

**J. Sargeant Reynolds Community College
Course Content Summary**

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.

Course Objectives:

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

Effective Date of Course Content Summary: Summer 2012