

AUTO G170: HYBRID VEHICLES

Item	Value
Curriculum Committee Approval Date	11/19/2024
Top Code	094840 - Alternative Fuels and Advanced Transportation Technology
Units	3 Total Units
Hours	72 Total Hours (Lecture Hours 45; Lab Hours 27)
Total Outside of Class Hours	0
Course Credit Status	Credit: Degree Applicable (D)
Material Fee	No
Basic Skills	Not Basic Skills (N)
Repeatable	No
Open Entry/Open Exit	No
Grading Policy	Standard Letter (S)

Course Description

Formerly: Hybrid Vehicles. This course is a hands-on approach to the world of hybrid, hydrogen fuel cell, and electric powered vehicles and prepares students for successful completion of the ASE L-3 exam. Explore technologies including configuration, operation, and maintenance of hybrid-electric powertrain systems while observing industry safety process and procedures. PREREQUISITE: AUTO G120. Transfer Credit: CSU.

Course Level Student Learning Outcome(s)

1. Course Outcomes
2. Diagnose automotive hybrid systems faults for normal system operation.
3. Use diagnostic tools and equipment used for hybrid automotive repair.
4. Identify high voltage systems and components.

Course Objectives

- 1. Identify the precautions and shop safety procedures needed to safely work with high voltage systems.
- 2. Describe the components used on modern Hybrid/Electronic vehicles (HEV).
- 3. Use reference materials such as schematics, flow charts, logic trees, and workshop manuals to aid in the battery system troubleshooting.
- 4. Perform basic maintenance related to Hybrid and electric vehicles.
- 5. Diagnose a basic hybrid or electric vehicle fault using standard diagnostic equipment.

Lecture Content

Hybrid safety design basics High voltage component identification Battery location Weight distribution Hybrid safety procedures Working safety with high voltage National Fire Protection Agency (NFPA) standards Standard of Automotive Engineers (SAE) high voltage

standards High Voltage disconnect procedure Basic personal protective equipment (PPE) High voltage related PPE EV specific insulated tool usage Powertrain comparisons Internal combustion powered (ICE) vehicles Gasoline fuel and E85 Diesel fuel Compressed and liquid natural gas (LNG/CNG) Liquid propane gas (LPG) Hybrid vehicles Electric vehicles Fuel cells vehicles Advantages and limitations of EV's Fuel cost savings Operating range Regenerative Braking (electrical energy recovery) Performance Maintenance costs long term HEV system component location and function Motor/Generators Power inverters Alternating current to direct current (AC to DC) DC to DC inverters Batteries, capacitors, and contactor relays Wiring and HV cables Auxiliary systems HEV cooling system Coolant pump based Air Conditioning Heating and Ventilation (HVAC) Electric power steering Electric water pump Electric high voltage air conditioning compressors HEV system monitoring sensor

Lab Content

High-Voltage Safety demonstration Explain the importance of proper grounding of technician to prevent electrical shock while servicing vehicle Explain the importance of orange colored harnesses as high voltage supply Perform EV service using insulated tools and equipment Properly shut down HV system and verify with multimeter Perform vehicle high voltage system deactivation Demonstrate proper high voltage start-up procedure after service Service procedures associated with hybrid/high-voltage technology Connect and observe hybrid/electric vehicle scan tool data Electrical inverter operation DC/DC AC to DC charging DC to AC Electric power steering, electric braking and regenerative energy collection

Method(s) of Instruction

- Lecture (02)
- DE Live Online Lecture (02S)
- DE Online Lecture (02X)
- Lab (04)
- DE Live Online Lab (04S)
- DE Online Lab (04X)

Reading Assignments

Textbook reading of assigned chapters.

Writing Assignments

Create vehicle repair orders related to various on-vehicle lab assignments.

Out-of-class Assignments

Reading assignments Interactive web-based training modules Worksheets

Demonstration of Critical Thinking

Analyze wiring diagrams to determine circuit faults. Evaluate HV battery diagnostic measurements and perform service to battery. Analyze vehicle body and powertrain control systems for performance concerns.

Required Writing, Problem Solving, Skills Demonstration

Demonstrate ability to retrieve service information wiring diagrams and TSBs of a vehicle. Demonstrate understanding of Ohm's Law by performing Voltage Drops in a circuit. Demonstrate understanding in diagnostic and service principles of the starting, charging and battery circuits.

Eligible Disciplines

Automotive technology: Any bachelor's degree and two years of professional experience, or any associate degree and six years of professional experience.

Textbooks Resources

1. Required Bennett, S. Electric Vehicles: a Systems Approach, ed. Goodheart Wilcox, 2024