COURSE INFORMATION FORM

DISCIPLINE
Automotive Technology

COURSE TITLE
Hybrid Electric Vehicles

CR.HR 4      LECT HR 2      LAB HR 4      CLIN/INTERN HR. _____      CLOCK HR. _____

CATALOG DESCRIPTION

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

PREREQUISITES

AUTO 100, AUTO 150, AUTO 166, AUTO 276, 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 Hybrid Electric 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 the 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)
Individual instructors may order this outline as fits the needs of their individual courses. In addition, they may place more emphasis on some areas than on others. What is assured is that this particular list is covered in the course. Other topics may be added to a course as the instructor sees fit, and as time and interest allow. An *asterisk can be used to mark an item as optional.

I. Introduction to Hybrid Electric Vehicles
   A. Classifications of Hybrids
   B. Driving a hybrid
   C. Levels of hybrids

II. Electricity review
   A. Electrical theories
   B. Electron flow
   C. DC
   D. AC
   E. Electrical paths in a hybrid vehicle

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

IV. 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

V. 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

VI. 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

VII. 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

VIII. 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

IX. First responder procedures

X. Comparison of manufacturer specific hybrid vehicle systems