J. Sargeant Reynolds Community College
Course Content Summary

Course Prefix and Number: AUT 253 **Credits: 4**

Course Title: Electric Vehicles

Course Description:

Covers electric vehicle systems and advanced automotive electronics. Provides students an opportunity to perform diagnostic procedures and maintenance of electric vehicle systems. Teaches theory, function, and operation of electric vehicle systems. Focuses on safety. Prerequisites: Experience in the automotive repair field, AUT 241, AUT 242, AUT 245, and AUT 230. Lecture 3 hours. Laboratory 3 hours. Total 6 hours per week. 4 credits

General Course Purpose:

To examine theory, function, and maintenance of electric vehicle systems. Safety will be emphasized. Course is required with acceptance of the Department of Energy (DOE) grant and will be utilized in a new career studies certificate currently under development as part of the DOE grant.

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. There are no co-requisites.

Student Learning Outcomes:
Upon completing the course, the student will be able to

- Demonstrate knowledge of safety in all areas of electric vehicle maintenance;
- Recognize and understand the principles of operation of electric vehicle systems;
- Identify and list various electric vehicle components and their relationship to hybrid system operation;
- Recognize and understand the principles of operation of alternative fuel vehicle systems; and
- Describe and identify different types of alternative fuel vehicles.

Major Topics to Be Included:

a. Introduction to electric vehicles
    1. History
    2. Early electric vehicles
    3. What is an electric vehicle
    4. Types of electric vehicles
    5. Levels of electric vehicles
    6. Electric motors
b. Electric 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. Electric vehicle batteries and battery service

1. Introduction
2. Battery technology
3. High-voltage batteries
4. Nickel-metal hydride technology
5. Auxiliary battery in the electric vehicle 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 electric vehicle 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

f. Electric vehicle transmissions and transaxles
   1. Manual versus automatic

g. Electric vehicle heating and air conditioning
   1. Electric vehicle electrical system cooling
   2. Electric vehicle HVAC systems

h. Electric vehicle conversion
   1. Conversion of ICE vehicle to electric drive

Effective Date/Updated: January 24, 2019