



Western Technical College

## 32404386 Introduction to Hybrid and Alternative Fueled Vehicles

### Course Outcome Summary

#### Course Information

<b>Description</b>	This course provides a brief history of hybrid electric vehicles, electric vehicle safety, maintenance, equipment and troubleshooting procedures. Also includes current and future alternative fueled vehicle configurations.
<b>Career Cluster</b>	Transportation, Distribution and Logistics
<b>Instructional Level</b>	Technical Diploma Courses
<b>Total Credits</b>	3
<b>Total Hours</b>	108

#### Textbooks

*Fundamentals of Automotive Technology*. 2nd Edition. Copyright 2018. CDX Automotive. Publisher: Jones & Bartlett Publishers. **ISBN-13:** 978-1-2842-0995-5. Required.

*Engine Performance 2*. Copyright 2018. Publisher: Pearson. **ISBN-13:** 978-1-323-55276-6. Required.

#### Learner Supplies

Safety glasses with side eye protection that meet Z87 OSHA guidelines. **Vendor:** To be discussed in class. Required.

Six inch ankle high, quality leather work shoes - \$75.00-100.00. **Vendor:** To be discussed in class. Required.

Pocket knife, six inch metal pocket ruler (English/metric measurement), small pocket flashlight, and pocket flat head screwdriver - \$20.00. **Vendor:** To be discussed in class. Required.

#### Success Abilities

1. Cultivate Passion: Enhance Personal Connections
2. Cultivate Passion: Expand a Growth-Mindset
3. Cultivate Passion: Increase Self-Awareness

4. Live Responsibly: Develop Resilience
5. Live Responsibly: Embrace Sustainability
6. Live Responsibly: Foster Accountability
7. Refine Professionalism: Act Ethically
8. Refine Professionalism: Improve Critical Thinking
9. Refine Professionalism: Participate Collaboratively
10. Refine Professionalism: Practice Effective Communication

## **Program Outcomes**

1. Demonstrate professionalism appropriate for the auto service industry.
2. Perform diagnosis, service, and repair of automotive automatic transmission/transaxle systems.
3. Perform diagnosis, service, and repair of automotive brake systems.
4. Perform diagnosis, service, and repair of automotive electrical and electronic systems.
5. Perform diagnosis, service, and repair of automotive heating and air conditioning systems.
6. Perform diagnosis, service, and repair of automotive engine performance systems.

## **Course Competencies**

### **1. Explore alternative fuels.**

#### **Assessment Strategies**

- 1.1. Written Product
- 1.2. Written Objective Test

#### **Criteria**

*You will know you are successful when:*

- 1.1. you describe common and alternative fuels
- 1.2. you determine advantages/disadvantages and safety precautions for each type of fuel

#### **Learning Objectives**

- 1.a. Describe common fuels
- 1.b. Describe common alternative fuels
- 1.c. Determine advantages and disadvantages of each fuel type
- 1.d. Describe safety considerations related to each fuel type

### **2. Investigate flex fuel systems.**

#### **Assessment Strategies**

- 2.1. Written Product
- 2.2. Skill Demonstration

#### **Criteria**

*You will know you are successful when:*

- 2.1. you identify system components and explain their function
- 2.2. you summarize flex fuel system operation

#### **Learning Objectives**

- 2.a. Identify system components
- 2.b. Explain the function of system components
- 2.c. Summarize system operation

### **3. Investigate CNG systems.**

### **Assessment Strategies**

- 3.1. Written Product
- 3.2. Skill Demonstration

### **Criteria**

*You will know you are successful when:*

- 3.1. you identify system components and explain their function
- 3.2. you summarize CNG system operation

### **Learning Objectives**

- 3.a. Identify system components
- 3.b. Explain the function of system components
- 3.c. Summarize system operation

## **4. Investigate hybrid systems.**

### **Assessment Strategies**

- 4.1. Written Product
- 4.2. Skill Demonstration
- 4.3. Written Objective Test

### **Criteria**

*You will know you are successful when:*

- 4.1. you identify safety and service precautions for aux 12 volt battery's, internal combustion engine, supplemental restraint system, & brake systems
- 4.2. you identify safety and service precautions for high voltage circuits to include power steering and air conditioning
- 4.3. you describe characteristics of hybrid drive train, regenerative braking, and automatic idle stop/start systems

### **Learning Objectives**

- 4.a. Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high voltage circuits. Supplemental task
- 4.b. Identify safety precautions for high voltage systems on electric, hybrid, hybrid-electric, and diesel vehicles. EEB-7
- 4.c. Identify service precautions related to service of the internal combustion engine of a hybrid vehicle. ERA-9
- 4.d. Identify hybrid vehicle power steering system electrical circuits and safety precautions. SSB-19
- 4.e. Identify hybrid vehicle auxiliary (12v) battery service, repair, and test procedures. EEB-9
- 4.f. Describe the operational characteristics of a hybrid vehicle drive train. ATC-5
- 4.g. Identify hybrid vehicle A/C system electrical circuits and service/safety precautions. ACB-4
- 4.h. Describe the operation of a regenerative braking system. BRG-2
- 4.i. Demonstrate knowledge of an automatic idle-stop/start-stop system. EEC-7

## **5. Evaluate CNG systems (Non NATEF).**

### **Assessment Strategies**

- 5.1. Written, oral, or skill product

### **Criteria**

*You will know you are successful when:*

- 5.1. you describe CNG fuel/air filters, manual shut off valve, service valve, check valve, pressure regulation system, and injection system components
- 5.2. you inspect or test fuel supply components for fuel odor or fuel loss
- 5.3. you explain working pressures and understanding of fuel characteristics during fueling procedures

### **Learning Objectives**

- 5.a. Inspect CNG system fuel and air filter; service or replace as needed
- 5.b. Inspect and test manual shut-off valve, service valve, check-valves, and solenoid valves
- 5.c. Explain the cause of fuel odor or fuel loss by inspecting or testing the fuel supply system components such as valves, fuel supply container, pressure relief device (PRD), tubing and hoses

- 5.d. Inspect and test fuel pressure regulation system and components of injection type fuel systems
- 5.e. Explain safe fueling procedures and determine fuel level
- 5.f. Identify working pressures and demonstrate an understanding of fuel characteristics as they relate to temperature and fill procedures

## **6. Evaluate hybrid systems.**

### **Assessment Strategies**

- 6.1. Written Product
- 6.2. Skill Demonstration
- 6.3. Written Objective Test

### **Criteria**

*You will know you are successful when:*

- 6.1. you perform high voltage pre-charge circuit and insulation test
- 6.2. you perform electric machine and inverter/converter operational tests related to drive motor power consumption
- 6.3. you perform battery pack performance testing

### **Learning Objectives**

- 6.a. Perform High Voltage Pre-Charge Circuit Test
- 6.b. Perform High Voltage Insulation Test
- 6.c. Perform electric machine operational tests.
- 6.d. Investigate Drive Motor Power Consumption
- 6.e. Perform inverter/converter operational test.
- 6.f. Perform Battery Pack Power Limiting and Energy Capability Test.