

1. Changes Being Made**2. Course Number and Title**

AUTO 89.3 Introduction to Hybrid, Electric Vehicle, and Alternative Propulsion Vehicle Technology

3. Discipline

AUTO - Automotive

4. Title 5 Category

AA/AS Degree

5. Certificate Applicable**6. Number of Units (Zero units for non-credit courses)**

4

7. Contact hours per term

48 – 54 Lecture

48 – 54 Lab

Activity

Out-of-Class Hours

Independent Study

Individualized Instruction

Maximum class size 25



Safety Issues

Based on Laboratory supervision requirements.

Enrollment Justification: Standard Automotive class size

TOP Code 094800 - Automotive Technology

8. Special Topics

No

9. Grading GRD - Letter Grade Only**10. Repeatability**

0

11. Catalog Description

This course explores the use of Hybrid, Electric power, and alternative fuels for vehicle transportation. Physics of battery storage, Hybrid generation systems, Electric vehicle applications and their integrated systems from many manufactures will be discussed. This course is suitable for students entering

12. Schedule Description

This course covers basic safety, theory, and maintenance of Hybrid, Electric Vehicle, and Alternative Propulsion Vehicles. It is the prerequisite to the Alternative Fuels intermediate courses.

13. Entrance Skills

Recommended Skill: ENGL 6

● ENGL 6 - Read and understand a variety of materials at an appropriate level of difficulty.

Recommended Skill: MATH 6

Requisite Skill: AUTO 50

● AUTO 50 - Recognize and identify shop safety, environmental hazards and sustainable environmental practices in an automotive repair facility.

● AUTO 50 - Identify and evaluate the correct automotive tool or equipment to use to facilitate an automotive repair

● AUTO 50 - Identify the major operating systems of an automobile.

● AUTO 50 - Identify and evaluate the correct measuring instrument to be used during automotive repairs

● AUTO 50 - Recognize and differentiate the automotive repair field areas of expertise.

14. Requisites

Prerequisite

Standard

none

AUTO 50

Lee Bennett VVC Automotive

Keith Shaner VVC Automotive

A minimum grade of C

Validated Date: 02/14/2017

Required safety and shop operation prerequisite for most Automotive courses.

Recommended Prep

ENGL 6

15. A. Instructional Objectives

Upon completion of the course the student should be able to:

1. Recognize and identify shop safety, environmental hazards and sustainable environmental practices in an automotive repair facility.

a. Exams/Tests/Quizzes

b. Simulation

c. Class Participation

d. Class Work

2. Identify and evaluate Hybrid / Electronic vehicle systems and components.

a. Exams/Tests/Quizzes

b. Simulation

c. Class Participation

d. Class Work

3. Use of supplemental materials, i.e. cut-a-ways, component parts, and running vehicles.

a. Exams/Tests/Quizzes

b. Simulation

c. Lab Activities

d. Competency based written and practical tests which demonstrate the students ability to apply skills and concepts learned to minimum standards established by the instructor

4. Demonstration of the use of current computer diagnostic equipment used in the transportation industry today.

a. Exams/Tests/Quizzes

b. Simulation

c. Lab Activities

d. Evaluate knowledge of assigned text reading and E-book pre-tests.

a. Exams/Tests/Quizzes

b. Home Work

c. Competency based written and practical tests which demonstrate the students ability to apply skills and concepts learned to minimum standards established by the instructor

6. Perform CDX/NATEF (trade approved) lab assignment and proficiency sheets

a. Lab Activities

b. Competency based written and practical tests which demonstrate the students ability to apply skills and concepts learned to minimum standards established by the instructor

B. Student Learning Outcomes

Upon completion of the course the student can:

1. Demonstrate the precautions needed to safely work with high voltage systems.

2. Demonstrate acquired knowledge related to the components used on modern Hybrid / Electronic vehicles.

3. Demonstrate familiarity with reference materials such as schematics, flow charts, logic trees, and workshop manuals to aid in battery system troubleshooting.

4. Demonstrate the electrical and computer skills required to repair and maintain Hybrid / Electronic vehicles.

5. Demonstrate personal and shop safety procedures.

C. Course Content

I. Vehicle safety

II. Sp2SafetyCertificates

III. High voltage PPE's

IV. Vehicle Service Disconnect

V. Drive Systems

A. Motor

B. Controller

C. Wiring

D. Ultra-capacitors

E. Maintenance and service

VI. Regenerative Braking (electrical energy recovery)

A. Principles of Operation

B. Charging / Recharging Characteristics

C. Maintenance and Service Requirements

D. Safety and Emergency Considerations

VII. Battery

A. Construction

B. Lead Ni-cad, Hi-Metal Nickel, Lithium Ion

C. Charging/discharging Characteristics

D. Maintenance and Service Requirements

E. Safety and Emergency Considerations

VIII. Power Management Systems

A. Signals and Telemetry Principles

B. General construction and fabrication

C. Power and Dissipation Ratios

D. Testing and Basic Troubleshooting

IX. On Board Computer Systems

A. Types and Operating Characteristics

g into automotive alternative fuels or power generation and energy technology field. This course is a required course for the Alternative Vehicle Propulsion Certificate / Degree.

A.Sp2SafetyCertificates B.High voltage PPE's C. Vehicle Service Disconnect

- B. Power and Back up systems
- C. Input and Monitoring Functions
- D. Output and Monitoring Functions
- E. Data Acquisition and transfer
- F. Testing and diagnosis
- X. System Monitoring Sensors
 - A. Current
 - B. Voltage
 - C. Frequency
 - D. Battery Charge / Discharge
- I. Amperes
- II. Watts
- III. Electrolyte
 - A. Temperature
- I. Motor
- II. Braking /Regenerative
- III. Battery
- IV. Capacitor SOC
- V. Ambient Levels
- VI. PRM
- VII. Power in / Out Invertors

- I. Instrument Cluster
 - A. Data Transfer Principles, (SAE, ISO)
 - B. Available Diagnosis
 - C. Display functions
 - D. Source of Error Codes
 - E. Monitoring System Interface
- II. Wiring, Cables and harness
 - A. Routing and Mechanical Protection
 - B. Connector
 - C. Terminal Repair
 - D. Voltage Drops
 - E. Fusing and Electrical System Protection
 - F. Troubleshooting and Maintenance
- III. Peripheral Systems
 - A. Climate Control (Heating / Air Conditioning, Heat Pump)
- I. Power Consumption
- II. Controls
- III. Temperature Limits
- IV. Ventilation

- I. Hybrid Controllers
- I. Regenerative Power Storage
- II. IMA Systems
- III. Motor Types
 - K. Fuel Cell
 - I. Types and Operating Characteristics
 - II. Fuel sources
 - III. Construction of cells
 - IV. Safe Handling of High Voltage Components
 - V. Maintenance

D. Course Lab Content

- I. Vehicle safety
- II. Sp2 Safety Certificates
- III. High voltage PPE's
- IV. Vehicle Service Disconnect
- V. Drive Systems
 - A. Motor
 - B. Controller
 - C. Wiring
 - D. Ultra-capacitors
 - E. Maintenance and service
- VI. Regenerative Braking (electrical energy recovery)
 - A. Principles of Operation
 - B. Charging / Recharging Characteristics
 - C. Maintenance and Service Requirements
 - D. Safety and Emergency Considerations
- VII. Battery
 - A. Construction
 - B. Lead Ni-cad, Hi-Metal Nickel, Lithium ion
 - C. Charging/discharging Characteristics
 - D. Maintenance and Service Requirements
 - E. Safety and Emergency Considerations
- VIII. Power Management Systems
 - A. Signals and Telemetry Principles
 - B. General construction and fabrication
 - C. Power and Dissipation Ratios
 - D. Testing and Basic Troubleshooting
- IX. On Board Computer Systems
 - A. Types and Operating Characteristics
 - B. Power and Back up systems
 - C. Input and Monitoring Functions
 - D. Output and Monitoring Functions
 - E. Data Acquisition and transfer
 - F. Testing and diagnosis
- X. System Monitoring Sensors
 - A. Current
 - B. Voltage
 - C. Frequency
 - D. Battery Charge / Discharge
 - 1. Amperes
 - 2. Watts
 - 3. Electrolyte
 - a. Temperature
 - 1. Motor
 - 2. Braking /Regenerative
 - 3. Battery

A.Sp2SafetyCertificates B.High voltage PPE's C. Vehicle Service Disconnect

4. Capacitor SOC
5. Ambient Levels
6. PRM
7. Power in / Out Invertors
1. Instrument Cluster
 - a. Data Transfer Principles, (SAE, ISO)
 - b. Available Diagnosis
 - c. Display functions
 - d. Source of Error Codes
 - e. Monitoring System Interface
2. Wiring, Cables and harness
 - a. Routing and Mechanical Protection
 - b. Connector
 - c. Terminal Repair
 - d. Voltage Drops
 - e. Fusing and Electrical System Protection
 - f. Troubleshooting and Maintenance
3. Peripheral Systems
 - a. Climate Control (Heating / Air Conditioning, Heat Pump)
1. Power Consumption
2. Controls
3. Temperature Limits
4. Ventilation
1. Hybrid Controllers
1. Regenerative Power Storage
2. IMA Systems
3. Motor Types
- K. Fuel Cell
 1. Types and Operating Characteristics
 2. Fuel sources
 3. Construction of cells
 4. Safe Handling of High Voltage Components
 5. Maintenance
 - i. Amperes
 - ii. Watts
 - i. Electrolyte
 - i. Temperature
- a. Motor
- b. Braking /Regenerative
- c. Battery
- d. Capacitor SOC
- e. Ambient Levels
- f. PRM
- g. Power in / Out Invertors

1. Instrument Cluster
 - a. Data Transfer Principles, (SAE, ISO)
 - b. Available Diagnosis
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2. Wiring, Cables and harness
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1. Hybrid Controllers
1. Regenerative Power Storage
2. IMA Systems
3. Motor Types

- K. Fuel Cell
 1. Types and Operating Characteristics
 2. Fuel sources
 3. Construction of cells
 4. Safe Handling of High Voltage Components
 5. Maintenance

E. Activity Content

none

F. Assignments

1. *Required Assignment - Describe in detail one specific example of a writing or problem solving or performance assignment. MATCH INSTRUCTIONAL OBJECTIVES TO THIS ASSIGNMENT BY USING THE BLUE LINK BELOW*
 Perform CDX/NATEF (trade approved)lab assignment and proficiency sheet #C561: Identify high-voltage circuits of Electric (EV) or Hybrid-electric vehicle and related safety precautions.
 1. Perform CDX/NATEF (trade approved)lab assignment and proficiency sheets
2. *Required Out of Class Assignment - Describe in detail one specific homework/out of class assignment. MATCH INSTRUCTIONAL OBJECTIVES TO THIS ASSIGNMENT BY USING THE BLUE LINK BELOW.*
 CDX E-book Chapter 52: Alternative Fuel System pre- and post-chapter examinations
 1. Evaluate knowledge of assigned text reading and E-book pre-tests.
3. *Required Reading Assignment - Describe in detail the chapter or article being read and the purpose for this assignment. MATCH THE INSTRUCTNL OBJECTVES FOR THIS ASSGNMNT BY USING THE BLUE LINK BELOW*
 CDX E-book Chapter 52: Alternative Fuel System text reading assignment
 1. Evaluate knowledge of assigned text reading and E-book pre-tests.

G. Methods of Instruction

1. Laboratory/Studio/Activity
2. Lecture
3. Web Enhanced-full classroom w/online components

H. Methods of Evaluation

1. Exams/Tests/Quizzes
2. Written Assignments
3. Simulation
4. Group Projects
5. Class Participation
6. Class Work
7. Home Work
8. Lab Activities
9. Competency based written and practical tests which demonstrate the students ability to apply skills and concepts learned to minimum standards established by the instructor

16. Text and Other Materials

Textbooks:
 Kirk Van Gelder, [CDX Auto E-book Fundamentals of Automotive Technology](#), 2nd ed. Burlington, Ma: Jones and Bartlett Learning, 2017, ISBN: 9781284109.

17. Distance Education: Regular Effective Contact

18. Learning Resources

none

19. Library Resources

Part A:
 The Library has sufficient resources presently available to support this course.

Part B:
 In order to maintain currency in the subject area(s) related to the proposed new course, please recommend current books or media sources (DO NOT include course text books) for purchase:

None

20. **Academic Accommodation**

- A. A course syllabus or other explanation with due dates for course materials and assignments is available for students in alternative formats (e.g., electronic format).
- B. Auxiliary aids can be used in classroom or lab setting (e.g., Tape recorder, interpreters, and mobility devices).
- C. If this course requires field trips, there will be alternatives for field trips.
- D. Material is available in more than one modality or methodology (e.g., visual, oral, tactile).
- E. Students have access to the instructor to discuss accommodations.
- F. Technology used to deliver Distance Education components of this course meet standards for accessibility to persons with disabilities.
- G. Video or audiotapes are available in accessible formats.

21. **Dates**

Board of Trustees Date 10/10/17
Effective Date 09/27/18
State Approval Date 10/25/17
Last Outline Revision Date 09/28/17
CC Approval Date 09/28/17
Content Review Date 09/28/17

22. **Proposed Start Date**

Fall of 2018

23. **Cross Listed Courses**

24. **Need for Course**

This is the first class in a degree/ certificate series of new technology classes supported by Strong Workforce development as identified by the Automobile Industry ATRE (Advanced Technology and Renewable Energy) in an effort to promote New Technologies training and curriculum to address Califo

25. **Attached Files**

mia's environmental challenges relating to Automobile emissions.

