

# AT R103: LIGHT DUTY ELECTRIC VEHICLES

## Originator

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## College

Oxnard College

## Discipline (CB01A)

AT - Automotive Technology

## Course Number (CB01B)

R103

## Course Title (CB02)

Light Duty Electric Vehicles

## Banner/Short Title

Light Duty Electric Vehicles

## Credit Type

Credit

## Start Term

Fall 2022

## Catalog Course Description

This course focuses on light-duty passenger electric vehicles (EVs). It provides a practical introduction to advanced EV designs and propulsion systems. The course includes: EV design and construction; the testing, assembly, operation, and maintenance of EVs; 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**

157.50

**Total Maximum Student Learning Hours**

157.50

**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 electric vehicles.  |
| 2 | Use equipment to cycle the battery pack in the EV system.                                   |
| 3 | Demonstrate the testing of individual cells in a battery pack.                              |
| 4 | Replace a battery pack, reset all monitors and measure voltage of a fully Electric Vehicle. |

**Course Objectives****Upon satisfactory completion of the course, students will be able to:**

- |   |  |
|---|--|
| 1 | Demonstrate safety procedures required for charging, starting and maintaining electric vehicles. |
| 2 | Analyze the different types of advanced technology available for electric vehicles.              |
| 3 | Assess various high technology traction battery packs or super-capacitor energy storage systems. |
| 4 | Evaluate and repair electrical/electronic problems with an OEM EV.                               |
| 5 | Perform service and repair procedures for electric vehicles.                                     |

**Course Content****Lecture/Course Content**

- I. Electric Vehicle (EV) safety procedures
  - A. High voltage systems
  - B. Fires and prevention
  - C. Short circuits
  - D. Shock prevention
- II. Update of basic and advanced shop skills
  - A. Basic hand tools
  - B. Foot, hand and eye protection
  - C. Proper clothing
  - D. Materials handling
- III. Update of technology
  - A. EV Components
  - B. Manufacturer vehicle trends
  - C. Emerging platforms
- IV. Identification of specific differences
  - A. Design and performance of various OEM EVs
- V. Identify new innovations in traction batteries and various crossover technologies used in electric vehicle transportation
- VI. Identification of EV systems and components, their locations and functions
- VII. Update of governmental regulations, standard and incentives related to EV owners and builders
- VIII. Diagnosing Electric Vehicles
  - A. Scan-tools
  - B. DVOMs
  - C. Insulation testers
  - D. Milli-ohmmeters
  - E. Impedance testers
- IX. Repair & Evaluation of Repairs
  - A. Sub-system unit repair
  - B. Repair versus Replace
  - C. Parts availability

**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

## 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):**

- Essay exams
- Group projects
- Laboratory activities
- Laboratory reports
- 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**

- Class activities
- Collaborative group work
- Demonstrations
- Distance Education
- Lecture
- Small group activities

**Describe specific examples of the methods the instructor will use:**

1. 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 Electric Vehicles Technology. Lectures are often accompanied with related informational handouts.
2. Instructors will perform various demonstration as they relate to Light Duty Electric Vehicles. The demonstrations will enrich students experience and give a real world adaptation to the theory they are learning in class.
3. Students working individually and in small groups will practically apply course content through various lab activities and situations that align with the course content.
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 cover the questions at the end of each chapter

Lab worksheets will be evaluated based on Manufacturers procedures and standards, neatness, and content knowledge

Students will write laboratory reports, which are complete, correct, and responsive to the assigned questions, showing mastery of the material and transfer of knowledge to new circumstances/problems and based on industry standards.

### **Critical Thinking Assignments**

Written homework will cover the questions at the end of each chapter and responses should be accurate and reflective of the use of critical thinking,

### **Reading Assignments**

1. Students are required to read chapters within their textbook and comprehend manufacturer's technical data sheets.
2. 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 lab assignments based on course content, and have to perform according to NATEF ( National Automotive Technicians Education Foundation) standards and procedures.

### **Outside Assignments**

#### **Representative Outside Assignments**

1. Written homework will cover the questions at the end of each chapter and responses should be accurate and reflective of the use of critical thinking,
2. Students are required to read chapters within their textbook and comprehend manufacturer's technical data sheets.
3. Students will be required to read articles in an industry related journals, or magazines of their choosing and write short excerpts on the piece.

### **Articulation**

#### **Equivalent Courses at other CCCs**

<b>College</b>	<b>Course ID</b>	<b>Course Title</b>	<b>Units</b>
Long Beach City College	280	Light Duty Electric 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 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 Test Prep - L3 Light Duty Hybrid Electric Vehicle Specialist Certification. Motor Age Training. 2017.

**Resource Type**

Textbook

**Classic Textbook**

No

**Description**

Modern Automotive Technology. James E. Duffy. 9th Edition. Goodheart-Willcox. 2017.

**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.
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.
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.
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.

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.)

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.

## 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

CCC000629039

### DOE/accreditation approval date

MM/DD/YYYY