

- A. Automotive technicians are vital to our mobile and transport-dependent community. HEV/EV are becoming more and more popular and it is imperative that students understand the proper maintenance, service, and repair of these systems. Efficiency, performance and compliance with EPA regulations (State and Federal) are mandatory in this field as well as customer satisfaction. This course covers the maintenance, diagnosis, and repair of the HEV/EV and is intended to enhance the student's knowledge beyond understanding.
- B. Lab assignments for the course will introduce students to the maintenance, diagnosis, and repair of automotive HEV/EV systems while maintaining instruction that reinforces safety practices in a demonstrative environment.
- C. This course is not intended for transfer

IV. Place of Course in College Curriculum

- A. Free Elective
- B. This course meets a program requirement for the Hybrid and Electric Vehicles Certificate of Completion.
- C. Course transferability; for New Jersey schools go to the NJ Transfer website, www.njtransfer.org. For all other colleges and universities go to their individual sites.

V. Outline of Course Content

- A. Smart grids
- B. Drive concepts
- C. Drive variants
- D. Operating modes
- E. Electrical hazards
- F. Safety regulations
- G. HV battery
- H. Batteries made of nickel-metal hydrides
- I. Lithium-ion batteries
- J. Cooling of battery systems
- K. Electricity "fueling" stations
- L. Working with high-voltage vehicles
- M. On-board power networks in high-voltage vehicles
- N. Vehicle-internal safety concepts
- O. Switch-on current and current limiting
- P. Hybrid driving
- Q. Boosting
- R. Electric drive systems for hybrid vehicles
- S. Hydrogen-fueled electric vehicles
- T. Asynchronous machines

- U. Synchronous machines
- V. Control units for hybrid drives
- W. Regenerative braking and energy recovery
- X. Operating principle for resolvers
- Y. Operating principle for interlock contacts
- Z. High speed - CAN bus
- A.A. Measurement of the CP signal of type2 charge connection during active charging process
- B.B. How to handle damaged HV vehicles

VI. A. Course Learning Outcomes

At the completion of the course, students will be able to:

1. Work directly on a high-voltage system
2. Investigate drive configurations, components of high-voltage systems, disconnection/isolation of HV systems, safe working with such systems, electrical fundamentals, charging of high-voltage batteries and diagnostics.
3. Develop various diagnostic strategies, including measurements on an actual HV system under the most stringent safety conditions.
4. Identify techniques to troubleshoot, repair, maintain, and solve problems with various automotive (H)EV systems (GE-4)
5. Apply quantitative reasoning to problems with the maintenance of automotive (H)EV systems (GE-2)
6. Discuss issues of automotive (H)EV systems (GE-1)

ASE Standards

- a. Identify service precautions related to service of the internal combustion engine of a hybrid vehicle.
- b. Describe the operational characteristics of a hybrid vehicle drive train.
- c. Identify hybrid vehicle power steering system electrical circuits and safety precautions.
- d. Identify safety precautions for high voltage systems on electric, hybrid, hybrid-electric, and diesel vehicles.
- e. Identify hybrid vehicle auxiliary (12v) battery service, repair, and test procedures.
- f. Identify hybrid vehicle A/C system electrical circuits and service/safety precautions.

B. Assessment Instruments

1. Lectures
2. Demonstrations
3. Laboratory work
4. Instructional videos/DVDs
5. Laboratory performance

6. Examinations
7. ASE task list
8. Online modules
9. Manufacturer programs
10. Lucas-Nuelle CarTrain "Hybrid and Electric Vehicles - ASE L3 Trainer

VII. Grade Determinants

- A. Lab performance
- B. Examinations
- C. Class participation
- D. Technical writing
- E. Interactive simulations
- F. Module completion
- G. Homework assignments
- H. Lucas-Nuelle CarTrain "Hybrid and Electric Vehicles - ASE L3 Trainer completion & practical exercises

Primary formats, modes, and methods for teaching and learning that may be used in the course:

- A. Lecture/discussion
- B. Small-group work
- C. Group discussion
- D. Computer-assisted instruction
- E. Laboratory
- F. Simulation/role playing
- G. Demonstration
- H. Student collaboration
- I. Individual assignments
- J. Manufacturer training
- K. Lucas-Nuelle CarTrain "Hybrid and Electric Vehicles - ASE L3 Trainer

VIII. Texts and Materials

- A. CDX interactive textbook
- B. Students will be required to wear clothing appropriate for auto shop safety at all classes. Student are required to wear a standard industry uniform. Safety glasses will also be required at all classes.
- C. The Automotive Program utilizes online curriculum and online industry service and repair information from the following sources:
 - I. AllData
 - II. Snap On Industries
 - III. Shop Key Pro.
 - IV. Manufacturer Training
 - V. CDX

- VI. Lucas-Nuelle CarTrain "Hybrid and Electric Vehicles - ASE L3 Trainer
- D. Various Automotive Magazines
- E. Students are provided the use of RVCC technology during the course

(Please Note: The course outline is intended only as a guide to course content and resources. Do not purchase textbooks based on this outline. The RVCC Bookstore is the sole resource for the most up-to-date information about textbooks.)

IX. Resources

- A. Reference books
- B. Text Book
- C. AllData
- D. Shop Key Pro
- E. Snap On Industries
- F. NAPA Pro-Link
- G. Published Automotive Magazines
- H. Lab/Shop Tools and Equipment
- I. Electude Interactive Courseware
- J. Safety equipment
- K. Lubricants and various automotive fluids
- L. Sample Steering and Suspension system components
- M. Instructional videos/DVDs
- N. Auto mechanics shop facility at RVCC workforce building
- O. Manufacturer Training
- P. Lucas-Nuelle CarTrain "Hybrid and Electric Vehicles - ASE L3 Trainer

X. Check One: Honors Course N/A