Control (ATC) System, and Electronic Stability Control (ESC) System.
<b>Unit 35: Brakes – Wheel Bearings</b>	
1.	Identify, inspect, and assemble wheel bearings
<b>Unit 36: Suspension and Steering Systems – General</b>	
1.	Identify and inspect suspension and steering systems.
<b>Unit 37: Suspension and Steering Systems – Steering Column</b>	
1.	Inspect steering columns.
<b>Unit 38: Suspension and Steering Systems – Steering Pump and Gear Units</b>	
1.	Service power steering systems.
<b>Unit 39: Suspension and Steering Systems – Steering Linkage</b>	
1.	Inspect steering linkages
<b>Unit 40: Suspension and Steering Systems – Suspension Systems</b>	
1.	Inspect suspension systems
<b>Unit 41: Suspension and Steering Systems – Wheel Alignment</b>	
1.	Explore and analyze wheel alignments.

<b>Unit 42: Suspension and Steering Systems – Wheels and Tires</b>		
	1.	Inspect and service wheel assemblies.
<b>Unit 43: Suspension and Steering Systems – Frame and Coupling Devices</b>		
	1.	Inspect frame and coupling devices.
<b>Unit 44: Drive Train – General</b>		
	1.	Identify and inspect drive train components.
<b>Unit 45: Drive Train – Clutch</b>		
	1.	Identify and inspect drive train clutch components.
<b>Unit 46: Drive Train – Transmission</b>		
	1.	Identify and inspect drive train transmission components.
<b>Unit 47: Drive Train – Driveshaft and Universal Joints</b>		
	1.	Identify and inspect driveshaft and universal joint components.
<b>Unit 48: Drive Train – Drive Axles</b>		
	1.	Explore and service drive axles.
<b>Unit 49: Heating, Ventilation, and Air Conditioning (HVAC) – General</b>		
	1.	Describe heating, ventilation, and air conditioning system components.
<b>Unit 50: Heating, Ventilation, and Air Conditioning (HVAC) – Refrigeration System Components</b>		
	1.	Examine and analyze refrigeration system components.
<b>Unit 51: Heating, Ventilation, and Air Conditioning (HVAC) – Heating, Ventilation, and Engine Cooling Systems</b>		
	1.	Inspect and diagnose issues regarding heating, ventilation, and engine cooling systems.
<b>Unit 52: Heating, Ventilation, and Air Conditioning (HVAC) – Operating Systems and Related Controls</b>		
	1.	Identify operating systems and related controls.



2. Inspect level and condition of fuel, oil, diesel exhaust fluid (DEF), and coolant. P-1
3. Inspect engine assembly for fuel, oil, coolant, air, and other leaks. P-1
4. Check engine operation (starting and running) including: noise, vibration, smoke, etc. P-2
5. Use appropriate electronic service tool(s) and procedures to check, record, and clear diagnostic codes; check and record trip/operational data; reset maintenance monitor (if applicable); interpret digital multimeter (DMM) readings. P-1
6. Identify system components, configurations, and types of the following: cylinder head(s), valve train, engine block, engine lubrication, engine cooling, air induction, exhaust, fuel, and engine braking. P-1

**IMMR-DE-B Diesel Engines (DE) - Cylinder Head and Valve Train**

1. Inspect electronic wiring harness and brackets for wear, bending, cracks, and looseness. P-1

**IMMR-DE-C Diesel Engines (DE) - Engine Block**

1. Inspect crankshaft vibration damper; inspect engine mounts. P-1

**IMMR-DE-D Diesel Engines (DE) - Lubrication Systems**

1. Test engine oil pressure and check operation of pressure sensor, gauge, and/or sending unit; test engine oil temperature and check operation of temperature sensor. P-1
2. Check engine oil level, condition, and consumption; take engine oil sample. P-1
3. Determine proper lubricant; perform oil and filter service. P-1.

**IMMR-DE-E Diesel Engines (DE) - Cooling System**

1. Check engine coolant type, level, condition, and test coolant for freeze protection and additive package concentration. P-1
2. Verify coolant temperature; check operation of temperature and level sensors, gauge, and/or sending unit. P-1
3. Inspect and reinstall/replace pulleys, tensioners and drive belts; adjust drive belts and check alignment. P-1
4. Recover coolant, flush, and refill with recommended coolant/additive package; bleed cooling system. P-1
5. Inspect coolant conditioner/filter assembly for leaks; inspect valves, lines, and fittings; replace as needed. P-1
6. Inspect water pump, hoses, and clamps. P-1
7. Inspect, and pressure test cooling system(s); pressure test cap, tank(s), and recovery systems; inspect radiator and mountings. P-1
8. Inspect thermostatic cooling fan system (hydraulic, pneumatic, and electronic) and fan shroud. P-1
9. Identify engine block heater(s). P-2

**IMMR-DE-F Diesel Engines (DE) - Air Induction and Exhaust Systems**

1. Inspect turbocharger(s), wastegate(s), and piping systems. P-2
2. Check air induction system including: cooler assembly, piping, hoses,

clamps, and mountings; replace air filter as needed; reset restriction indicator (if applicable). P-1

3. Inspect intake manifold, gaskets, and connections. P-1
4. Inspect engine exhaust system, exhaust gas recirculation (EGR) system, and exhaust aftertreatment system for leaks, mounting, proper routing, and damaged or missing components. P-1
5. Inspect crankcase ventilation system; service as needed. P-1

**IMMR-DE-G Diesel Engines (DE) - Fuel System**

1. Check fuel level and condition. P-1
2. Inspect fuel tanks, vents, caps, mounts, valves, screens, crossover system, hoses, lines, and fittings. P-1
3. Inspect low pressure fuel system components (fuel pump, pump drives, screens, fuel/water separators/indicators, hoses, lines, filters, heaters, coolers, ECM cooling plates, check valves, pressure regulator valves, restrictive fittings, and mounting hardware). P-1
4. Replace fuel filter; prime and bleed fuel system. P-1
5. Inspect high pressure fuel system components (fuel pump, pump drives, hoses, injection lines, filters, hold-downs, fittings, seals, and mounting hardware). P-1

**IMMR-DE-H Diesel Engines (DE) - Engine Brakes**

1. Inspect engine compression and/or exhaust brake housing, valves, seals, lines, and fittings. P-1

**IMMR-DT-A Drive Train (DT) - General**

1. Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins. P-1
2. Identify drive train components, transmission type, and configuration. P-1

**IMMR-DT-B Drive Train (DT) - Clutch**

1. Inspect and adjust clutch, clutch brake, linkage, cables, levers, brackets, bushings, pivots, springs, and clutch safety switch (includes push-type and pull-type); check pedal height and travel; determine needed action. P-1
2. Inspect clutch master cylinder fluid level; check clutch master cylinder, slave cylinder, lines, and hoses for leaks and damage; determine needed action. P-1

**IMMR-DT-C Drive Train (DT) - Transmission**

1. Inspect transmission shifter and linkage; inspect transmission mounts, insulators, and mounting bolts. P-1
2. Inspect transmission for leakage; determine needed action. P-1
3. Replace transmission cover plates, gaskets, seals, and cap bolts; inspect seal surfaces and vents; determine needed action. P-1
4. Check transmission fluid level and condition; determine needed action. P-1
5. Inspect transmission breather; inspect transmission oil filters, coolers and related components; determine needed action. P-2



6. Inspect speedometer components. P-2
7. Inspect and test function of REVERSE light, neutral start, and warning device circuits. P-1

**IMMR-DT-D Drive Train (DT) - Driveshaft and Universal Joints**

1. Inspect, service, and/or replace driveshafts, slip joints, yokes, drive flanges, support bearings, universal joints, boots, seals, and retaining/mounting hardware; check phasing of all shafts. P-1

**IMMR- DT-E Drive Train (DT) - Drive Axles**

1. Check for fluid leaks; inspect drive axle housing assembly, cover plates, gaskets, seals, vent/breather, and magnetic plugs. P-1
2. Check drive axle fluid level and condition; check drive axle filter; determine needed action. P-1
3. Inspect air-operated power divider (inter-axle differential) assembly including: diaphragms, seals, springs, yokes, pins, lines, hoses, fittings, and controls. P-2
4. Inspect drive axle shafts; determine needed action. P-2
5. Remove and replace wheel assembly; check rear wheel seal and axle flange for leaks; determine needed action. P-1

**IMMR-TB-A Brakes (TB) - General**

1. Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins. P-1
2. Identify brake system components and configurations (including air and hydraulic systems, parking brake, power assist, and vehicle dynamic brake systems). P-1
3. Identify brake performance problems caused by the mechanical/foundation brake system (air and hydraulic). P-1

**IMMR-TB-B Brakes (TB) - Air Brakes: Air Supply and Service Systems**

1. Inspect air supply system components such as compressor, governor, air drier, tanks, and lines; inspect service system components such as lines, fittings, mountings, and valves (hand brake/trailer control, brake relay, quick release, tractor protection, emergency/spring brake control/modulator, pressure relief/safety). P-1
2. Verify proper gauge operation and readings; verify low pressure warning alarm operation; perform air supply system tests such as pressure build-up, governor settings, and leakage; drain air tanks and check for contamination. P-1

**IMMR-TB-C Brakes (TB) - Air Brakes: Mechanical/Foundation Brake System**

1. Inspect service brake chambers, diaphragms, clamps, springs, pushrods, clevises, and mounting brackets; determine needed action. P-1
2. Identify slack adjuster type; inspect slack adjusters; determine needed action. P-1
3. Check camshafts (S-cams), tubes, rollers, bushings, seals, spacers, retainers, brake spiders, shields, anchor pins, and springs; determine needed action. P-1

4. Inspect rotor and mounting surface; measure rotor thickness, thickness variation, and lateral runout; determine needed action. P-1
5. Inspect, clean, and adjust air disc brake caliper assemblies; inspect and measure disc brake pads; inspect mounting hardware; perform needed action. P-1
6. Remove brake drum; clean and inspect brake drum and mounting surface; measure brake drum diameter; measure brake lining thickness; inspect brake lining condition; determine needed action. P-1

**IMMR-TB-D**

**Brakes (TB) - Air brakes: Parking Brake System**

1. Inspect and check parking (spring) brake chamber for leaks; determine needed action. P-1
2. Inspect and test parking (spring) brake check valves, lines, hoses, and fittings; determine needed action. P-1
3. Inspect and test parking (spring) brake application and release valve; determine needed action. P-1
4. Manually release (cage) and reset (uncage) parking (spring) brakes. P-1

**IMMR-TB-E**

**Brakes (TB) - Hydraulic Brakes: Hydraulic System**

1. Check master cylinder fluid level and condition; determine proper fluid type for application. P-1
2. Inspect hydraulic brake system components for leaks and damage. P-1
3. Check hydraulic brake system operation including pedal travel, pedal effort, and pedal feel. P-1

**IMMR-TB-F**

**Brakes (TB) - Hydraulic Brakes: Mechanical/Foundation Brake System**

1. Inspect rotor and mounting surface; measure rotor thickness, thickness variation, and lateral runout; determine needed action. P-1
2. Inspect and clean disc brake caliper assemblies; inspect and measure disc brake pads; inspect mounting hardware; determine needed action. P-1
3. Remove brake drum; clean and inspect brake drum and mounting surface; measure brake drum diameter; measure brake lining thickness; inspect brake lining condition; inspect wheel cylinders; determine needed action. P-1

**IMMR-TB-G**

**Brakes (TB) - Hydraulic Brakes: Parking Brake System**

1. Check parking brake operation; inspect parking brake application and holding devices. P-1

**IMMR-TB-H**

**Brakes (TB) - Power Assist Systems**

1. Check brake assist/booster system (vacuum or hydraulic) hoses and control valves; check fluid level and condition (if applicable). P-1
2. Check operation of emergency (back-up/reserve) brake assist system. P-1

**IMMR-TB-I**

**Brakes (TB) - Vehicle Dynamic Brake Systems (Air and Hydraulic): Antilock Brake System (ABS), Automatic Traction Control (ATC) System, and Electronic Stability Control (ESC) System**

1. Observe antilock brake system (ABS) warning light operation including trailer and dash mounted trailer ABS warning light. P-1
  2. Observe automatic traction control (ATC) and electronic stability control (ESC) warning light operation. P-2
- IMMR-TB-J Brakes (TB) - Wheel Bearings**
1. Clean, inspect, lubricate, and/or replace wheel bearings and races/cups; replace seals and wear rings; inspect spindle/tube; inspect and replace retaining hardware; adjust wheel bearings; check hub assembly fluid level and condition; verify end play with dial indicator method. P-1
  2. Identify, inspect, and/or replace unitized/preset hub bearing assemblies. P-2
- IMMR-TS-A Suspension and Steering (TS) - General**
1. Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins. P-1
  2. Disable and enable supplemental restraint system (SRS); verify indicator lamp operation. P-1
  3. Identify suspension and steering system components and configurations. P-1
- IMMR-TS-B Suspension and Steering (TS) - Steering Column**
1. Check steering wheel for free play, binding, and proper centering; inspect and service steering shaft U-joint(s), slip joint(s), bearings, bushings, and seals; phase steering shaft. P-1
  2. Check operation of tilt and telescoping steering column. P-1
  3. Check cab mounting. P-2
- IMMR-TS-C Suspension and Steering (TS) - Steering Pump and Gear Units**
1. Check power steering pump and gear operation, mountings, lines, and hoses; check fluid level and condition; service filter; inspect system for leaks. P-1
  2. Flush and refill power steering system; purge air from system. P-2
- IMMR-TS-D Suspension and Steering (TS) - Steering Linkage**
1. Inspect tie rod ends, ball joints, kingpins, pitman arms, idler arms, and other steering linkage components; lubricate as needed. P-1
- IMMR-TS-E Suspension and Steering (TS) - Suspension Systems**
1. Inspect shock absorbers, bushings, brackets, and mounts; determine needed action. P-1
  2. Inspect leaf springs, center bolts, clips, pins, bushings, shackles, U-bolts, insulators, brackets, and mounts; determine needed action. P-1
  3. Inspect axle and axle aligning devices such as: radius rods, track bars, stabilizer bars, and torque arms; inspect related bushings, mounts, and shims. P-1
  4. Inspect tandem suspension equalizer components. P-3
  5. Inspect and test air suspension pressure regulator and height control valves, lines, hoses, dump valves, and fittings; check and record ride height. P-1

6. Inspect air springs, mounting plates, springs, suspension arms, and bushings. P-1
- IMMR-TS-F Suspension and Steering (TS) - Wheel Alignment**
1. Demonstrate understanding of alignment angles. P-3
- IMMR-TS-G Suspension and Steering (TS) - Wheels and Tires**
1. Inspect tire condition; identify tire wear patterns; measure tread depth; verify tire matching (diameter and tread); inspect valve stem and cap; set tire pressure. P-1
2. Identify wheel/tire vibration, shimmy, pounding, and hop (tramp) problems. P-2
3. Check wheel mounting hardware; check wheel condition; remove and install wheel/tire assemblies (steering and drive axle); torque fasteners to manufacturer's specification using torque wrench. P-1
- IMMR-TS-H Suspension and Steering (TS) - Frame and Coupling Devices**
1. Inspect, service, and/or adjust fifth wheel, pivot pins, bushings, locking mechanisms, mounting hardware, air lines, and fittings. P-1
2. Inspect frame and frame members for cracks, breaks, corrosion, distortion, elongated holes, looseness, and damage. P-1
3. Inspect frame hangers, brackets, and cross members. P-3
4. Check pintle hook and mounting (if applicable). P-1
- IMMR-TE-A Electrical/Electronic Systems (TE) - General**
1. Research vehicle service information, including vehicle service history, service precautions, and technical service bulletins. P-1
2. Demonstrate knowledge of electrical/electronic series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law). P-1
3. Demonstrate proper use of test equipment when measuring source voltage, voltage drop (including grounds), current flow, continuity, and resistance. P-1
4. Demonstrate knowledge of the causes and effects of shorts, grounds, opens, and resistance problems in electrical/electronic circuits. P-1
5. Use wiring diagrams to trace electrical/electronic circuits. P-1
6. Measure parasitic (key-off) battery drain. P-1
7. Demonstrate knowledge of the function, operation, and testing of fusible links, circuit breakers, relays, solenoids, diodes, and fuses. P-1
8. Inspect, repair (including solder repair), and/or replace connectors, seals, terminal ends, and wiring; verify proper routing and securement. P-1
9. Use appropriate electronic service tool(s) and procedures to check, record, and clear diagnostic codes; interpret digital multimeter (DMM) readings. P-2
10. Check for malfunctions caused by faults in the data bus communications network. P-2
11. Identify electrical/electronic system components and configuration. P-1
- IMMR-TE-B Electrical/Electronic Systems (TE) - Battery System**
1. Identify battery type and system configuration. P-1

2. Confirm proper battery capacity for application; perform battery state-of-charge test; perform battery capacity test, determine needed action. P-1
  3. Inspect battery, battery cables, connectors, battery boxes, mounts, and hold-downs; determine needed action. P-1
  4. Charge battery using appropriate method for battery type. P-1
  5. Jump-start vehicle using a booster battery and jumper cables or using an appropriate auxiliary power supply. P-1
  6. Identify low voltage disconnect (LVD) systems. P-2
- IMMR-TE-C Electrical/Electronic Systems (TE) - Starting System**
1. Demonstrate understanding of starter system operation. P-1
  2. Perform starter circuit cranking voltage and voltage drop tests. P-1
  3. Inspect starter control circuit switches, relays, connectors, terminals, wires, and harnesses (including over-crank protection). P-1
- IMMR-TE-D Electrical/Electronic Systems (TE) - Charging System**
1. Identify and understand operation of the generator (alternator). P-1
  2. Check instrument panel mounted voltmeters and/or indicator lamps. P-1
  3. Inspect generator (alternator) drive belt condition; check pulleys and tensioners for wear; check fans and mounting brackets; verify proper belt alignment. P-1
  4. Inspect cables, wires, and connectors in the charging circuit. P-1
  5. Perform charging system voltage and amperage output tests; perform AC ripple test. P-1
- IMMR-TE-E Electrical/Electronic Systems (TE) - Lighting Systems**
1. Inspect for brighter-than-normal, intermittent, dim, or no-light operation; determine needed action. P-1
  2. Test, replace, and aim headlights. P-1
  3. Inspect cables, wires, and connectors in the lighting systems. P-1
  4. Inspect tractor-to-trailer multi-wire connectors, cables, and holders. P-1
- IMMR-TE-F Electrical/Electronic Systems (TE) - Instrument Cluster and Driver Information Systems**
1. Check gauge and warning indicator operation. P-1
  2. Identify the sensor/sending units, gauges, switches, relays, bulbs/LEDs, wires, terminals, connectors, sockets, printed circuits, and control components/modules of the instrument cluster, driver information system, and warning systems. P-2
- IMMR-CC-A Heating, Ventilation, and Air Conditioning (CC) - General**
1. Research vehicle service information, including refrigerant/oil type, vehicle service history, service precautions, and technical service bulletins. P-1
  2. Identify heating, ventilation, and air conditioning (HVAC) components and configuration. P-1

3. Use appropriate electronic service tool(s) and procedures to check, record, and clear diagnostic codes; interpret digital multimeter (DMM) readings. P-1
- IMMR-CC-B Heating, Ventilation, and Air Conditioning (CC) - Refrigeration System Components**
1. Inspect A/C compressor drive belts, pulleys, and tensioners; verify proper belt alignment. P-1
  2. Check A/C system operation including system pressures; visually inspect A/C components for signs of leaks; check A/C monitoring system (if applicable). P-1
  3. Inspect A/C condenser for airflow restrictions; determine needed action. P-1
- IMMR-CC-C Heating, Ventilation, and Air Conditioning (CC) - Heating, Ventilation, and Engine Cooling Systems**
1. Inspect engine cooling system and heater system hoses and pipes; determine needed action. P-1
  2. Inspect HVAC system-heater ducts, doors, hoses, cabin filters, and outlets; determine needed action. P-1
  3. Identify the source of A/C system odors. P-2
- IMMR-CC-D Heating, Ventilation, and Air Conditioning (CC) - Operating Systems and Related Controls**
1. Verify blower motor operation; confirm proper air distribution; confirm proper temperature control; determine needed action. P-1
- IMMR-TC-A CAB (TC) - General**
1. Research vehicle service information including, vehicle service history, service precautions, and technical service bulletins. P-1
  2. Use appropriate electronic service tool(s) and procedures to check, record, and clear diagnostic codes; check and record trip/operational data; reset maintenance monitor (if applicable); interpret digital multimeter (DMM) readings. P-1
- IMMR-TC-B CAB (TC) - Instruments and Controls**
1. Inspect mechanical key condition; check operation of ignition switch; check operation of indicator lights, warning lights and/or alarms; check instruments; record oil pressure and system voltage; check operation of electronic power take-off (PTO) and engine idle speed controls (if applicable). P-1
  2. Check operation of all accessories. P-1
  3. Understand operation of auxiliary power unit (APU)/electric power unit (EPU). P-3
- IMMR-TC-C CAB (TC) - Safety Equipment**
1. Check operation of horns (electric and air); check warning device operation (reverse, air pressure, etc.); check condition of spare fuses, safety triangles, fire extinguisher, and all required decals; inspect seat belts and sleeper restraints; inspect condition of wiper blades and arms. P-1
- IMMR-TC-D CAB (TC) - Hardware**

1. Check operation of wipers and washer; inspect windshield glass for cracks or discoloration; check sun visor; check seat condition, operation, and mounting; check door glass and window operation; verify operation of door and cab locks; inspect steps and grab handles; inspect mirrors, mountings, brackets, and glass. P-1
2. Record all physical damage. P-2
3. Lubricate all cab grease fittings; inspect and lubricate door and hood hinges, latches, strikers, lock cylinders, safety latches, linkages, and cables. P-2
4. Inspect cab mountings, hinges, latches, linkages, and ride height. P-1
5. Inspect quarter fender, mud flaps, and brackets. P-1

**IMMR-HY-A**

**Hydraulics (HY) - General**

1. Research vehicle service information, including vehicle service history, service precautions, fluid type, and technical service bulletins. P-3
2. Verify placement of equipment/component safety labels and placards; determine needed action. P-3
3. Identify hydraulic system components; locate filtration system components; service filters and breathers. P-3
4. Check fluid level and condition; take a hydraulic fluid sample for analysis. P-3
5. Inspect hoses and connections for leaks, proper routing, and proper protection; determine needed action. P-3

