



El Camino College  
COURSE OUTLINE OF RECORD – Official

<b>Course Acronym:</b>	ATEC
<b>Course Number:</b>	53
<b>Descriptive Title:</b>	Hybrid, Fuel-Cell and Electric Vehicle Diagnosis & Repair
<b>Division:</b>	Industry and Technology
<b>Department:</b>	Automotive Technology
<b>Course Disciplines:</b>	Automotive Technology
<b>Catalog Description:</b>	This course provides the student with the skills necessary to diagnose and repair basic to intermediate level malfunctions with hybrid, fuel-cell and electric vehicles. Students will perform regular maintenance service activities, testing with repair procedures, refueling, and Original Equipment Manufacturer (OEM) scan tool operations. This will instruct students in identifying and utilizing tools and equipment that can be sourced from manufacturers to facilitate these operations.
<b>Prerequisite:</b>	Automotive Technology 52 AND Automotive Technology 22B or Automotive Technology 25 with a minimum grade of "C" in prerequisite or concurrent enrollment
<b>Co-requisite:</b>	
<b>Recommended Preparation:</b>	
<b>Enrollment Limitation:</b>	
<b>Hours Lecture (per week):</b>	2
<b>Hours Laboratory (per week):</b>	3
<b>Outside Study Hours:</b>	4
<b>Total Course Hours:</b>	90
<b>Course Units:</b>	3
<b>Grading Method:</b>	Letter Grade only
<b>Credit Status:</b>	Credit, degree applicable
<b>Transfer CSU:</b>	Yes
<b>Effective Date:</b>	Fall 2023
<b>Transfer UC:</b>	No
<b>Effective Date:</b>	
<b>General Education: ECC</b>	
<b>Term:</b>	
<b>Other:</b>	
<b>CSU GE:</b>	
<b>Term:</b>	

	<b>Other:</b>
	<b>IGETC:</b>
	<b>Term:</b>
	<b>Other:</b>
<b>Student Learning Outcomes:</b>	<p><b>SLO #1 Safety</b></p> <p>Describe safety procedures and concerns when diagnosing and repairing hybrid, fuel-cell and electric vehicles.</p> <p><b>SLO #2 Diagnosis and Repair</b></p> <p>Locate and follow manufacturer service information related to diagnosis and repair of hybrid, fuel-cell and electric vehicles.</p> <p><b>SLO #3 Scan Tool</b></p> <p>Diagnose and repair a basic to intermediate level customer concern using an industry standard scan tool.</p>
<b>Course Objectives:</b>	<ol style="list-style-type: none"> <li>1. Describe safety procedures related to hybrid, fuel-cell and electric vehicle safety.</li> <li>2. List the similarities and differences, from a customer's perspective, between hybrid, fuel-cell and electric vehicles and internal combustion engine (ICE) vehicles.</li> <li>3. Compare and contrast the similarities and differences from the business perspective of servicing hybrid, fuel-cell and electric vehicles.</li> <li>4. Describe the system operation, component location, and diagnostic procedures for OEM hybrid, fuel-cell and electric vehicles.</li> <li>5. Describe the differences between aftermarket and OEM service tools.</li> <li>6. Diagnose, troubleshoot and repair basic to intermediate malfunctions of hybrid, fuel-cell and electric vehicles.</li> <li>7. Recognize which repairs can and cannot be performed outside of a manufacture's dealership service facilities.</li> <li>8. Flash reprogram a computer on a hybrid, fuel-cell or electric vehicle.</li> </ol>
<b>Major Topics:</b>	<p><b>I. Overview of Hybrid, Fuel-Cell and Electric Vehicle Diagnosis and Repair (2 hours, lecture)</b></p> <ol style="list-style-type: none"> <li>A. Safety</li> <li>B. Personal Protection Equipment (PPE)</li> <li>C. Tools and meters</li> <li>D. Facility/work area safety</li> <li>E. High Voltage (HV) batteries, inverters, capacitors</li> <li>F. Fuel-cells</li> <li>G. First-aid, rescuing a co-worker</li> </ol> <p><b>II. Overview of Hybrid, Fuel-Cell and Electric Vehicle Diagnosis and Repair (3 hours, lab)</b></p> <ol style="list-style-type: none"> <li>A. Safety policies and procedures</li> <li>B. Electrical measurements</li> <li>C. Insulated tool use and care</li> </ol>

### **III. History of the Technology (2 hours, lecture)**

- A. First hybrid, fuel-cell, electric vehicles
- B. Modern era history and progression
- C. Hybrid, fuel-cell, electric vehicles (federal/state regulations, fossil fuels, environmental concerns)
- D. Customer Relations
- E. Demographics/profile of typical buyer
- F. Customer expectations
- G. Owner's manual
- H. Interacting with hybrid, fuel-cell, electric vehicle customers
- I. Refueling
- J. Driving the car for maximum range

### **IV. Vehicle Walk-A-Round Ride and Drive (3 hours, lab)**

- A. Differences in components between each vehicle
- B. Charging ports and stations differences
- C. Driving modes
- D. Hydrogen filling stations

### **V. Common Components and Service Information (2 hours, lecture)**

- A. Wiring diagrams
- B. Special tools
- C. Diagnostic Trouble Codes
- D. 12 volt systems
  - 1. Battery, lighting, customer convenience
- E. High Voltage (HV) systems
  - 1. HV battery, inverter, fuel-cell, HV safety systems
- F. Internal combustion engine in hybrid
  - 1. Atkinson cycle
- G. Regular maintenance
  - 1. Filters, engine or transmission oils and regular visual inspections

### **VI. Standard Test Procedures (3 hours, lab)**

- A. Compression testing
- B. Absorbent Glass Mat (AGM) battery testing and charging
- C. Coolant testing

### **VII. Repair (4 hours, lecture)**

- A. Safety
- B. Unique issue with hybrid, fuel-cell and electric vehicles
- C. When to send the vehicle to the dealer
- D. Maintenance indicator lamps
- E. Service lamps and icons unique to hybrid, fuel-cell and electric vehicles
- F. Repair order

### **VIII. Regular Service Activities (6 hours, lab)**

- A. Repair order
- B. Oil changes
- C. Ignition
- D. Coolant
- E. Tires
- F. Air Conditioning (A/C) refrigerant precautions
- G. refrigerant

**IX. Scan Tool (2 hours, lecture)**

- A. Interpreting service information descriptions with generic scan tools
- B. Symptom-based and Diagnostic Trouble Code (DTC) based
- C. Updating the scan tool

**X. Scan Tool and Service Information Activities (3 hours, lab)**

- A. Navigation: inputs versus outputs
- B. Generic mode versus OEM mode
- C. Other functions: oscilloscope, pressure measurement, and Digital Multimeter (DMM) functions

**XI. Toyota Prius (or equivalent hybrid vehicle) (4 hours, lecture)**

- A. Warnings, cautions, dangers (service information)
- B. System type
- C. Common component function and location
- D. Unique component function and location

**XII. Toyota Prius (or equivalent hybrid vehicle) (6 hours, lab)**

- A. Familiarity and navigation of service information
- B. Unique maintenance procedures
- C. Scan tool familiarity
- D. Diagnostics and troubleshooting

**XIII. Toyota Mirai (or equivalent fuel-cell vehicle) (4 hours, lecture)**

- A. Warnings, cautions, dangers (service information)
- B. System type
- C. Common component function and location
- D. Unique component function and location

**XIV. Toyota Mirai (or equivalent fuel-cell vehicle) (6 hours, lab)**

- A. Familiarity and navigation of service information
- B. Unique maintenance procedures
- C. Scan tool familiarity
- D. Diagnostics and troubleshooting

**XV. Fiat E (or equivalent electric vehicle) (4 hours, lecture)**

- A. Warnings, cautions, dangers (service information)

- B. System type
- C. Common component function and location
- D. Unique component function and location

**XVI. Fiat E (or equivalent electric vehicle) (6 hours, lab)**

- A. Familiarity and navigation of service information
- B. Unique maintenance procedures
- C. Scan tool familiarity
- D. Diagnostics and troubleshooting

**XVII. Honda Civic Hybrid (or equivalent hybrid vehicle) (4 hours, lecture)**

- A. Warnings, cautions, dangers (service information)
- B. System type
- C. Common component function and location
- D. Unique component function and location

**XVIII. Honda Civic Hybrid (or equivalent hybrid vehicle) (6 hours, lab)**

- A. Familiarity and navigation of service information
- B. Unique maintenance procedures
- C. Scan tool familiarity
- D. Diagnostics and troubleshooting

**XIX. Chevrolet Volt (or equivalent plug-in hybrid vehicle) (4 hours, lecture)**

- A. Warnings, cautions, dangers (service information)
- B. System type
- C. Common component function and location
- D. Unique component function and location

**XX. Chevrolet Volt (or equivalent plug-in hybrid vehicle) (6 hours, lab)**

- A. Familiarity and navigation of service information
- B. Unique maintenance procedures
- C. Scan tool familiarity
- D. Diagnostics and troubleshooting

**XXI. Diagnosis & Troubleshooting (2 hours, lecture)**

- A. Five-step procedure
- B. OEM service information
- C. Aftermarket information
  - 1. Mitchell 1 or Identifix
- D. Training opportunities
  - 1. OEM
  - 2. NAPA Part Suppliers
  - 3. Complimentary coursework
- E. Internet information
- F. Diagnostic scenarios

	<p><b>XXII. Basic to Intermediate Diagnostic Scenarios (3 hours, lab)</b></p> <ul style="list-style-type: none"> <li>A. Five-step procedure</li> <li>B. Intermittent fault finding</li> <li>C. Technical Service Bulletins (TSB)</li> </ul> <p><b>XXIII. Flash Reprogramming (2 hours, lecture)</b></p> <ul style="list-style-type: none"> <li>A. Safety</li> <li>B. Proper set-up</li> <li>C. What to do if the reprogramming fails</li> <li>D. How to access the revised software</li> </ul> <p><b>XXIV. Flash Reprogramming (3 hours, lab)</b></p> <ul style="list-style-type: none"> <li>A. Manufacturer's scan tools</li> <li>B. Aftermarket scan tools</li> <li>C. Precautions to prevent expensive repairs</li> </ul>
<b>Total Lecture Hours:</b>	36
<b>Total Laboratory Hours:</b>	54
<b>Total Hours:</b>	90
<b>Primary Method of Evaluation:</b>	2) Problem solving demonstrations (computational or non-computational)
<b>Typical Assignment Using Primary Method of Evaluation:</b>	In a group of three students, work on the vehicle assigned to you. Find the service information for your vehicle's power down procedure and demonstrate each step ensuring safety needs are met. Make sure that all the procedural guidelines are followed, the correct safety equipment is used, and the proper tools are utilized. Your group will be evaluated on your performance of this task.
<b>Critical Thinking Assignment 1:</b>	Given a hybrid, fuel-cell or electric vehicle with a system malfunction, a scan tool and service information; repair the system malfunction. Document diagnostic steps, faults found and needed repairs on a one-to two-page lab report. Submit your report to the instructor.
<b>Critical Thinking Assignment 2:</b>	Given a scan tool, compression tester and service information: Perform a cylinder compression test on a hybrid vehicle with an internal combustion engine. Document the service procedure steps, any faults found and possible causes of the faults on a one-to two- page lab report and submit to the instructor.
<b>Other Evaluation Methods:</b>	Class Performance Homework Problems Laboratory Reports Multiple Choice Objective Exam Term or Other Papers True/False Written Homework

<b>Instructional Methods:</b>	Demonstration Discussion Field Trips Group Activities Guest Speakers Lab Lecture Multimedia Presentations Role Play/Simulation
<b>If other:</b>	Internet Presentation/Resources Observation
<b>Work Outside of Class:</b>	Answer questions Problem solving activity Required reading Study Written work (such as essay/composition/report/analysis/research)
<b>If Other:</b>	
<b>Up-To-Date Representative Textbooks:</b>	Craig Van Batenburg. <u>Understanding Hybrid and Electric Vehicle Service and Technology</u> ACDC Self-Published, 2013 DISCIPLINE STANDARD
<b>Alternative Textbooks:</b>	
<b>Required Supplementary Readings:</b>	Instructor hand-outs
<b>Other Required Materials:</b>	Electude: Simulation-based learning solutions for visual and kinesthetic learners
<b>Requisite:</b>	Prerequisite
<b>Category:</b>	sequential
<b>Requisite course(s): List both prerequisites and corequisites in this box.</b>	Automotive Technology 52 AND Automotive Technology-22B OR Automotive Technology 25 or concurrent enrollment.
<b>Requisite and Matching skill(s): Bold the requisite skill. List the corresponding course objective under each skill(s).</b>	<b>Explain safety concerns and protocols related to hybrid and electric vehicles and service equipment.</b>  ATEC 52 - Comply with shop and vehicle safety practices relevant to electric, hybrid, and fuel cell vehicles. <b>Electrical fundamentals Automotive Technology 25</b> ATEC 25 - Diagnose and repair electrical circuits. ATEC 25 - Examine electrical components.  ATEC 25 - Diagnose electrical circuits (Automotive Service Excellence (ASE) tests).

	<p>ATEC 25 - Evaluate computer controlled components.</p> <p>ATEC 25 - Analyze electrical testing data and recommend needed repairs.</p> <p><b>Ability to perform engine diagnosis.</b></p> <p>ATEC 22B - Perform engine diagnosis using a flow chart.</p>
<b>Requisite Skill:</b>	
<b>Requisite Skill and Matching Skill(s): Bold the requisite skill(s). If applicable</b>	
<b>Requisite course:</b>	
<b>Requisite and Matching skill(s): Bold the requisite skill. List the corresponding course objective under each skill(s).</b>	
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<b>Enrollment Limitations and Category:</b>	
<b>Enrollment Limitations Impact:</b>	
<b>Course Created by:</b>	Edward Matykiewicz
<b>Date:</b>	09/04/2017
<b>Original Board Approval Date:</b>	
<b>Last Reviewed and/or Revised by:</b>	Edward Matykiewicz
<b>Date:</b>	03/08/2022
<b>Last Board Approval Date:</b>	06/20/2022