

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

Course Prefix and Number: AUT 293

Credits: 4

Course Title: Advanced Automotive Technology: Plug-In Hybrid Vehicles

Course Description (including lecture hours, lab hours, total contacts)

Introduces advanced automotive technologies, including 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. Focuses on safety. Lecture 3 hours. Laboratory 3 hours. Total 6 hours per week.

General Course Purpose

This course, which will be a requirement for the Advanced Automotive 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/Corequisites (Entry-level competencies **required** for enrollment)

None

Course Objectives (Each item should complete the following sentence.)

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.
- 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 (Month, Date Year): May 1, 2011