Course Prefix and Number: AUT 254  
Credits: 4

Course Title: Plug-in Hybrid Vehicles

Course Description: Covers plug-in hybrid electric vehicle systems, extended-range electric vehicle systems, and advanced automotive electronics. Teaches theory, function, and operation of each plug-in hybrid vehicle system and provides students an opportunity to perform diagnostic procedures and maintenance on these vehicles. Focuses on safety. Prerequisites: Experience in the automotive repair field, AUT 241, AUT 242, AUT 245, and AUT 230 or approval of the program head. Lecture 3 hours. Laboratory 3 hours. Total 6 hours per week.

General Course Purpose: This course, which is required for the Hybrid and Electric Technology Career Studies Certificate, addresses the rapidly emerging automotive technology of plug-in hybrid vehicles, which automotive technicians are now being required to service. The course was developed with funding provided by a grant from the Department of Energy.

Course Prerequisites and Co-requisites:  
Prerequisites: Experience in the automotive repair field, AUT 241, AUT 242, AUT 245, and AUT 230. These prerequisites may be waived only with approval of the program head.

Student Learning Outcomes:  
Upon completing the course, the student will be able to  
a. Demonstrate knowledge of safety in all areas of plug-in hybrid vehicle maintenance;  
b. Explain principles of operation for plug-in hybrid vehicle systems;  
c. Describe various plug-in hybrid vehicle components and their relationship to hybrid system operation;  
d. Explain principles of operation for extended range electric vehicle systems; and  
e. Compare and contrast different types of extended range electric vehicles.

Major Topics to Be Included:  
a. Introduction to plug-in hybrid vehicles  
   1. History  
   2. Early electric vehicles  
   3. Overview of the plug-in hybrid vehicle  
   4. Types of plug-in hybrid vehicles  
   5. Levels of plug-in hybrid vehicles  
   6. Electric motors  
b. Plug-in hybrid vehicle safety procedures  
   1. High voltage safety equipment  
   2. First responder procedures  
   3. Electric shock potential  
   4. Preventing current flow through high-voltage cables
c. Plug-in hybrid vehicle batteries and battery service
   1. Introduction
   2. Battery technology
   3. High-voltage battery in the plug-in hybrid system
   4. Auxiliary battery in the hybrid system
   5. Lithium-ion battery technology

d. Electric motors, generators, and controls
   1. Fundamentals of magnetism, electromagnetism, and electromagnetic induction
   2. Electric motors
   3. Brushless motors
   4. Motor control
   5. Capacitors in plug-in hybrid controllers
   6. Converters and inverters
   7. Electric power steering

e. Regenerative braking systems
   1. Principles of regenerative braking
   2. Regenerative braking
   3. How the regenerative braking system works
   4. Deceleration rates

f. Plug-in hybrid vehicle transmissions and transaxles
   1. Manual versus automatic
   2. Conventional automatic transmissions
   3. Continuously variable transmissions (CVT)

g. Plug-in hybrid vehicle heating and air conditioning
   1. Plug-in hybrid ICE cooling and cabin heating
   2. Plug-in hybrid electrical system cooling
   3. Plug-in hybrid air-conditioning systems

h. Toyota/Lexus plug-in hybrid vehicles
   1. Toyota plug-in hybrid Prius
   2. Cold-start emission controls
   3. High-voltage battery pack
   4. Toyota plug-in hybrid system
   5. Maintenance and service procedures

i. General motors plug-in hybrid vehicles
   1. Chevrolet Volt plug-in hybrid vehicle
   2. Maintenance and service procedures

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