

Course Outline of Record

1. Course Code: AUTO-043B
2.
 - a. Long Course Title: Hybrid, Fuel-Cell and Electric Vehicle Diagnosis & Repair
 - b. Short Course Title: HYBRID DIAG & REPAIR
3.
 - a. Catalog Course Description:
 This course provides the student with the skills to diagnose and repair basic to intermediate level malfunctions with hybrid, fuel-cell and electric vehicles.
 - b. Class Schedule Course Description:
 Hybrid, Fuel-Cell, Elect Diag & Repair
 - c. Semester Cycle (if applicable): Spring
 - d. Name of Approved Program(s):
 - ADVANCED TRANSPORTATION TECHNOLOGIES AS Degree for Employment Preparation
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 0x
 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 043A
 Prerequisite: AUTO 011B or
 Corequisite: AUTO 011B
6. Textbooks, Required Reading or Software: (List in APA or MLA format.)
 - a. Van Batenburg, Craig (2013). Understanding Hybrid and Electric Vehicle Service and Technology (2013/e). Self-published.
 College Level: Yes
 Flesch-Kincaid reading level: 13
 - b. Instructor hand-outs.
7. Entrance Skills: *Before entering the course students must be able:*
 - a.
 Explain safety concerns and protocols related to hybrid and electric vehicles and service equipment.
 - AUTO 043A - Comply with shop and vehicle safety practices relevant to electric, hybrid and fuel cell vehicles.
 - b.
 Perform basic maintenance related to hybrid, electric and fuel-cell vehicles.
 - AUTO 043A - Explain the operation of internal combustion hybrid electric drives.
 - AUTO 043A - Perform basic maintenance related to hybrid/electric/fuel-cell vehicles.
 - AUTO 043A - Practice basic maintenance procedures for internal combustion hybrid drives.
 - c.
 Identify and interpret electrical/electronic system concern; determine necessary action.
 - AUTO 011B - Identify and interpret electrical/electronic system concern; determine necessary action.

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d.

Diagnose electrical/electronic integrity of series, parallel and series-parallel circuits using principles of electricity (Ohm's Law).

- AUTO 011B - Diagnose electrical/electronic integrity of series, parallel and series-parallel circuits using principles of electricity (Ohm's Law).

e.

Inspect and test switches, connectors, relays, solenoid solid state devices, and wires of electrical/electronic circuits; perform necessary action.

- AUTO 011B - Inspect and test switches, connectors, relays, solenoid solid state devices, and wires of electrical/electronic circuits; perform necessary action.

f.

Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action.

- AUTO 011B - Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action.

g.

Perform battery capacity test (or conductance test); confirm proper battery capacity for vehicle application; determine necessary action.

- AUTO 011B - Perform battery state-of-charge test; determine necessary action.

8. Course Content and Scope:

Lecture:

1. Safety
 1. Personal protection equipment (PPE)
 2. Tools and meters
 3. Facility/work area safety
 4. High Voltage (HV) batteries, inverters, capacitors
 5. Fuel-cells
 6. First-aid, rescuing a coworker
2. History
 1. The first hybrid, fuel-cell, elect vehicles
 2. Modern era history and progression
 3. Why hybrid, fuel-cell, electric vehicles (federal/state regulations; fossil fuels; environmental concerns)
3. Customer
 1. Demographic/profile of typical buyer
 2. Customer expectations
 3. The customer and the owner's manual
 4. How to interact with hybrid, fuel-cell, electric vehicle customers
 5. Refueling
 6. How to drive the car for maximum range
4. Common Components
 1. 12v systems
 1. 12v battery
 2. Lighting
 3. Customer convenience
 2. HV systems
 1. High Voltage (HV) battery
 2. Inverter
 3. Fuel-cell
 4. High Voltage (HV) safety systems

3. Internal combustion engine in hybrid
 1. Atkinson cycle
4. Regular maintenance
 1. Filters
 2. Engine, transmission oils
 3. Regular visual inspections
5. Toyota Prius (or equivalent hybrid vehicle)
 1. Warnings/ cautions/ dangers (service information)
 2. System type
 3. Common component function and location
 4. Unique component function and location
 5. Familiarity and navigation of service information
 6. Unique maintenance procedures
 7. Scan tool familiarity
 8. Diagnostics and troubleshooting
6. Toyota Mirai (or equivalent fuel-cell vehicle)
 1. Warnings/ cautions/ dangers (service information)
 2. System type
 3. Common component function and location
 4. Unique component function and location
 5. Familiarity and navigation of service information
 6. Unique maintenance procedures
 7. Scan tool familiarity
 8. Diagnostics and troubleshooting
7. Fiat E (or equivalent electric vehicle)
 1. Warnings/ cautions/ dangers (service information)
 2. System type
 3. Common component function and location
 4. Unique component function and location
 5. Familiarity and navigation of service information
 6. Unique maintenance procedures
 7. Scan tool familiarity
 8. Diagnostics and troubleshooting
8. Honda Civic Hybrid (or equivalent hybrid vehicle)
 1. Warnings/ cautions/ dangers (service information)
 2. System type
 3. Common component function and location
 4. Unique component function and location
 5. Familiarity and navigation of service information
 6. Unique maintenance procedures
 7. Scan tool familiarity
 8. Diagnostics and troubleshooting
9. Chevrolet Volt (or equivalent plug-in hybrid vehicle)
 1. Warnings/ cautions/ dangers (service information)
 2. System type
 3. Common component function and location
 4. Unique component function and location
 5. Familiarity and navigation of service information
 6. Unique maintenance procedures
 7. Scan tool familiarity
 8. Diagnostics and troubleshooting
10. Service Information
 1. Wiring diagrams
 2. Special tools
 3. Diagnostic Trouble Codes
11. Scan Tool
 1. Interpreting service information descriptions with generic scan tools
 1. Symptom based
 2. Diagnostic Trouble Code (DTC) based
 2. Updating the scan tool

- 3. Navigation
 - 1. Inputs vs. outputs
- 4. Generic mode vs. Original Equipment Manufacturer (OEM) mode
- 5. Other functions
 - 1. Oscilloscope
 - 2. Pressure measurement
 - 3. DMM functions
- 12. Diagnosis & Troubleshooting
 - 1. 5-step procedure
 - 2. Original Equipment Manufacturer (OEM) service information
 - 3. Aftermarket information
 - 1. Mitchell 1
 - 2. Identifix
 - 4. Training opportunities
 - 1. Original Equipment Manufacturer (OEM)
 - 2. NAPA Part Suppliers
 - 3. Complementary coursework
 - 5. Internet information
 - 6. Diagnostic scenarios
- 13. Repair
 - 1. Safety
 - 2. Unique issue with hybrid, fuel-cell and electric vehicles
 - 3. When to send it to the dealer
 - 4. Maintenance indicator lamps
 - 5. Service lamps and icons unique to hybrid, full-cell and electric vehicles
- 14. Flash Reprogramming
 - 1. Safety
 - 2. Proper set-up
 - 3. What to do if the reprogramming fails
 - 4. How to access the revised software

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

- 1. Safety
- 2. Vehicle walk-a-round
- 3. Ride and drive
- 4. Standard test procedures
- 5. Regular service activities
- 6. Scan tool and service information activities
- 7. Repair order completion
- 8. Basic to intermediate diagnostic scenarios
- 9. Flash reprogramming

9. Course Student Learning Outcomes:

- 1.
Describe safety procedures and concerns when diagnosing and repairing hybrid, fuel-cell and electric vehicles.
- 2.
Locate and follow manufacturer service information related to diagnosis and repair of hybrid, fuel-cell and electric vehicles.
- 3.
Diagnose and repair a basic to intermediate level customer concern using an industry standard scan tool.

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

- a. Describe safety procedures related to hybrid, fuel-cell and electric vehicle safety.
- b. List the similarities and differences, from a customer's perspective, between hybrid, fuel-cell and electric vehicles and

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internal combustion engine (ICE) vehicles.

- c. Compare and contrast the similarities and differences from the business perspective of servicing hybrid, fuel-cell and electric vehicles.
- d. Describe the system operation, component location and diagnostic procedures for the top 5 OEM hybrid, fuel-cell and electric vehicles.
- e. Diagnose, troubleshoot and repair basic to intermediate malfunctions of hybrid, fuel-cell and electric vehicles.
- f. Flash reprogram a computer on a hybrid, fuel-cell or electric vehicle.

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

- a. Activity
- b. Collaborative/Team
- c. Discussion
- d. Laboratory
- e. Lecture
- f. Observation
- g. Participation
- h. Technology-based instruction

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. Participate in discussions
2. Start assigned group presentations
3. Quizzes
4. Exams
5. Take notes from lecture

b. Out-of-class Assignments

1. Complete assigned reading from text and other material
2. Homework from the text
3. Complete assigned group presentations
4. Book report
5. Take-home test

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

- Written homework
- Laboratory projects
- Group activity participation/observation
- True/false/multiple choice examinations
- Mid-term and final evaluations
- Student participation/contribution
- Student preparation

14. Methods of Evaluating: Additional Assessment Information:

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

PO - Career and Technical Education

Fulfill the requirements for an entry-level position in their field.

Apply critical thinking skills to execute daily duties in their area of employment.

Display the skills and aptitude necessary to pass certification exams in their field.

PO-BS Critical Thinking

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Assess relevant information and come to thought-out conclusions and solutions.

IO - Global Citizenship - Ethical Behavior

Exhibit respect for self and others.

PO-SSS Self-Sufficiency and Independent Learning

Career/Transfer Center Resources

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:

1. Safety glasses.

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:

The regional automotive instructors conducted a series of meetings over the Fall of 2016 where we analyzed LMI and regional need. It was determined that the hybrid, fuel-cell and electric vehicle markets were increasing, thus demanding a trained workforce. For example, Toyota is now selling a hydrogen car; all manufacturers have hybrids and electrics, and Tesla keeps growing and introducing new models.

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]: *N/A*
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]: C = Non-Transferable
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*): ADVANCED TRANSPORTATION TECHNOLOGIES
Attach listings of Degree and/or Certificate Programs showing this course as a required or a restricted elective.

23. Enrollment - Estimate Enrollment

First Year: 14
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*

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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 06/27/17