COURSE INFORMATION FORM

DISCIPLINE: Automotive Technology
COURSE TITLE: Alternative Fuels and Vehicles

CR.HR. 6  LECT HR. 3  LAB HR. 6  CLIN/INTERN HR.  CLOCK HR. 

CATALOG DESCRIPTION

This course incorporates history, theories of operation, maintenance, diagnosis and repair of alternative fuel vehicle power trains including hybrid electric vehicles. Computerized management systems related to alternative fuel and hybrid electric vehicles will be covered in detail.

PREREQUISITES

AUTO 100, AUTO 150, AUTO 166, AUTO 276, and AUTO 279.
Concurrent enrollment in or completion of AUTO 280.

EXPECTED STUDENT OUTCOMES IN THE COURSE (ESO)

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

1. Demonstrate the cognitive and manipulative behaviors necessary to complete assigned tasks.
2. Describe and employ safe work habits, observing both personal safety and a concern for the safety of others.
3. Analyze, diagnose, and determine necessary actions to solve alternative fuel vehicle concerns.
4. Apply procedures needed to successfully perform service operations.
5. Employ effective behaviors necessary to successfully work with others.

GENERAL EDUCATION OUTCOMES (ESO)

Specify which general education outcomes, if any, are substantially addressed by the course. Numbers in parentheses identify the Expected Student Outcomes linked to the specific General Education Outcome.

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<th>Outcomes</th>
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PROGRAM-LEVEL OUTCOMES

CAREER AND TECHNICAL EDUCATION PROGRAM OUTCOMES
Specify which Career and Technical program outcomes, if any, are substantially addressed by the course by completing the “Career and Technical Education template” to show the relationship between course and program outcomes to assessment measures.

1. Students will demonstrate the knowledge necessary to obtain recognized certifications.
2. Students will demonstrate or apply knowledge of basic sciences to the practices of automotive technology.
3. Students will demonstrate knowledge and application of safety rules and regulations.
4. Students will exhibit professional behavior.
5. Students will be able to use mathematics as it pertains to automotive technicians.

CLASS-LEVEL ASSESSMENT MEASURES
Student accomplishment of expected student outcomes may be assessed using the following measures. (Identify which measures are used to assess which outcomes.)

1. Written evaluation (1-4)
2. Oral evaluation (1-5)
3. Performance exam (1-4)
4. Written laboratory assignments (1-5)
I. Introduction to alternative fuel vehicles  
   A. Hybrid vehicles  
   B. Fuel cell vehicles  
   C. Ethanol  
   D. Methanol  
   E. Propane  
   F. Other alternative fuels  

II. Carbon based fuels and the environment  
   A. Purpose of alternative fueled vehicles  
   B. Chemical fundamentals of a carbon-based society  
   C. The Clean Air Act  
   D. Emission standards in the United States  
   E. European standards  
   F. Ozone  
   G. Ultraviolet radiation absorption  
   H. Kyoto protocol  
   I. Health effects of air pollution  
   J. Acid rain  
   K. Carbon footprint  
   L. Global warming  

III. Introduction to hybrid vehicles  
   A. Hybrid vehicle  
   B. Driving and owning a hybrid vehicle  
   C. Classifications of hybrid vehicles  
   D. Levels of hybrid vehicles  

IV. Internal combustion engine systems  
   A. Hybrid internal combustion engine systems  
   B. Engine fundamentals  
   C. Atkinson cycle  
   D. Engine specifications  
   E. Torque, work, and power
F. Hybrid engine lubrication systems
G. Engine oil
H. Synthetic oil
I. Oil change intervals
J. Hybrid engine ignition system
K. Oxygen sensors
L. Wide-band oxygen sensors
M. Fuel injection systems
N. Fuel pressure and volume diagnosis
O. Fuel injectors
P. Electronic throttle controls

V. Gasoline
   A. Refining
   B. Volatility
   C. Gasoline combustion process
   D. Normal and abnormal combustion
   E. Octane rating
   F. Gasoline additives
   G. Viscosity
   H. Flash point
   I. Moisture Content
   J. Corrosivity

VI. Alternative fuels
    A. Ethanol
    B. Cellulose ethanol
    C. E85
    D. Methanol
    E. Propane
    F. Compressed natural gas (CNG)
    G. Liquefied natural gas (LNG)
    H. P-series fuels
    I. Synthetic fuels
    J. Safety precautions when working with alternative fuels

VII. Diesel and biodiesel fuels
     A. Diesel fuel
     B. Biodiesel fuel
     C. Biodiesel production

VIII. Hybrid safety
     A. High-voltage safety
     B. High-voltage safety equipment

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C. Electrical shock potential  
D. De-powering the high-voltage system  
E. Checking for potential voltage  
F. Collision and repair industry industry issues  
G. Moving and towing a hybrid  
H. Removing high-voltage batteries  
I. Routing service procedures  

IX. Hybrid Batteries  
A. Battery types  
   1. Lead-Acid batteries  
   2. Nickel-cadmium  
   3. Nickel-metal hydride  
   4. Lithium-ion  
   5. Lithium polymer  
   6. Zink-air  
   7. Sodium-sulfur  
   8. Sodium-metal-chloride  
B. Battery comparisons  
C. Auxiliary batteries  
D. Battery ratings  
E. High-voltage battery construction  
F. High-voltage battery cooling  
G. High-voltage service  

X. Electric motors, generators, and controls  
A. Fundamentals of magnetism  
B. Electromagnetic induction  
C. Electric motors  
D. Brushless motors  
E. Motor phasing  
F. Motor controls  
G. Capacitors in hybrid controllers  
H. Converters and inverters  
I. Electric power steering  

XI. Regenerative braking systems  
A. Principles of regenerative braking  
B. Types of regenerative braking systems  
C. Battery charging during regenerative braking  
D. Deceleration rates  
E. Engine design changes related to regenerative braking  
F. Servicing regenerative braking systems
XII. Hybrid vehicle transmissions and transaxles
   A. Types of transmissions and transaxles
   B. Hybrid transmission and transaxle operation
   C. Hybrid transmission and transaxle service
   D. Continuously variable transmissions and transaxles

XIII. Hybrid vehicle heating and air conditioning
   A. Hybrid air conditioning systems
   B. Hybrid air conditioning system operation
   C. Hybrid air conditioning system components
   D. Cabin heating systems
   E. Hybrid electrical system cooling
   F. Battery temperature maintenance systems

XIV. First responder procedures

XV. Comparison of manufacturer specific hybrid systems

XVI. Fuel cells and advanced technologies
   A. Fuel-cell technology
   B. PEM fuel cells
   C. Direct methanol fuel cells
   D. Fuel-cell vehicle systems
   E. Hydrogen storage
   F. Hydraulic-hybrid storage system
   G. HCCI
   H. Plug-in hybrid electric vehicles
   I. Future technologies
   J. Wind power
   K. Hydroelectric power