

Victor Valley College Course Outline

1. Changes Being Made

2. Course Number and Title

AUTO 89.4 Hybrid Vehicle Propulsion

3. Discipline

AUTO - Automotive

4. Title 5 Category

AA/AS Degree

5. Certificate Applicable

6. Number of Units (Zero units for non-credit courses)

3

7. Contact hours per term

32 – 36 Lecture

48 – 54 Lab

Activity

Out-of-Class Hours

Independent Study

Individualized Instruction

Maximum class size

☒ Other - do not use class room seats as a reason.

Lab size restricted by risk management to 25 unless IA is present. IA is not available some evenings.

☒ Safety Issues

Lab size restricted by risk management to 25 unless IA is present. IA is not available some evenings.

Enrollment Justification: There is still a glitch that records the class size as 25, 25, 25 and saves as no number. The class size recommended for this course is 25.

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 vehicle propulsion for vehicle transportation. Topics will include: safety when using high voltage, Hybrid vehicle drive systems, Battery technology, Hybrid generation systems, energy management systems, Hybrid vehicle peripheral systems. Hybrid vehicle maintenance, service, diagnostic and repair procedures will also be covered.

12. Schedule Description

This intermediate-level Hybrid vehicle systems class will place an emphasis on theory, operation, maintenance, diagnosis and repair of Hybrid vehicle systems.

13. Entrance Skills

Recommended Skill: Satisfactory completion of Auto 79, 80, 80.6, 80A, or 82.0.

- AUTO 80.6 - Recognize and identify shop safety, environmental hazards and sustainable environmental practices in an automotive shop
- AUTO 80A - Recognize and identify shop safety, environmental hazards and sustainable environmental practices in an automotive shop
- AUTO 80A - Recognize and evaluate the condition of an automotive electrical system
- AUTO 79 - Recognize and identify shop safety, environmental hazards and sustainable environmental practices in an automotive shop
- AUTO 80.6 - Identify and evaluate electrical values using Ohms and Watts Law
- AUTO 80.6 - Recognize and evaluate the condition of an automotive electrical (circuit) system
- AUTO 82 - Recognize and identify shop safety, environmental hazards and sustainable environmental practices in an automotive shop
- AUTO 82 - Recognize and evaluate the condition of an automotive electrical system
- AUTO 79 - Analyze electrical malfunctions pertaining to customer driveability complaints.

Recommended Skill: Or possession of current ASE A-6 certification.

- AUTO 82 - Recognize and evaluate the condition of an automotive electrical system

Recommended Skill: Or 2 years of full-time Automotive trade experience in electrical, diagnostic, and runnability.

- AUTO 80 - Recognize and evaluate the condition of an automotive electrical system

Requisite Skill: Auto 50 - Recognize and identify shop safety, environmental hazards and sustainable environmental practices in an automotive shop Identify and perform safe High Voltage circuit handling practices

Requisite Skill: AUTO 89.3

14. Requisites

Prerequisite

Standard

none

AUTO 89.3

none

A minimum grade of C

Validated Date: 02/16/2017

Introductory level prerequisite course in series for Alternative Propulsion certificate or degree.

and Prerequisite

Equivalent Experience

not transferable

AUTO 50

Steve Coultas

Lee Bennett

A minimum grade of C

Validated Date: 03/28/2017

Department curriculum is aligned with the requirements from the ASE.

or Recommended Prep

Automotive tune-up, emission control, and fuel systems

AUTO 79

or Recommended Prep

Automotive computers, electronics, and electrical systems

AUTO 80

or Recommended Prep

Introduction to automotive electricity

AUTO 80.6

or Recommended Prep

Automotive computers, electronics, and electrical systems

AUTO 80A

or Recommended Prep

Automotive electrical repair

AUTO 82

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. Competency based written and practical tests which demonstrate the students ability to apply skills and concepts learned to minimum standards established by the instructor
2. Identify and evaluate systems and components related to modern

Hybrid vehicles.

- a. Exams/Tests/Quizzes
 - b. Simulation
 - c. Class Participation
 - d. Home Work
 - e. Lab Activities
 - f. Competency based written and practical tests which demonstrate the students ability to apply skills and concepts learned to minimum standards established by the instructor
3. Identify and evaluate Hybrid systems through the use of reference materials such as schematics, flow charts, logic trees, and workshop manuals to aid in Hybrid system troubleshooting.
 - a. Class Participation
 - b. Lab Activities
 - 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
 4. Identify and evaluate Hybrid systems through the use of electrical and computer skills required to maintain, diagnose, and repair Hybrid vehicle systems
 - a. Exams/Tests/Quizzes
 - b. Simulation
 - c. Class Participation
 - d. Lab Activities
 - e. 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 personal and shop precautions needed to safely work with high voltage systems.
2. Demonstrate acquired knowledge related to the systems and components used on modern Hybrid vehicles.
3. Demonstrate familiarity with reference materials such as schematics, flow charts, logic trees, and workshop manuals to aid in Hybrid system troubleshooting.
4. Demonstrate the electrical and computer troubleshooting skills required to maintain, diagnose, and repair Hybrid vehicles using standard industry diagnostic equipment.

C. Course Content

I. Drive Systems

A. Motor

B. Controller

- C. Wiring
- D. Ultra-capacitors
- E. Maintenance and service

II. Regenerative Braking (electrical energy recovery)

- A. Principles of Operation
- B. Charging / Recharging Characteristics
- C. Maintenance and Service Requirements
- D. Safety and Emergency Considerations

III. 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

IV. Power Management Systems

- A. Signals and Telemetry Principles
- B. General construction and fabrication
- C. Power and Dissipation Ratios
- D. Testing and Basic Troubleshooting

V. 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

VI. 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

D. Course Lab Content

I. These topics will be covered in lab demonstrations and hands-on exercises:

II. Drive Systems

A. Motor

B. Controller

C. Wiring

D. Ultra-capacitors

E. Maintenance and service

III. Regenerative Braking (electrical energy recovery)

A. Principles of Operation

B. Charging / Recharging Characteristics

C. Maintenance and Service Requirements

D. Safety and Emergency Considerations

IV. Battery

A. Construction

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

C. Charging/discharging Characteristics

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V. Power Management Systems

A. Signals and Telemetry Principles

B. General construction and fabrication

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VI. On Board Computer Systems

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- 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**

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*

Hybrid Electric Vehicle Technology Chapter 3 "Hybrid Engines"
written examination

1. Identify and evaluate systems and components related to modern Hybrid vehicles.

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.*

Hybrid Electric Vehicle Technology CD-ROM Flash Card Vocabulary
exercises

1. Identify and evaluate systems and components related to modern Hybrid vehicles.

3. *Required Reading Assignment - Describe in detail the chapter or article being read and the purpose for this assignment. MATCH THE INSTRUCTNL OBJCTVES FOR THIS ASSGNMNT BY USING THE BLUE LINK BELOW*

Hybrid Electric Vehicle Technology Chapter 2 "High Voltage Vehicle
Safety Systems" text reading assignment.

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

G. Methods of Instruction

1. Laboratory/Studio/Activity
2. Lecture

H. Methods of Evaluation

1. Exams/Tests/Quizzes

2. Simulation
3. Class Participation
4. Home Work
5. Lab Activities
6. 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:

N/A. Hybrid Electric Vehicle Technology, 1st ed. Orland Park, IL: American Technical Publishers, 2010, ISBN: 0826900661.

Jim Halderman. Hybrid and Alternative Fuel Vehicles, 4 ed. Ohio: Pearson, 2015, ISBN: 0013351212.

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 09/12/17
Effective Date 08/27/18
State Approval Date 09/25/17
Last Outline Revision Date 08/31/17
CC Approval Date 08/31/17
Content Review Date 08/31/17

22. Proposed Start Date

Fall of 2018

23. Cross Listed Courses

24. Need for Course

Automotive repair trade necessity due to new vehicle technology advancements.

25. Attached Files