

City College of San Francisco
 Course Outline of Record
 Course Status: Active

I. GENERAL DESCRIPTION

A. Approval Date	September 2016
B. Effective Semester	Spring 2017
C. Department	Automotive, Motorcycle, Construction & Building Maintenance
D. Course Number	AUTO 56
E. Course Title	Introduction to Hybrid and EV Auto Maintenance and Repair
F. Course Outline Originator	Nick Rothman
G. Department Chairperson	Ben Macri
H. Dean	David Yee

II. COURSE SPECIFICS

A. Hours	Lecture: 52.5 total Lab: 52.5 total
B. Units	4
C. Prerequisite	AUTO 50 and AUTO 51
Corequisite	None
Pre/Corequisite	None
Advisory	None
Advisory Pre/Corequisite	None
D. Course Justification	Hybrid electric vehicles are a relatively new addition to the automotive world. Both technicians in training and seasoned technicians will benefit from this course. The basics of hybrid and electric vehicle technology are covered with a strong emphasis on safety. This course will also serve as a base for advanced content related to Hybrid and Electric vehicles covered in higher level classes like automotive electrical and air conditioning.
E. Field Trips	Yes
Description of Field Trips	Yes, trip to local repair shop that specializes in hybrid vehicle repair.
F. Method of Grading	Letter or Pass/No Pass
G. Repeatability	Course is not repeatable

III. CATALOG DESCRIPTION

Principles and functions of hybrid automobiles, and procedures for their maintenance, problem diagnosis and repair. Function of individual system components examined. Critical importance of safety and hybrid-unique equipment and procedures. Maintenance procedures and diagnostic and repair processes for common hybrids (Toyota and Ford) taught in detail.

IV. STUDENT LEARNING OUTCOMES

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

- A. Explain introductory principles of motor and generator basics, and battery basics.
- B. Demonstrate safety procedures and describe their critical importance.
- C. Perform routine maintenance per manufacturer specifications.
- D. Diagnose and solve mechanical and electrical problems.
- E. Describe the locations and functions of hybrid system components in a vehicle.

V. CONTENTS

- A. Introductory principles
 1. Hybrid and electric vehicle vocabulary
 2. Automotive information resources
 3. Hybrid and electric vehicles in production
 4. Types of hybrid systems

- a. Series
 - b. Parallel
 - c. Series parallel
 - d. Mild and assist hybrids
 - e. Plug-in hybrids
- 5. Electrical theory basics
 - a. Electrical basics
 - b. Safety implications
- B. Motor and generator basics
 - 1. Basic motor operations
 - a. Series
 - b. Parallel
 - 2. Generators
 - 3. Motor generators
 - 4. Controllers
- C. Battery basics
 - 1. Lead-acid (Pb-A)
 - 2. AGM battery (12 volt system)
 - 3. High-voltage (HV) system batteries
 - a. NiMH
 - b. Li-Ion and other new battery technologies
 - c. Importance of HV state-of-charge
- D. Hybrid system components and operation
 - 1. System components
 - a. Internal combustion engine (ICE) and motor generators (MG)
 - b. Battery pack
 - c. Rectifiers, inverters, converters
 - d. Cables, switches
 - 2. Battery charging
 - 3. Regenerative braking
 - 4. Driving
- E. Safety
 - 1. Personal safety
 - 2. Gloves
 - 3. Tools and equipment
 - a. Mega-ohm meter
 - b. Scanners (eg, Toyota techstream)
 - c. Using appropriate fluids
 - 4. Safety procedures (Shop)
 - a. Depowering HV system
 - b. Importance of ensuring auto in shutdown mode
 - c. Repowering HV system
 - 5. Safety procedures (test driving)
- F. GM and/or Toyota (plug-in hybrid)
 - 1. Routine maintenance (unique to this type of hybrid system)
 - a. System-specific fluids
 - b. Other system-specific requirements (e.g., tires)
 - 2. Diagnostics (for plug-in hybrid-system related problems)
 - a. Types and use of test equipment
 - b. Reading data codes
 - c. Assuring proper use of fluids
- G. Toyota and/or Ford (full hybrid) systems
 - 1. Routine maintenance (unique to this type of hybrid system)
 - a. System-specific fluids
 - b. Other system-specific requirements (e.g., tires)
 - 2. Diagnostics (for hybrid-system related problems)
 - a. Types and use of test equipment
 - b. Reading data codes
 - c. Assuring proper use of fluids

VI. INSTRUCTIONAL METHODOLOGY

A. Assignments

1. **In-class activity:** Participation in class discussion of principles, operational basics, safety procedures, and the maintenance and diagnostic procedures appropriate to sample vehicle.
 2. **In-class activity:** Participate in a group conducting routine diagnostics and maintenance on a college vehicle (or vehicles), and by responding to instructor questions to individual group members.
 3. **In-class activity:** Presentation of summary of the findings of the paper analyzing vehicle systems, to enable other students to improve their understanding of the competing systems and their functionality.
 4. **Out-of-class assignment:** Evaluations of on-line resources. Each student will be expected to critique either a manufacturer or independent web-site providing information on hybrid system operations. This will assist students in understanding the types of information that they will be able to obtain from on-line resources.
 5. **Out-of-class assignment:** Textbook and hand-out reading assignments.
 6. **Out-of-class assignment:** Write a paper analyzing one of the current (Toyota, Honda, Nissan, GM or Tesla) vehicle systems. Such a paper would be expected to demonstrate knowledge of the operation of the particular system, its strengths, its weaknesses and the complexity it adds to a non-hybrid vehicle (both mechanical and electrical).
- B. Evaluation
1. **Exams/Quizzes/Tests:** Weekly written exams on the subjects of the course. The first exams will emphasize principles, basics, components and operations, safety, maintenance and diagnostic procedures.
 2. **Performance:** Student demonstration of hybrid auto maintenance and diagnostic procedures. Demonstrate ability to diagnose a sample problem arranged by instructor. For example, "Demonstrate (or describe, as appropriate) the procedure for testing insulating gloves before each use.
 3. **Participation:** Participation in in-class discussions
 4. **Written work:** Online resources critique demonstrating ability to effectively locate and describe resources on components, manufacturer specifications and other vehicle information.
 5. **Other:** Paper and presentation analyzing vehicle systems evaluated on appropriate description and analysis of basic principles, resources, components and functions
 6. **Final Assessment:** Final exam designed to assess students comprehension of hybrid and electric vehicle technology and industry standard safe working practices as related to electrified vehicles. Exam will include questions related to all content areas covered during in the class.
- C. Representative Textbooks and Other Instructional Materials
1. Erjavec, Jack & Jeff Arias. 2012. *Hybrid, Electric & Fuel Cell Vehicles*. .
 2. Instructor hand outs such as Toyota hybrid service procedures.
 3. Library resources such as articles from Popular Mechanics, Car and Driver, Road and Track, and Automotive Engineering on new hybrid and electric car developments.
 4. Website: <http://www.hybridcenter.org/hybrid-center-how-hybrid-cars-workunder-the-hood-2.html>
 5. Website: <http://auto.howstuffworks.com/hybrid-car2.htm>

VII. TITLE 5 CLASSIFICATION

CREDIT/DEGREE APPLICABLE (meets all standards of Title 5. Section 55002(a))

Generated on: 2/2/2018 7:45:34 AM