AT R104: LIGHT DUTY HYBRID VEHICLES

Originator
kevin_corse1

College
Oxnard College

Discipline (CB01A)
AT - Automotive Technology

Course Number (CB01B)
R104

Course Title (CB02)
Light Duty Hybrid Vehicles

Banner/Short Title
Light Duty Hybrid Vehicles

Credit Type
Credit

Start Term
Fall 2022

Catalog Course Description
This course focuses light-duty passenger hybrid electric vehicles (HEVs). It provides a practical introduction to advanced HEV design and propulsion systems. The course includes: HEV design and construction; the testing, assembly, operation, and maintenance of HEVs; the influence of aerodynamic design; advanced technology batteries, super-capacitors, intelligent charging systems; hydrogen fuel cell technology, and alternative EV drive systems. Successful completion of this course will prepare students for the ASE L3 Light Duty Hybrid/EV Vehicle Specialist Certification.

Taxonomy of Programs (TOP) Code (CB03)
0948.40 - *Alternative Fuels and Advanced Transportation Technology

Course Credit Status (CB04)
D (Credit - Degree Applicable)

Course Transfer Status (CB05) (select one only)
B (Transferable to CSU only)

Course Basic Skills Status (CB08)
N - The Course is Not a Basic Skills Course

SAM Priority Code (CB09)
C - Clearly Occupational

Course Cooperative Work Experience Education Status (CB10)
N - Is Not Part of a Cooperative Work Experience Education Program

Course Classification Status (CB11)
Y - Credit Course

Educational Assistance Class Instruction (Approved Special Class) (CB13)
N - The Course is Not an Approved Special Class

Course Prior to Transfer Level (CB21)
Y - Not Applicable

Course Noncredit Category (CB22)
Y - Credit Course

Funding Agency Category (CB23)
Y - Not Applicable (Funding Not Used)

Course Program Status (CB24)
1 - Program Applicable

General Education Status (CB25)
Y - Not Applicable

Support Course Status (CB26)
N - Course is not a support course

Field trips
May be required

Grading method
(L) Letter Graded

Alternate grading methods
(E) Credit by exam, license, etc.

Does this course require an instructional materials fee?
No

Repeatable for Credit
No

Is this course part of a family?
No

Units and Hours

Carnegie Unit Override
No

In-Class

Lecture
Minimum Contact/In-Class Lecture Hours
43.75
Maximum Contact/In-Class Lecture Hours
43.75

Activity

Laboratory
Minimum Contact/In-Class Laboratory Hours
26.25
Maximum Contact/In-Class Laboratory Hours
26.25

Total in-Class

Total in-Class
Total Minimum Contact/In-Class Hours
70

Total Maximum Contact/In-Class Hours
70

Outside-of-Class

Internship/Cooperative Work Experience

Paid

Unpaid

Total Outside-of-Class

Total Outside-of-Class
Minimum Outside-of-Class Hours
87.5
Maximum Outside-of-Class Hours
87.5

Total Student Learning

Total Student Learning
Total Minimum Student Learning Hours
157.5
Total Maximum Student Learning Hours
157.5

Minimum Units (CB07)
3
Maximum Units (CB06)
3

Prerequisites
AT R100

Entrance Skills

Entrance Skills
Identify and use hand tools and automotive equipment safely and properly while assessing and performing minor maintenance on automotive systems.

Prerequisite Course Objectives
AT R100-Demonstrate the precautions personal and shop safety procedures needed to safely work with high voltage systems.
AT R100-Demonstrate familiarity with reference materials such as schematics, flow charts, logic trees, and workshop manuals to aid in battery system troubleshooting.
AT R100-Demonstrate familiarity with reference materials such as schematics, flow charts, logic trees, and workshop manuals to aid in battery system troubleshooting.
AT R100-Demonstrate how to perform basic maintenance related to hybrid and electric vehicles.
AT R100-Demonstrate how to diagnose a basic hybrid or electric vehicle fault using standard diagnostic equipment.

Requisite Justification

Requisite Type
Prerequisite

Requisite
AT R100

Requisite Description
Course in a sequence

Level of Scrutiny/Justification
Content review

Student Learning Outcomes (CSLOs)

	Upon satisfactory completion of the course, students will be able to:
1	Differentiate between the different types of drivetrain systems used in hybrid and plug-in hybrid vehicles.
2	Demonstrate maintenance and repair skills that are necessary for hybrid and partial EV automobiles.
3	Demonstrate safety procedures servicing high voltage and low voltage components for EV and hybrid vehicles.
4	Complete training on the use and care of charging stations.
5	Complete appropriate industry safety certification for hybrid and EV servicing.

Course Objectives

	Upon satisfactory completion of the course, students will be able to:
1	Demonstrate safety procedures required for hybrid electric vehicles.
2	Analyze the different types of advanced technology available for hybrid electric propulsion systems.
3	Appraise various high technology traction battery packs or super-capacitor energy storage systems.
4	Analyze the appropriate energy requirements for a specific OEM HEV (including motor size, voltage/ampere-hour requirements, battery charging system, rolling resistance factors, and aerodynamics).
5	Evaluate and repair electrical/electronic problems with an OEM HEV.
6	Reconstruct a working vehicle by disassembling each component then rebuilding the vehicle. The vehicle must run at the completion.
7	Calculate the return-on-investment (ROI) for a given HEV purchase versus conventional gasoline vehicle designs.

Course Content

Lecture/Course Content

I. Hybrid Electric Vehicle (HEV) safety procedures
A. Handling high voltage components
B. Proper dress for safety
C. Eye protection
D. Hand protection
E. Insulation
II. Comparative analysis of HEV conversions, internal combustion powered vehicles, OEM-built HEV's including Fuel Cell and hybrid HEV's.
A. OEM EVs versus conversions
B. Internal combustion versus electric
C. Fuel cell and hydrogen realities.
D. Hybrid systems versus pure electric vehicles.
III. Advantages and limitations of Hybrid Electric Vehicles
A. Emissions and air pollution
B. Range and performance
C. Cost of operation
D. Maintenance
E. Initial investment
IV. Identification of HEV systems and components, their locations and functions.
A. Motors
B. Controllers
C. Battery systems
D. Electronics
E. Instrumentation
F. Charging systems
G. Drive systems
H. Wiring
V. Identification of sources and types of components best suited for conversion to HEV, establish desired specifications for the chosen conversion.
A. OEM suppliers
B. After-market suppliers

C. Fabricated components
D. Used parts market
VI. Governmental regulations, standards and incentives related to HEV's
A. Tax advantages
B. Safety standards
C. Disposal and recycling
D. Diamond Lane
VII. Testing and evaluation of converted vehicle including Hybrid EV's
VIII. Shop equipment and hand tool safety
A. Hand tools
B. Power equipment and machinery
C. Hazardous waste disposal
D. High voltage tool requirements
E. Protective clothing and body protection

Laboratory or Activity Content

I. Practice Electric Vehicle (EV) safety procedures
A. Safely disconnect and reconnect high voltage systems
B. Locate possible fire hazards and document protocols
C. Identify possible short circuits
D. Practice using dual isolated gloves and protection equipment
II. Complete task sheet outlining basic and advanced shop skills
A. Locate and identify specialty insulated hand tools
B. Use insulated and composite foot, hand and eye protection
C. Identify parts of clothing that may not be insulated from shock. Identify improper clothing or clothing items.
D. Locate Data sheets concerning hazardous materials handling
III. Locate procedure information systems and practice with lab vehicles.
IV. Identification of specific differences
A. Design and performance of various OEM EVs
V. Diagnosing Electric Vehicles
A. Use Scan-tools
B. Use of special DVOMs
C. Practice procedures of insulation testers
IX. Repair & Evaluation of Repairs
A. Electric Sub-system unit repair
B. Source repair parts through vendor ports
C. Determine replacement parts availability
D. Perform comparative analysis of HEV conversions, internal combustion powered vehicles, OEM-built HEV’s including Fuel Cell and hybrid HEV’s.

Methods of Evaluation

Which of these methods will students use to demonstrate proficiency in the subject matter of this course? (Check all that apply):

Written expression
Problem solving exercises
Skills demonstrations

Methods of Evaluation may include, but are not limited to, the following typical classroom assessment techniques/required assignments (check as many as are deemed appropriate):

Individual projects
Laboratory activities
Objective exams
Performances
Quizzes
Skills demonstrations
Skills tests or practical examinations
Written homework

Instructional Methodology

Specify the methods of instruction that may be employed in this course

Audio-visual presentations
Case studies
Class activities
Class discussions

Collaborative group work
Demonstrations
Distance Education
Field experience/internship
Field trips
Guest speakers
Instructor-guided use of technology
Lecture
Modeling
Small group activities

Describe specific examples of the methods the instructor will use:

1. Instructors will perform various demonstration as they relate to Light Duty Hybrid Vehicles systems. The demonstrations will enrich students experience and give a real world adaptation to the theory they are learning in class.
2. Students working individually and in small groups will practically apply course content through various activities and situations that align with the course content.
3. Lectures will be given on each topic in the listed content. The lectures will make the concepts understandable, meaningful, and emphasize key points as they relate to Light Duty Hybrid Vehicles. Lectures are often accompanied with related informational handouts.
4. Students will work in teams to solve problems presented in class lecture and laboratory settings in order to practice effective collaboration and communication skills. This collaborative learning experience will also simulate real world working environment in an automotive shop, enriching their learning experience

Representative Course Assignments

Writing Assignments

Written homework will be assigned for every content module in the course. The assignment will come from the course textbook and lecture.

Laboratory Task sheet(s): Lab worksheets will be evaluated based on NATEF (National Automotive Technicians Education Foundation) standards,
neatness, basic English writing skills, and content knowledge.

Critical Thinking Assignments

Written homework will cover the questions at the end of each chapter and responses should be accurate, reflective of the use of critical thinking, and complete. Students may be required to complete a group project.

Reading Assignments

Students are required to read chapters within their textbook and comprehend manufacturer's technical data sheets.

Students will be required to read articles in an industry related journals, or magazines of their choosing and write short excerpts on the piece.

Skills Demonstrations

Students will have many lab assignments based on course content, and have to perform hands on practice according to NATEF (National Automotive Technicians Education Foundation) standards and procedures.

Outside Assignments

Articulation

Equivalent Courses at other CCCs

College	Course ID	Course Title	Units
Long Beach City College	AUTO 281	Light Duty Hybrid Vehicles	3

District General Education

A. Natural Sciences

B. Social and Behavioral Sciences

C. Humanities

D. Language and Rationality

E. Health and Physical Education/Kinesiology

F. Ethnic Studies/Gender Studies

Course is CSU transferable
Yes

CSU Baccalaureate List effective term:
Fall 2022

CSU GE-Breadth

Area A: English Language Communication and Critical Thinking

Area B: Scientific Inquiry and Quantitative Reasoning

Area C: Arts and Humanities

Area D: Social Sciences

Area E: Lifelong Learning and Self-Development

Area F: Ethnic Studies

CSU Graduation Requirement in U.S. History, Constitution and American Ideals:

IGETC

Area 1: English Communication

Area 2A: Mathematical Concepts & Quantitative Reasoning

Area 3: Arts and Humanities

Area 4: Social and Behavioral Sciences

Area 5: Physical and Biological Sciences

Area 6: Languages Other than English (LOTE)

Textbooks and Lab Manuals

Resource Type
Textbook

Classic Textbook
No

Description

ASE L3 - Hybrid / Electric Vehicle Specialist Certification Study Guide. Motor Age Staff. 2nd edition. Advanstar Communication Inc. 2014.

Library Resources

Sufficient Library Resources exist

Yes

Distance Education Addendum

Definitions

Distance Education Modalities

Hybrid (1%–50% online)

Faculty Certifications

Faculty assigned to teach Hybrid or Fully Online sections of this course will receive training in how to satisfy the Federal and state regulations governing regular effective/substantive contact for distance education. The training will include common elements in the district-supported learning management system (LMS), online teaching methods, regular effective/substantive contact, and best practices.

Yes

Faculty assigned to teach Hybrid or Fully Online sections of this course will meet with the EAC Alternate Media Specialist to ensure that the course content meets the required Federal and state accessibility standards for access by students with disabilities. Common areas for discussion include accessibility of PDF files, images, captioning of videos, Power Point presentations, math and scientific notation, and ensuring the use of style mark-up in Word documents.

Yes

Regular Effective/Substantive Contact

Hybrid (1%–50% online) Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Asynchronous Dialog (e.g., discussion board)	Regular use of asynchronous discussion boards encourages various types of interaction and critical thinking skills among all course participants. Questions and topics posed will allow students to discuss, compare and contrast, identify, and analyze elements of the course outcomes. Other discussion boards may be used for Q&A and general class discussion by students and instructor to facilitate student success and strengthen student learning outcomes.
Face to Face (by student request; cannot be required)	Students will have direct face-to-face contact with instructor during weekly class meetings. This time will provide the opportunity for students to discuss and ask questions about the material to facilitate student learning objectives and course outcomes. The instructor will also hold weekly, scheduled office hours for students to be able to meet and discuss course materials or individual progress. Students can request additional in-person or web conferencing meetings with faculty member as needed. Faculty may encourage online students to form “study groups” in person or online. Note: For hybrid classes, face-to-face class time will provide opportunities for students to discuss amongst themselves (in groups or pairs) and ask questions about the material to facilitate SLOs and course outcomes.

E-mail	E-mail, class announcements and various learning management system tools such as “Message Students Who” and “Assignment Comments”, will be used to regularly communicate with all students on matters such as clarification of class content, reminders of upcoming assignments and/or course responsibilities, to provide prompt feedback to students on coursework to facilitate student learning outcomes, or to increase the role of an individual educator in the academic lives of a student. Students will be given multiple ways to email instructor through both the learning management system inbox and faculty provided email accounts.
Synchronous Dialog (e.g., online chat)	Instructor may provide a set time each week where they will be available for synchronous chat and be available in the discussion board and can answer questions in live time.
Other DE (e.g., recorded lectures)	Faculty may use a variety of ADA compliant tools and media integrated within the learning management system to help students reach SLO competency. Tools may include: o Recorded Lectures, Narrated Slides, Screencasts o Instructor created content o VC Online Library Resources o Canvas Peer Review Tool o Canvas Student Groups (Assignments, Discussions) o 3rd Party (Publisher) Tools (MyOpenMath) o Websites and Blogs o Multimedia (YouTube, Films on Demand, 3CMedia, Khan Academy, etc.)
Video Conferencing	Video tools such as ConferZoom can be used to provide live synchronous or asynchronous sessions with students. ADA compliance will be upheld with Closed Captioning during the session or of the recorded session. Video Conferences will be used to facilitate SLOs and student-to-student group meetings will also be encouraged.

Examinations

Hybrid (1%—50% online) Modality

On campus
Online

Primary Minimum Qualification

AUTOMOTIVE TECHNOLOGY

Review and Approval Dates

Department Chair
10/22/2021

Dean
10/26/2021

Technical Review
MM/DD/YYYY

Curriculum Committee
10/27/2021

DTRW-I
10/28/2021

Curriculum Committee
12/08/2021

Board
12/14/2021

CCCCO
01/21/2022

Control Number
CCC000629040

DOE/accreditation approval date
MM/DD/YYYY