

**Course Outline for AUTO L3**

**LIGHT DUTY HYBRID/ELECTRIC VEHICLES**

**Effective: Fall 2016**

**I. CATALOG DESCRIPTION:**

**AUTO L3 — LIGHT DUTY HYBRID/ELECTRIC VEHICLES — 4.00 units**

A study in the history, current and future of alternative fuels, hybrids and electric vehicles in the automotive industry. Emphasis in shop safety, hazardous waste handling, high voltage electrical precautions, basic engine construction of hybrids, battery storage systems, fuel storage systems, compressed natural gas, liquid propane gas, bio-diesel and hydrogen cell technology. Students are strongly recommended to enroll in Automotive Lab concurrently.

2.00 Units Lecture 2.00 Units Lab

**Prerequisite**

AUTO INTR - Automotive Service and Introduction  
 with a minimum grade of C  
 (May be taken concurrently)

**Grading Methods:**

Letter or P/NP

**Discipline:**

	<u>MIN</u>
<b>Lecture Hours:</b>	36.00
<b>Lab Hours:</b>	108.00
<b>Total Hours:</b>	144.00

**II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: 1**

**III. PREREQUISITE AND/OR ADVISORY SKILLS:**

**Before entering the course a student should be able to:**

**A. AUTOINTR**

1. identify and describe uses of automotive related tools;
2. discuss four stroke engine cycle and identify engine parts;
3. apply Ohm's law, read basic schematics, test automotive electrical systems;
4. identify emissions components, understand 5 gas theory;
5. discuss heating and cooling systems, perform basic cooling systems tests;
6. identify air conditioning systems, understand cycles of refrigerant;
7. discuss braking systems, perform a brake inspection, identify parts;
8. differentiate between suspension and steering system types, inspect and qualify components;
9. identify different transmissions, understand theory of operation of both manual and automatic transmissions and fluid requirements;
10. restraints system identification, know safety concerns of each system and inspection of restraint systems;
11. theorize on the future of the automotive industry.

**IV. MEASURABLE OBJECTIVES:**

**Upon completion of this course, the student should be able to:**

- A. Describe the importance of shop safety relating to different alternative fuels;
- B. Explain the importance of implementation of alternative fuels;
- C. Identify and perform safety procedures in regards to the handling of alternative fuels and battery disposal;
- D. Access and research service information stored on computer;
- E. Specify and list the differences in alternative fuels;
- F. Distinguish and compare the different Hybrid fuel systems;
- G. Use critical thinking skills to explore the future of alternative fuels.
- H. Maintain a clean and professional environment.

**V. CONTENT:**

- A. Shop safety when dealing with alternative fuels.
  1. Proper attire.
    - a. Manufacturer and Government
  2. Fire Hazards, what to do and how to respond.

3. Cautionary Colors
  - a. Under 50 Volts
  - b. 50 to 100 Volts
  - c. Over 100 Volts.
- B. Alternative Fuel Government regulations and implementation.
  1. History and future of Alternative Fuel regulations.
  2. Laws, domestic and international governing alternative fuels.
  3. Gasoline supply and pricing.
    - a. How much is left?
    - b. Middle east Stability
    - c. OPEC
  4. Fueling station availability.
    - a. Gasoline
    - b. Bio-Diesel
    - c. CNG
    - d. LPG
    - e. Propane
- C. Safety and Handling of alternative fuels and battery systems.
  1. Occupational Safety Health Administration (OSHA) Shop standards applied.
  2. Flash points of different fuels.
  3. Hazardous material handling; CNG, LPG, Bio-Diesel, Batteries, Hydrogen cell, as well as other chemicals related to the automobile and alternative fuels.
- D. Service information.
  1. Access Computer based service information; Alldata, Mitchell on demand as well as Manufacturer information systems as available.
- E. Automotive Alternative Fuels Systems.
  1. Ethanol systems and blends.
    - a. Major Manufacturing Changes
    - b. Effects on internal engine components
    - c. Effects on fueling systems
  2. CNG systems and blends.
    - a. Major Manufacturing Changes
    - b. Effects on internal engine components
    - c. Effects on fueling systems
  3. LPG systems and blends.
    - a. Major Manufacturing Changes
    - b. Effects on internal engine components
    - c. Effects on fueling systems
  4. Bio-Diesel systems and blends.
    - a. Major Manufacturing Changes
    - b. Effects on internal engine components
    - c. Effects on fueling systems
  5. Electrical motor and solar systems.
    - a. Motor Technology Challenges
    - b. Solar Technology Challenges
    - c. Battery Technology Challenges
      1. Lead acid
      2. Ni-Cd
      3. Ni-Mh
      4. Lit-Ion
      5. Lit-Ion gel
      6. Coming Technology
  6. Hydrogen Cell systems
    - a. Hydrogen Technology Challenges
    - b. Hydrogen Supply and rendering
- F. Hybrid Fuel Systems.
  1. Gasoline-Electric systems.
  2. Gasoline-CNG systems.
  3. Gasoline-LPG systems.
- G. Future of Alternative Fuels systems.
  1. Advances in Technology.
  2. What's next?
  3. Challenges new fuels have.
- H. Professional environment
  1. Safety glasses (Clear lenses) worn in all Laboratory areas.
  2. No loose clothing (Coveralls strongly recommended).
  3. Long Hair secured.
  4. No open toe shoes (safety shoes recommended).
  5. Work areas maintained; clean free of debris and spills.

## VI. METHODS OF INSTRUCTION:

- A. **Lecture** -
- B. **Discussion** - Group discussions.
- C. **Lab** - Student Hands-on laboratory activities and assignments.
- D. **Audio-visual Activity** - 1. PowerPoint presentations. 2. Mockup parts from automobile.

## VII. TYPICAL ASSIGNMENTS:

- A. Lecture based assignments.
  1. Lecture on PPE
- B. Text based assignments
  1. Read Chapter One
- C. Lab assignments
  1. Perform High voltage disabling

## VIII. EVALUATION:

- A. **Methods**
  1. Exams/Tests
  2. Quizzes

3. Class Participation
4. Home Work

**B. Frequency**

1. Minimum two tests
  - a. Midterm
  - b. Final
2. Weekly quizzes
3. Weekly homework
4. Lab assignments

**IX. TYPICAL TEXTS:**

1. Erjavec, Jack. *A. Hybrid, Electric & Fuel-Cell Vehicles*. 3 ed., Thomson Delmar Publishing, 2014.
2. Duffy, James. *Modern Automotive Technology*. 6 ed., Goodheart-Wilcox, 2014.
3. Gilles, Tim. *Automotive Service*. 6 ed., Cengage, 2014.

**X. OTHER MATERIALS REQUIRED OF STUDENTS:**

- A. Safety glasses