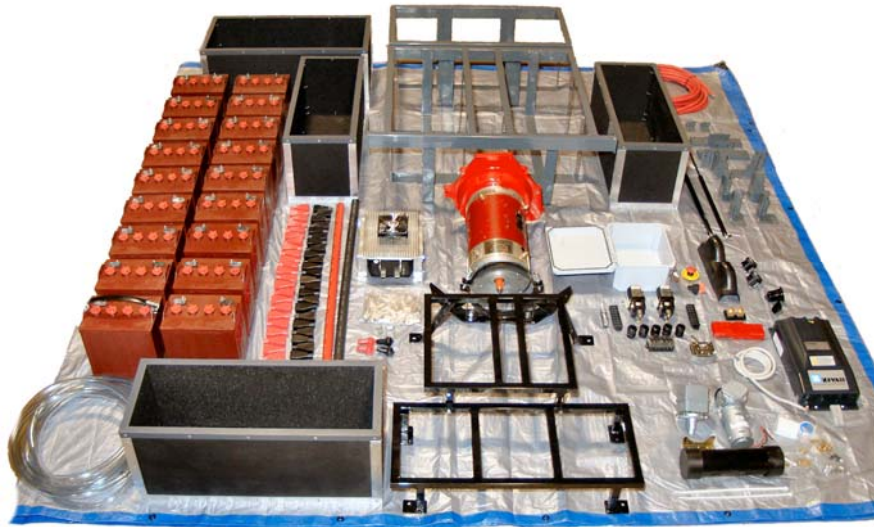


electricautoshop.com



A Step-By-Step Curriculum for Teaching 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 modifying a production vehicle with an internal combustion engine (ICE) and drive train into battery electric drive. The resulting vehicle will be a fully operational electric vehicle (EV).

Program Name

This program is named *Electric Auto Shop*.

Program Scope

This program is designed to educate students about alternate fuel vehicles, their technical design and assembly, and career options.

Course Description and Objectives

Electric Auto Shop is an educational program designed to introduce electric transportation to 7th-12th grade, vocational, and college students. Students will learn all aspects of building an actual working electric vehicle (EV) by installing an EV 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 advantages of using an electric drive train, including cost savings, environmental impact, and ease of use. The course includes background theory on electrical power, including definitions and terms (ex: amps, volts, watts, watt-hours, energy, power, aerodynamics, rms voltage, electric mpg, and more). The course also includes a brief history and current status of EV technologies and career possibilities in electric transportation industry. The vehicle produced by the class is will be street legal and meet all licensing regulations.

Students will use basic automotive skills and knowledge, supplemented by the **Electric Auto Shop** Curriculum, to complete the conversion. No special engineering skills are necessary. Except for the vehicle, all of the components to make the conversion are included in the program.

Course Objectives

- **Electric Auto Shop** will help create a professional working atmosphere such as that found in a technical college training class.
- Students will be able to identify the major parts, and describe the operation of, an 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.
- A working EV will be introduced to the local community.

Competency Objectives

- **Electric Auto Shop** 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 ***Electric Auto Shop*** are that the curriculum:

1. exposes and clarifies truths and myths and practicality of EV technology;
2. is project-based, 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 7th – 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

This course is an original curriculum originally developed in 2007-2008, and is published by WestCoastPop Publications. The ***Electric Auto Shop*** curriculum is maintained solely by WestCoastPop. The contents do not necessarily represent the policies of any participating schools or school district or the administrations thereof.

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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.

Grade Level

9th – 12th Grade, Community College, College, Vocational Education.

Materials Included

- Complete Conversion Kit with all batteries & materials
- 8 Modules in 10 binders
- 24 pull-out Lesson Plan Sections
- 63 Instructional Videos on 3 DVDs
- 146 Slide PowerPoint Presentation

Materials Not Included

- 1994-2004 Model Year S-10 Truck
- General Shop Tools

Duration & Timing

Suggested Term is 16 Weeks

The course is divided into 16 modules and lesson plans. Weeks 1-3 are preparation and safety, and weeks 4-14 are assembly of the electric conversion kit. 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 1-40
- Week 5 –Module 5, Unit U assembly steps 1-40 cont'd
- Week 6 –Module 5, Unit U assembly steps 41-50
- Week 7 –Module 5, Unit U assembly steps 51-70
- Week 8 –Module 5, Unit U assembly steps 51-70 cont'd
- Week 9 –Module 5, Unit U assembly steps 71-84
- Week 10 –Module 5, Unit U assembly steps 71-84 cont'd
- Week 11 –Module 5, Unit U assembly steps 85-97
- Week 12 –Module 5, Unit U assembly steps 98-117
- Week 13 –Module 5, Unit U assembly steps 118-126
- Week 14 –Module 5, Unit U assembly steps 127-146
- 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 conversion process, where technique and specific assembly locations are identified.

Video is assembled on 3 DVDs:

Systems Overview DVD (10 videos)

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

- Intro to ElectricAutoShop
- Tools Overview
- Motor System Overview
- Battery System Overview
- Tilt Bed System Overview
- Control System Overview
- Safety System Overview
- Battery Frame System Overview
- Machine Shop Overview

Checklist Steps DVD (20 PowerPoint/Camtasia videos)

This video PowerPoint illustrates each step in the conversion sequence, with audio explanation of the step performed. There are twenty checklists in the conversion sequence, with one video for each checklist.

- Checklist #1 Intro
- Checklist #2 Steps 1-6
- Checklist #3 Steps 7-13
- Checklist #4 Steps 14-25
- Checklist #5 Steps 26-41
- Checklist #6 Steps 42-52
- Checklist #7 Steps 53-56

- Checklist #8 Steps 57-61
- Checklist #9 Steps 62-71
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- Checklist #15 Steps 116-121
- Checklist #16 Step 122
- Checklist #17 Steps 123-125
- Checklist #18 Steps 126-134
- Checklist #19 Steps 135-140
- Checklist #20 Steps 141-146

Conversion Sequences 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 conversion sequence.

- Step 10 Transmission Drive Angle
- Step 25 Driveshaft Yoke
- Step 49 Remove Fuel Tank
- Step 50 Preparing Frame Rails
- Step 53 Motor Shaft Spacer & Key
- Step 54 Install Coupler & Taper Lock
- Step 55 Install Transmission Adaptor
- Step 56 Initial Spin Test
- Step 59 Connect Motor to Transmission
- Step 73 Attach Battery Frame Brackets
- Step 74 Attach Saddle Battery Frame
- Step 75 Attach Saddle Battery Boxes
- Step 79 Attach Tail Battery Frame

- Step 80 Attach Tail Battery Boxes
- Step 83 Prepare Tilt Bed
- Step 95 Install Front Battery Frames
- Step 97 Attach Controller to Heat Sink
- Step 100 Identify Controller Connections
- Step 101 Mount Motor Controller
- Step 102 Assemble Control Circuit Enclosure
- Step 105 Mount Control Circuit Enclosure
- Step 106 Locate Key-on Wire at Loom
- Step 109 Attach Throttle Cable
- Step 110 Install Emergency Dash Cutoff Switch
- Step 111 Install DC-DC Converter
- Step 114 Install Front Battery Box
- Step 125 Install Rear Batteries
- Step 126 Install Cable Runs
- Step 132 Test Anderson Disconnect
- Step 138 Perform Initial Key-on Check
- Final Wrap Up

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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