Electric Automotive Technology

COURSE OUTLINE

1. Course Title: Electric Automotive Technology
2. CBEDS Title: Automotive Mechanics, combination
3. CBEDS Number: 5655
4. Job Titles:

Automotive Service Technicians & Mechanic
Electric Service Technicians & Mechanic
Industrial Machinery Installation, Repair and Maintenance Worker
Precision Instrument & Equipment Repairer
Rail Transportation Technician & Mechanic
Small Engine Mechanic
Stationary Engineer and Boiler Operator

5. Course Description:
This course involves modifying an internal combustion vehicle with an internal combustion engine (ICE) and drive train into battery electric drive. The resulting vehicle will be a pure drive electric vehicle (EV). Students will learn all aspects of building an actual working electrical vehicle (EV) by installing an EV drive train into an existing production vehicle. The course will focus on the advantages of using an electric drive train, including cost savings, environmental impact, and ease of use. The course includes a brief history and current status of EV technologies and career possibilities in electric transportation industry.

Student Outcomes and Objectives:
Students will:

1. Develop safe shop work practices and become familiar with OSHA standards as they apply to the auto mechanics trade.
2. Identify the major parts, and describe the operation of an electric drive train.
3. Build a working electric vehicle in the shop under the supervision of the instructor.
4. Complete hands-on and theoretical coursework through lab/shop work, assignments, and testing, to reach a comprehensive understanding of electric vehicle theory, construction, and operation.
5. Gain better knowledge of electric vehicles and how electric transportation can work with the community.
6. Learn the history, facts and current status of electric vehicles.

Pathway

Recommended Sequence	Courses
Introductory	Automotive Technology 1, 2
Skill Building	Automotive Technology 3, 4
Advanced Skill	Advanced Automotive Technology 5, 6 or **Electric Automotive Technology**

6. Hours: *Students receive up to 180 hours of classroom instruction.*

7. Prerequisites: Automotive Technology

8. Date (of creation/revision): June 2009

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Upon successful completion of this course, students will be able to demonstrate the following skills necessary for entry-level employment.

Instructional Units and Competencies	Course Hours	Model Curr. Standards	CA Academic Content Standards	CAHSEE
I. CAREER PREPARATION STANDARDS A. Career Planning and Management. 1. Know the personal qualifications, interests, aptitudes, knowledge, and skills necessary to succeed in careers. a. Students will identify skills needed for job success b. Students will identify the education and experience required for moving along a career ladder. 2. Understand the scope of career opportunities and know the requirements for education, training, and licensure. a. Students will describe how to find a job. b. Students will select two jobs in the field and map out a timeline for completing education and/or licensing requirements. 3. Develop a career plan that is designed to reflect career interests, pathways, and postsecondary options. a. Students will conduct a self—assessment and explain how professional qualifications affect career choices. 4. Understand the role and function of professional organizations, industry associations, and organized labor in a productive society. a. Contact two professional organization and identify the steps to become a member. 5. Understand the past, present and future trends that affect careers, such as technological developments and societal trends, and the resulting need for lifelong learning. a. Students will describe careers in the transportation industry sector. b. Students will identify work-related cultural differences to prepare for a global workplace. 6. Know the main strategies for self-promotion in the hiring process, such as completing job applications, resume writing, interviewing skills, and preparing a portfolio. a. Students will write and key a resume, cover letters, thank you letters, and job applications. b. Students will participate in mock job interviews. B. Technology. 1. Understand past, present and future technological advances as they relate to a chosen pathway. 2. Understand the use of technological resources to gain access to, manipulate, and produce information, products and services. 3. Understand the influence of current and emerging technology on selected segments of the economy. 4. Use appropriate technology in the chosen career pathway. C. Problem solving and Critical Thinking. 1. Apply appropriate problem-solving strategies and critical thinking to work-related issues and tasks. 2. Understand the systematic problem-solving models that incorporate input, process, outcome and feedback components.	15 Additional hours are integrated throughout the course.	Transportation Industry Sector, Model Curriculum Standards 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0	Language Arts (8) R 1.3, 2.6 W1.3, 2.5. LC 1.4,1.5 1.6 LS1.2, 1.3, (9/10) R2.1,2.3,2 W2.5 LC1.4 LS 1.1, 2.3 (11/12) R2.3 W2.5 LC1.2 Math (7) NS1.2, 1.7 MR 1.1,1.3 2.7,2.8, 3.1	**Lang. Arts R 8.2.1** **(9/10) R 2.1, 2.3 W2.5** **Math (7) NS 1.2, 1.3, 1.7 MR 1.1, 2.1, 3.1**

3. Use critical thinking skills to make informed decisions and solve problems. 4. Apply decision-making skills to achieve balance in the multiple roles of personal, home, work and community life. D. Health and Safety. 1. Know policies, procedures, and regulations regarding health and safety in the workplace, including employers' and employees' responsibilities. 2. Understand critical elements of health and safety practices related to storing, cleaning and maintaining tools, equipment, and supplies. E. Responsibility & Flexibility. 1. Understand the qualities and behaviors that constitute a positive and professional work demeanor. 2. Understand the importance of accountability and responsibility in fulfilling personal, community, and work-place roles. 3. Understand the need to adapt to varied roles and responsibilities. 4. Understand that individual actions can affect the larger community. F. Ethics and Legal Responsibilities 1. Know the major local, district, state, and federal regulatory agencies and entities that affect the industry and how they enforce laws and regulations. 2. Understand the concept and application of ethical and legal behavior consistent with workplace standards. a. Contact a business and obtain a copy of their rules for employment. b. Role play difference ethical scenarios. 3. Understand the role of personal integrity and ethical behavior in the workplace. G. Leadership and Teamwork. 1. Understand the characteristics and benefits of teamwork, leadership, citizenship in the school, community, and workplace settings. 2. Understand the ways in which professional associations, such as SkillsUSA, ASE, NATEF, and competitive career development activities enhance academic skills, career choices, and contribute to promote employability. 3. Understand how to organize and structure work individually and in teams for effective performance and attainment of goals. 4. Know multiple approaches to conflict resolution and their appropriateness for a variety of situations in the workplace. 5. Understand how to interact with others in ways that demonstrate respect for individual and cultural differences and for the attitudes and feelings of others.				

Instructional Units and Competencies	Hours	Industry Standards.	CA Academic Standards	CAHSEE
I. Safety - Review A. Personal 1. Eye & ear safety 2. OSHA Regulations B. Tools 1. Power 2. Hand C. Equipment 1. Lifts 2. Jacks 3. Drill press/grinders 4. Cleaning Equipment D. Hazardous Material -MSDA 1. Oil 2. Coolant 3. Gasoline	20	Transportation Industry Sector Vehicle Maintenance Service & Repair Pathway C1.0, 1.2, 1.5 C2.0, 2.2, 2.3, 2.5 C3.0, 3.1	ELA 9-10; LS; 1.1 & 1.6 ELA 9-10; R; 2.1, 2.2 S. 6; 3b Fdtn. Stds. 1.1M (1.2), (1.3) G(1.1), (2.4)	**(7) NS 1.2, 1.3 (7)MR 2.1, 3.3**
II. HISTORY OF ELECTRIC TRANSPORTATION A. Electric Vehicles – 1910 - 2000 B. Evolution of Manufacturers C. Advantages of the Electric Drive Train D. Students will be able to: 1. Express increased awareness of the scope of time EVs have been in production 2. Identify the historical scope of EV production 3. Describe advantages of the electric drive train 4. Track the modern manufacturing history of EVs	10			
III. POLITICS AND PLANNING FOR THE FUTURE OF ALTERNATIVE TRANSPORTATION A. Energy and the Environment B. Fuel, Maintenance & Development Costs C. The Potential of Today's Technology D. Students will be able to: 1. Express increased awareness of the amounts of energy consumed by all types of vehicles 2. Describe the effects of mobile source emissions 3. Describe the interaction of cost and demand on fuel 4. Explain the sources of electricity in the USA 5. Calculate maintenance costs of gas vs. electric vehicles.	20			

Instructional Units and Competencies	Hours	Industry Standards.	CA Academic Standards	CAHSEE
IV. THE BASICS OF PHYSICS & POWER A. Mechanics of Power and Work B. Turning Electricity Into Motion C. Work, Energy, and Power D. Energy Storage E. Students will be able to: 1. List different mechanical and electrical terms 2. Describe key facts about energy, power conversion and mechanical work 3. Identify key singular components in the electrical drive train and identify their fit and function 4. Identify subsystems in the EV drive train and summarize purpose and location 5. Prepare and understand the sequence of the conversion process	20	Transportation Industry Sector Foundation Standards 10.5 Vehicle Maintenance Service & Repair Pathway C3.0, 3.1,3.4, 3.5, 3.6 Energy & Utilities Industry Sector Energy & Environmental Technology Pathway B2.0, 2.1, 2.3	ELA 9-10; R; 2.1, 2.2 S. 9-12; Physics; 1.d, f, g S. 9-12; Physics; 2h	**M. 7; MG; 1.2, 1.3, 2.4**
V. CONVERSION COMPONENTS A. The Electric Motor B. Controller & control enclosure Subassembly C. Battery System D. Battery Charger E. Wheels & Tires F. Braking G. Suspension H. Gauges & Instruments I. Accessories & Safety Features J. Students will be able to: 1. Describe the Bill of Materials 2. Describe the basic drive train operation in an EV 3. Identify the series of events that occur as the operator uses the EV 4. Identify the existing and replaced components in the ICE-to-EV drive train 5. Demonstrate an understanding of daily charging and overall battery life	7			

Instructional Units and Competencies	Hours	Industry Standards.	CA Academic Standards	CAHSEE
VI. CONVERSION PROCESS A. Work Area Safety B. The Conversion Sequence C. Students will be able to: 1. Demonstrate and describe safe shop/lab practices 2. Describe the logic of the conversion sequence in general terms 3. Describe and execute parts staging and layout 4. Describe daily format and scheduling for completing the daily action series prescribed by the instructor 5. Report on project status and adjust for follow up 6. Summarize the project			S. 9-12; Physics; 1.d, f, g 3b 5a, b, c S. 8; 5c S. 9-12; Chem.; 4a, c, d, 6a, b, c	**M. 7; MG; 1.2, 1.3, 2.4**
VII. USING THE VEHICLE A. Driving &Daily Commuting B. Licensing & Maintaining the EV C. Students will be able to: 1. Describe their daily driving habits and create a projection of related energy use 2. Evaluate and project the use of mobile source energy in their community 3. Discuss advantages to charging an EV with the existing electric grid over use of petroleum 4. Record and evaluate performance date 5. Create and maintain a running Maintenance Logbook.				
VIII. PROMOTION, COMPETITION AND CAREERS *(covered in Career Exploration Unit)*				
IX. FINAL CONCLUSIONS A. Overview B. Transportation Policy C. Showrooms of 2010 D. Students will be able to:	10			

10. Additional recommended/optional items
    a. Articulation: None
    b. Academic credit: None
    c. Instructional strategies:
        Methods of Instruction:
        a. Lecture

b. Audio Visual Materials
c. Research Readings and Written Presentations
d. Homework Assignments
e. Demonstrations
f. Group & Individual Projects
g. Quizzes, Tests, Performance Evaluations & Final Exam
h. Guest Speakers
i. Internet Exploration

d. Instructional materials:
Electric Autoshop: A Step-by-Step Curriculum for Teaching Electric Vehicle Technology,. West Coast Publications, 2007-08.
e. Certificates: None