

Course Outline of Record

1. Course Code: AUTO-043A
2.
  - a. Long Course Title: Intro to Hybrid, Electric & Fuel-Cell Vehicle Technology
  - b. Short Course Title: Intro Hybrid/EV/FC
3.
  - a. Catalog Course Description:
 

This course explores the use of Hybrid and Electric battery power for vehicle transportation. Topics will include safety when using high voltage, maintenance, drivability, inverter, DC/DC power transfer, and battery technology. Physics of battery storage, Hybrid generation systems, Electric vehicle applications and their integrated systems from many manufacturers will be discussed. Hybrid and high voltage service and maintenance procedures. This course could be a preparation for the student to successfully complete the L-3 ASE exam.
  - b. Class Schedule Course Description:
 

This course explores the use of Hybrid and Electric battery power for vehicle transportation. Topics will include safety when using high voltage, maintenance, drivability, inverter, DC/DC power transfer, and battery technology. Physics of battery storage, Hybrid generation systems, Electric vehicle applications and their integrated systems from many manufacturers will be discussed. Hybrid and high voltage service and maintenance procedures. This course could be a preparation for the student to successfully complete the L-3 ASE exam.
  - c. Semester Cycle (if applicable): Fall
  - d. Name of Approved Program(s):
    - AUTOMOTIVE ALTERNATIVE FUELS Certificate of Achievement
4. Total Units: 3.00      Total Semester Hrs: 90.00  
 Lecture Units: 2      Semester Lecture Hrs: 36.00  
 Lab Units: 1      Semester Lab Hrs: 54.00  
 Class Size Maximum: 21      Allow Audit: No  
 Repeatability No Repeats Allowed  
 Justification 0
5. Prerequisite or Corequisite Courses or Advisories:
 

*Course with requisite(s) and/or advisory is required to complete Content Review Matrix (CCForm I-A)*

 Prerequisite: AUTO 010 or  
 Corequisite: AUTO 010  
 Advisory: RDG 061
6. Textbooks, Required Reading or Software: (List in APA or MLA format.)
  - a. Erjavec, Jack (2013). Hybrid, Electric & Fuel-Cell Vehicles (2nd/e). Cengage. ISBN: 9780840023957  
 College Level: Yes  
 Flesch-Kincaid reading level: 13
7. Entrance Skills: *Before entering the course students must be able:*
  - a.
 

Utilize proper safety precautions when working with various types of storage batteries used in hybrid electric vehicles.

    - AUTO 010 - Describe shop safety practices.
    - AUTO 010 - Maintain a clean working environment.
  - b.

Discuss the operation of fuel cell hybrid electric drives.

- AUTO 010 - Properly connect a digital multimeter and read volts, amps and ohms on a basic electrical circuit.

c.

Practice basic maintenance procedures for internal combustion hybrid drives.

- AUTO 010 - Locate applicable vehicle service specifications and procedures using the latest online service information.
- AUTO 010 - Verify proper fill and type for all fluids on the automobile.

d.

Demonstrate basic maintenance procedures for fuel engines and subsystems.

- AUTO 010 - Perform a chassis lubrication, change oil and filter.
- AUTO 010 - Identify and describe the purpose of the following components and systems: engine, transmission, suspension, braking system, fuel system, ignition system, electrical system and steering system.

## **Advisory skills:**

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e.

Use various reading strategies to prepare, read and comprehend expository text

- RDG 061 - Use SQ3R &/or SOAR along with outlining, note-taking, mapping summarizing and other strategies to prepare, read, & comprehend expository text.

f.

Read a variety of texts fluently

- RDG 061 - Read a variety of texts fluently.

g.

Write organized summaries & reactions that capture main idea and supporting details.

- RDG 061 - Write organized summaries & reactions that capture main idea and supporting details.

h.

Understand multiple word meanings, uses & synonyms

- RDG 061 - Understand multiple word meanings, uses & synonyms

## 8. Course Content and Scope:

Lecture:

1. Orientation, safety and environmental concerns
2. High-Voltage safety, NFPA and SAE high-voltage standards
3. Proper power down and verification with a DMM
4. Electrical basics
5. HV Battery, motor and generator basics
6. Intro to electric vehicles
7. Introduction to hybrid vehicles
8. Introduction to fuel-cell vehicles
9. Hybrid maintenance and service
10. Hybrid/Elec/Fuel-cell system: design, operation, regenerative braking and power management systems
11. High-voltage cables, harness, wiring, controllers and A/C compressors
12. Operation of: converters/inverter, DC/DC, AC/DC & DC/AC, fuel-cells
13. Connect and observe hybrid/elect/fuel-cell scan tool data
14. Chrysler web-based training modules

Lab: (if the "Lab Hours" is greater than zero this is required)

1. High-voltage safety demonstration & environmental concerns.
2. Remove and replace: HV battery, inverter, disassemble engine and transaxle with drive motors.
3. Perform basic maintenance on electric/hybrid/fuel-cell vehicle.
4. Demonstrate and perform basic safety protocols and HV battery isolation including powering down and verification with a DMM.
5. Operation and function of electric power steering, high-voltage AC compressors, electric braking, regenerative energy collection, inverter (including A/C to D/C, D/C to D/C and D/C to A/C).
5. Connect a scan tool and observe electric/hybrid/fuel-cell vehicle data.
6. Perform basic diagnostics with scan tool related to hybrid and electric vehicles.

9. Course Student Learning Outcomes:

1.  
Explain safety concerns and protocols related to hybrid, electric and hydrogen vehicles and service equipment.
2.  
Perform basic maintenance related to hybrid, electric and hydrogen vehicles.
3.  
Diagnose a basic hybrid, electric or hydrogen vehicle fault.
4.  
Research proper diagnostic procedures and safety precautions related to hybrid and electric vehicles.
5.  
Explain hybrid and electric vehicle powertrain operation including the function and operation of key components.

10. Course Objectives: *Upon completion of this course, students will be able to:*

- a. Comply with shop and vehicle safety practices relevant to electric, hybrid and fuel cell vehicles.
- b. List principles of fuel cell operations.
- c. Explain the operation of Proton Exchange Membrane (PEM) fuel cells.
- d. Discuss the operation of fuel cell hybrid electric drives.
- e. Explain the operation of internal combustion hybrid electric drives.
- f. Utilize proper safety precautions when working with various types of storage batteries used in hybrid electric vehicles.
- g. Perform basic maintenance related to hybrid/electric/fuel-cell vehicles.
- h. Demonstrate the precautions, personal and shop safety procedures needed to safely work with high-voltage systems.
- i. Practice basic maintenance procedures for internal combustion hybrid drives.
- j. Demonstrate acquired knowledge related to the components used on modern hybrid/electric/fuel-cell vehicles.
- k. Demonstrate familiarity with reference materials such as schematics, flow charts, logic trees, and workshop manuals to aid in battery system troubleshooting.
- l. Demonstrate how to diagnose a basic hybrid or electric or fuel-cell vehicle fault using standard diagnostic equipment.

11. Methods of Instruction: *(Integration: Elements should validate parallel course outline elements)*

- a. Collaborative/Team
- b. Demonstration, Repetition/Practice
- c. Discussion
- d. Laboratory
- e. Lecture
- f. Observation
- g. Technology-based instruction

Other Methods:

Reading assignments

12. Assignments: *(List samples of specific activities/assignments students are expected to complete both in and outside of class.)*

In Class Hours: 90.00

Outside Class Hours: 72.00

a. In-class Assignments

1. Lecture from required text: 1-3 chapters per week from both classroom and shop manuals.
2. In class worksheets.
3. Instruction on safety related to hybrid tools and vehicle service.
4. Assigned readings and written summaries from selected instructor handouts.
5. Written summaries and analysis of assigned websites.
6. Must complete a course project consisting of an essay describing, analyzing and summarizing a selected topic, including out of class research and fieldwork.
7. Students must keep a notebook of all course materials including homework, class notes, handouts, class project and team activities. The notebook must be organized by chapter, in-class notes, handouts and extra-credit assignments. The notebook will be evaluated after the half way point and graded at the end of the course.
8. Research of service information related to vehicle diagnosis, troubleshooting and repair of personal, shop and other vehicles to be evaluated by the instructor during lab time.
9. Develop teamwork skills through group activities and assigned special projects.

b. Out-of-class Assignments

1. Readings from required text: 1-3 chapters per week from both classroom and shop manuals.
2. Homework from required text: multiple-choice questions, fill in the blank and essay questions to be graded each week.
3. Completion of 3 SP2 safety tests.
4. Assigned readings and written summaries from selected instructor handouts.
5. Must complete a course project consisting an essay describing, analyzing and summarizing a selected topic, including out of class research and fieldwork.
6. Students must keep a notebook of all course materials including homework, class notes, handouts, class project and team activities. The notebook must be organized by chapter, in-class notes, handouts and extra-credit assignments. The notebook will be evaluated after the half way point and graded at the end of the course.
7. Vehicle diagnosis, troubleshooting and repair of personal, shop and other vehicles to be evaluated by the instructor during lab time.
8. Hands-on lab worksheets matching each course objective. These will be graded by the instructor throughout the semester during lab time.
9. Must develop teamwork skills through lab activities and assigned special projects.
10. Chrysler web-based training modules.

13. Methods of Evaluating Student Progress: *The student will demonstrate proficiency by:*

- College level or pre-collegiate essays
- Written homework
- Guided/unguided journals
- Laboratory projects
- Group activity participation/observation
- True/false/multiple choice examinations
- Mid-term and final evaluations
- Student participation/contribution

14. Methods of Evaluating: Additional Assessment Information:

Review of homework Lab activity evaluations Written and hands-on exams

15. Need/Purpose/Rationale -- *All courses must meet one or more CCC missions.*

PO-BS Critical Thinking

Locate questions and problems as a result of conversation, reading, and lectures

Communicate meaningfully with others.

PO-BS Problem Solving

Recognize that a solution may not be possible, given limits of time, money, or other finite resources.

Use background information in a subject to understand the nature of a problem and transfer information to new problems accordingly.

IO - Global Citizenship - Ethical Behavior

Integrate universally accepted values such as honesty, responsibility, respect, fairness, courage and compassion into judgments and decision-making.

Exhibit respect for self and others.

16. Comparable Transfer Course

University System	Campus	Course Number	Course Title	Catalog Year
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17. Special Materials and/or Equipment Required of Students:

- |                                                              |
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| 1. Safety glasses meeting ANSI Z87.1<br>2. Three ring binder |
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18. Materials Fees:  Required Material?

Material or Item	Cost Per Unit	Total Cost
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19. Provide Reasons for the Substantial Modifications or New Course:

Change requisite and entrance skills to Reading 061

20. a. Cross-Listed Course (*Enter Course Code*): *N/A*  
 b. Replacement Course (*Enter original Course Code*): *N/A*

21. Grading Method (*choose one*): Letter Grade Only

22. MIS Course Data Elements

- a. Course Control Number [CB00]: CCC000455030
- b. T.O.P. Code [CB03]: 94840.00 - Alternative Fuels and Adv
- c. Credit Status [CB04]: D - Credit - Degree Applicable
- d. Course Transfer Status [CB05]: B = Transfer CSU
- e. Basic Skills Status [CB08]: 2N = Not basic skills course
- f. Vocational Status [CB09]: Advanced Occupational
- g. Course Classification [CB11]: Y - Credit Course
- h. Special Class Status [CB13]: N - Not Special
- i. Course CAN Code [CB14]: *N/A*
- j. Course Prior to College Level [CB21]: Y = Not Applicable
- k. Course Noncredit Category [CB22]: Y - Not Applicable
  - l. Funding Agency Category [CB23]: Y = Not Applicable
- m. Program Status [CB24]: 1 = Program Applicable

Name of Approved Program (*if program-applicable*): AUTOMOTIVE ALTERNATIVE FUELS

*Attach listings of Degree and/or Certificate Programs showing this course as a required or a restricted elective.)*

23. Enrollment - Estimate Enrollment

First Year: 21

Third Year: 21

24. Resources - Faculty - Discipline and Other Qualifications:

a. Sufficient Faculty Resources: Yes

b. If No, list number of FTE needed to offer this course: *N/A*

25. Additional Equipment and/or Supplies Needed and Source of Funding.

N/A

26. Additional Construction or Modification of Existing Classroom Space Needed. (*Explain:*)

N/A

27. FOR NEW OR SUBSTANTIALLY MODIFIED COURSES

Library and/or Learning Resources Present in the Collection are Sufficient to Meet the Need of the Students Enrolled in the Course: Yes

28. Originator Douglas Hugh Redman Origination Date 11/09/17