

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

Course Prefix and Number: AUT 193

Credits: 3

Course Title: Studies in Automotive: Advanced Automotive Technology

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

Introduces advanced automotive technologies, including hybrid electric vehicle systems, alternative fueled vehicle systems, and advanced automotive electronics. Teaches theory, function, and operation of each hybrid vehicle system and provides students an opportunity to perform diagnostic procedures and maintenance. Prerequisite: approval of Automotive Technology faculty. Lecture 2 hours. Laboratory 3 hours. Total 5 hours per week.

General Course Purpose

This new course was developed with a CEED grant to provide students an opportunity to learn about advanced automotive technology systems, which are becoming increasingly popular. The course emphasizes safety. Initially, this course will serve as an additional course that students interested in automotive technology may take. In time, this course may become a required course in the Automotive Technology AAS degree program.

Course Prerequisites/Corequisites (Entry-level competencies **required** for enrollment)

Prerequisite: approval of Automotive Technology faculty

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 hybrid vehicle maintenance.
- b. understand principles of operation of hybrid vehicle systems.
- c. identify and list various Hybrid vehicle components and their relationship to hybrid system operation.
- d. understand principles of operation of alternative fuel vehicle systems.
- e. describe and identify different types of alternative fuel vehicles.

Major Topics to be Included

- a. Introduction to Hybrid Vehicles
 1. History
 2. Early Electric Vehicles
 3. What is a Hybrid Vehicle
 4. Types of Hybrid Vehicles
 5. Levels of Hybrid Vehicles
 6. Electric Motors
- b. Hybrid Vehicles Safety Procedures
 1. High Voltage Safety Equipment
 2. First Responder Procedures
 3. Electric Shock Potential
 4. Preventing Current Flow through High-Voltage Cables

- c. Hybrid Batteries and Battery Service
 - 1. Introduction
 - 2. Battery Technology
 - 3. High-Voltage Battery in the Hybrid System
 - 4. Nickel-Metal Hydride Technology
 - 5. Auxiliary Battery in the Hybrid System
 - 6. Lead-Acid Technology
 - 7. 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 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. Hybrid Vehicle Transmissions and Transaxles
 - 1. Manual versus Automatic
 - 2. Conventional Automatic Transmissions
 - 3. Continuously Variable Transmissions (CVT)

- g. Hybrid Vehicle Heating and Air Conditioning
 - 1. Hybrid ICE Cooling and Cabin Heating
 - 2. Hybrid Electrical System Cooling
 - 3. Hybrid Air-Conditioning Systems

- h. Honda Hybrid Vehicles
 - 1. Background
 - 2. Body/Interior Features
 - 3. Power Train Features
 - 4. Safety Procedures
 - 5. Service Features

- i. Toyota/Lexus Hybrid Vehicles
 - 1. Toyota Prius
 - 2. Cold-Start Emission Controls
 - 3. High-Voltage Battery Pack
 - 4. Toyota Hybrid System
 - 5. Lexus RX400h/Toyota Highlander Hybrid
 - 6. Toyota Camry Hybrid
 - 7. Lexus GS450h
 - 8. Maintenance and Service Procedures

- j. Ford/Mercury Hybrid Vehicles
 - 1. Full Hybrid
 - 2. Electric Traction Motor
 - 3. Generator Motor
 - 4. High-Voltage Battery Pack
 - 5. Electronic Controller
 - 6. Electric Power Assist Steering (EPAS)
 - 7. Regenerative Braking System (RBS)
 - 8. Maintenance and Service Procedures

- k. General Motors Hybrid Vehicles
 - 1. Chevrolet/GMC Parallel Hybrid Truck
 - 2. Saturn VUE and Chevrolet Malibu Hybrids
 - 3. General Motors Tow-Mode Hybrid
 - 4. Maintenance and Service Procedures

Effective Date of Course Content Summary (Month, Date Year): April 21, 2009