

EAS-CHASSISLAB-DC



A Step-By-Step Curriculum for Instructing Electric Vehicle Technology

WestCoastPop Publications

Introduction

Purpose

This program is designed to educate students about the design, construction and assembly of electric vehicles. The course describes sequential procedures for assembling a production Electric Vehicle (EV). The resulting vehicle will be a fully operational Electric Vehicle with direct current (DC) drive train.

Course Name

This company is named ***Electric Auto Shop***. This Course is entitled **EAS-CHASSISLAB-DC**.

Course Scope

This course is designed to educate students about alternate fuel vehicles, their technical design and assembly, and introduce them to potential career options.

Course Description and Objectives

EAS-CHASSISLAB-DC is an educational program designed to introduce electric transportation to 9th-12th grade, vocational, and college students. Students will learn all aspects of building an actual working electric vehicle (EV) by assembling an electric direct current drive train into an existing production vehicle. The class will work in teams in the Auto Shop classroom with a curriculum supporting electric vehicle theory, construction and assembly. The class will learn the maintenance and assembly procedures inherent to this assembly. The course includes background theory on electrical power, including definitions and terms (ex: amps, volts, watts, watt-hours, energy, power, aerodynamics, electric mpg, and more). The course also includes a brief history and current status of EV technologies and career possibilities in electric transportation industry.

Students will use basic automotive skills and knowledge, supplemented by the **EAS-CHASSISLAB-DC** Curriculum, to complete the course. No special engineering skills are necessary. All of the components to complete the course are included in the program.

Course Objectives

- **EAS-CHASSISLAB-DC** will help create a professional working atmosphere such as that found in a technical college or manufacturer-sponsored training class.
- Students will be able to identify the major parts, and describe the operation of a DC powered electric drive train.
- Students will build a working electric vehicle in the conventional Auto Shop classroom under the supervision of the shop instructor.
- Students will complete both hands-on and theoretical coursework through lab/shop work, assignments, and testing, to reach a comprehensive understanding of electric vehicle theory, construction, and operation.
- Students will emerge with a better knowledge of electric vehicles and how electric transportation can work within the community.
- Students will learn the history, facts and current status of EVs.

Competency Objectives

- **EAS-CHASSISLAB-DC** will help teach students to gather, interpret, organize, and evaluate information.
- Students will think analytically to form reasoned judgments and solve problems.
- Students will use mathematical thinking skills.
- Students will read, analyze, and interpret various types of written materials.

Guiding Principles

Guiding principles for **EAS-CHASSISLAB-DC** are that the curriculum:

1. Exposes and clarifies truths and myths and practicality of EV technology.
2. Advances theory in a project-based manner, using step by step lessons to achieve a systematic understanding of EV technology.
3. Is cross-platform, and not linked to any single auto manufacturer.
4. Includes interactive social elements (i.e. organizational skills and the ability to work with and communicate effectively with team members).
5. Provides students with real world experience assembling, understanding, and using EV technology.

Goals for Students

1. Learn about the history and viability of electric transportation.
2. Learn about the design and structure of an electric drive train.
3. Build an actual working electric vehicle in the classroom.
4. Present and describe that vehicle to the community.

Rationale for Program

This program is designed to address the issues of transportation options available to today's auto consumer market. The content is matched to 9th – 12th grade students and vocational/college adults who have acquired basic automotive skills. The program focuses on the viability of electric transportation by emphasizing the simplicity of drive train component installation. The role of the instructor is to direct the lesson plans at a pace designed for one semester. A goal of the course is to develop a rational understanding of alternative transportation options. Traditional learning activities involving vehicle assembly will be used. Previous experience in component design or fabrication is not necessary for participation in this program.

Disclaimer

This course is designed to be carried out in classroom and shop conditions under the supervision of a qualified instructor. No work should take place without the presence of the instructor. Students should read and acknowledge understanding of safety instructions and be made aware of hazards involved in the automotive workshop. WestCoastPop accepts no liability for any accident or damage that may occur while converting a vehicle while using this course and manual. All automotive work is potentially hazardous, and should only be performed according to strict safety standards. Students must read and abide by all safety rules designated by the instructor and school.

Credits and Copyright

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Course Structure

The curriculum begins by establishing a foundation of design principles. Students see these principles applied as a result of the completed project. The vehicle used in this course is an "electric vehicle" or "EV". EV's are generic term representing multiple types of drive trains, as are "hybrid electric vehicles" (HEV), "neighborhood electric vehicles" (NEV); and the terms "EV", "HEV" and "NEV" are used throughout this course to describe various electric drive systems.

Grade Level

9th – 12th Grade, Secondary, Post-Secondary Schools.

Materials Included

- Complete Chassislab drivetrain with vehicle, batteries & assembly materials
- 8 Educational Modules in 10 binders
- 25 pull-out Lesson Plan Units
- 60 Instructional Videos on multiple DVDs
- 255 Assembly Steps

Materials Not Included

- General Shop Tools

Duration & Timing

Suggested Term is 16 Weeks

The course is divided into 8 modules and lesson plans. Weeks 1-3 are introduction, preparation and safety, and weeks 4-14 are assembly of the electric vehicle. The final 2 weeks allow for testing and promotion. The following is a general guide to how the course may be deployed over a term of 16-weeks.

- Week 1 –Modules 1, 2, 3, All Units
- Week 2 –Module 4 All Units
- Week 3 –Module 5 Unit T
- Week 4 –Module 5, Unit U assembly steps 1-80
- Week 5 –Module 5, Unit U assembly steps 81-92
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- Week 11 –Module 5, Unit U assembly steps 194-219
- Week 12 –Module 5, Unit U assembly steps 220-238
- Week 13 –Module 5, Unit U assembly steps 239-255
- Week 14 – Appendices, Unit U-related assembly steps

Week 15 –Modules 6, 7, 8 All Units
Week 16 –Review & Testing

VideoGuide

This course uses video to support the content contained in the Modules. Instructors can determine the best way to use video to accomplish their lesson goals. Video segments can be previewed, or watched multiple times as interactive reference during its related Module. Unlike a feature type movie, the videos are brief segments, designed to be used illustratively. Reviewing video is especially helpful during the assembly process, where technique and specific assembly locations are identified.

Video is identified within the course with colored logos:

ELECTRIC AUTO SHOP VIDEO

Video is assembled on multiple DVDs:

ELECTRIC AUTO SHOP VIDEO Systems Overviews, Green DVD (9 videos)

These segments show overviews of systems used in electric vehicles, tools, safety, and a general introduction. These are the videos on this DVD:

- Systems Overview Video #1: Intro to **EAS-CHASSISLAB-DC**
- Systems Overview Video #2: Shop Safety
- Systems Overview Video #3: Tools Overview
- Systems Overview Video #4: Motor System Overview
- Systems Overview Video #5: Battery System Overview
- Systems Overview Video #6: Control System Overview
- Systems Overview Video #7: Vehicle Safety System Overview
- Systems Overview Video #8: Battery Enclosure System Overview
- Systems Overview Video #9: Machine Shop Overview

ELECTRIC AUTO SHOP VIDEO Checklist Steps, Blue DVD (26 videos)

This video series illustrates each step in the assembly sequence, with audio explanation of the step performed. There are twenty-six checklists in the assembly sequence, with one video for each checklist.

- Intro Pre-Checklist
- Checklist #1 Shop Floor Plan Layout, Steps 1-10

- Checklist #2 Dashboard & Gauges, Steps 11-22
- Checklist #3 Switches, Steps 23-52
- Checklist #4 Check Tow/Run Switch, Steps 53-56
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ELECTRIC AUTO SHOP VIDEO

Assembly Sequences, Red DVD (30 videos)

This is video of actual work on the vehicle. Each segment is identified in Module 5 as a reference point for the particular step being performed in the assembly sequence.

ELECTRIC AUTO SHOP VIDEO

Video Lecture Sessions, Gold DVD (8 videos)

These videos are a series of lectures to be viewed in the classroom at various points in the course. These segments are identified with the video logo in the left margin of the written modules.

- Video Lecture 1: Powered Vehicle History (p. 33)
- Video Lecture 2: Batteries (p. 106)
- Video Lecture 3: Chargers & Charging System Components (p. 159)
- Video Lecture 4: Circuits, Watts & Wire (p. 170)
- Video Lecture 5: Contactors & Relays (p. 185)
- Video Lecture 6: Controller/Inverter (p. 137)
- Video Lecture 7: DC Motor (p. 132)
- Video Lecture 8: Component Review (p.191)

Using this Curriculum

This course curriculum was designed for use in grades 9-12 and secondary school (vocational or college). This edition includes lesson material and information for teaching and assembling an EV in the classroom setting.

The main document is intended to be used by the instructor as a guide through the course. Removable sections can be copied and distributed to the class and used as classroom and lab/shop documents. The course can be rearranged, expanded or compressed to meet instructor focus and goals and accommodate school resources and scheduling.

If logistics allow, instructors are encouraged to supplement these materials with additional activities, including guest speakers from the local EV community, visits to local EV events and competitions. These connections within the real world of EV design will help introduce students to the viability of this type of transportation and potential employment opportunities.

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