Power Mechanics

COURSE OUTLINE

1. Course Title: **Power Mechanics**
2. CBEDS Title: **Mechanics and Engineering Technology**
3. CBEDS Number: 4030
4. Job Titles:

Farm Equipment Mechanic
Outdoor Power Equipment Mechanic
Small Engine Mechanic
Engine & Other Machine Assemblers

5. Course Description:

This competency course teaches students specialized skills in the construction, maintenance, repair and service of agricultural equipment. Students will fabricate and adapt various pieces of farm machinery by cutting, forming, and welding different types of metals. Students will learn about engine overhauls and conversions from internal combustion engines to battery electric drives. This course includes classroom instruction and lab activities.

Student Outcomes and Objectives:

Students will:

1. Pass tests on engine and electrical motor theory
2. Disassemble and reassemble: Engines, carburetors, starters, and ignition systems
3. Identify and repair engine failures: Compression, ignition, and carburetion
4. Use precision measurement tools: Micrometers, dial indicators, and feeler gauges
5. Use engine diagnostic equipment: Compression tester, volt, ohm, milliamp meter
6. Service chain saws, bars, and saw chain
7. Identify and service electric motors
8. Identify types of tractors and their application
9. Demonstrate an understanding of electric vehicle theory, construction, and operation
10. Modify an internal combustion engine and drive train into a battery electric drive

Integrated throughout the course are career preparation standards, which include basic academic skills, communication, interpersonal skills, problem solving, workplace safety, technology, and employment literacy.

Pathway

Recommended Sequence	Courses
Introductory	Agriculture Science Basic Core
Skill Building	**Power Mechanics**
Advanced Skill	Supervised Agricultural Experience Project

6. Hours: *Students receive up to <u>180</u> hours of classroom instruction.*

7. Prerequisites: None

8. Date (of creation/revision): July 2010

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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	Industry Standards	CA Academic Content Standards	CAHSEE
I. CAREER PREPARATION 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. 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 use word processing software to create a resume, cover letters, thank you letters, and job applications. b. Students will participate in mock job interviews. 4. *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.* *5. 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.* *6. 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 business industry sector.* *b. Students will identify work-related cultural differences to prepare for a global workplace.* B. Technology. 1. Understand past, present and future technological advances as they relate to a chosen pathway and on selected segments of the economy. 2. Understand the use of technological resources to gain access to, manipulate, and produce information, products and services. 3. Use appropriate technology in the chosen career pathway. C. Problem solving and Critical Thinking. 1. Understand the systematic problem-solving models that incorporate input, process, outcome and feedback components, and apply appropriate problem-solving strategies and critical thinking to work-related issues and	5 Additional hours are integrated throughout the course.	Transportation Industry Sector, Foundation 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**

tasks. 2. Use and apply critical thinking and decision making skills to make informed decisions, solve problems, and 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 a variety of business environments. 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 and how individual actions can affect the larger community. 3. Understand the need to adapt to varied roles and responsibilities. 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 for effective performance and attainment of goals. 2. Understand the ways in which professional associations, such as FFA, Skills USA, ASE, NATEF, and competitive career development activities enhance academic skills, career choices, and contribute to promote employability. 4. Know multiple approaches to personal conflict resolution and 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
A. Safety Review 1. Personal a. Eye and ear safety b. OSHA regulations 2. Tools a. Power b. Hand 3. Equipment a. Lifts b. Jacks c. Drill press/grinders d. Cleaning Equipment 4. Hazardous Material –MSDA a. Oil b. Coolant c. Gasoline	5	Transportation Industry Sector Vehicle Mtnc., Svc., & Repair Pathway C1.2, C1.4, C1.5, C2.2 Ag & Natural Resource Industry Sector Ag Mechanics Pathway B1.1, B1.2, B10.1, B10.2, B10.3, b10.5, B10.6, B11.3, B11.4	ELA. 7; LS; 1.1, 1.2, 1.3 S. Physics; 1f & g, 2c, f & h. S. 8; Phys. Sci; Inv. & Exp. 9a,b& c.	**ELA 8; R; 2.1** M. 7; NS; 1.1, 1.2, 1.3, 1.6. **M. 7; MAG; 1.1 & 1.3** **ELA. 8; R 2.1.** **ELA 9-10; R; 2.1 & 2.6.**
B. Engine Operating Principles 1. Four – Stroke Cycle 2. Two – Stroke Cycle	5			
C. Measuring and Testing Instruments 1. Micrometers 2. Thickness gauges 3. Reject gauges 4. Torque wrenches 5. Compression testers 6. Tachometers	5			
D. Compression System 1. Power Conversion 2. Power Train a. Cylinder, crankshaft, connecting rod, piston & head b. Valve train i. Valve configurations ii. Valves, seats, camshaft, valve springs iii. Valve timing c. Components of engine power i. Bore, stroke, compression ratio, RPM, displacement	10			
E. Comparison of 4 stroke & 2 stroke cycle engines 1. Slide vs. poppet valves 2. Valve configurations 3. Power strokes 4. Lubrication 5. Port designs and scavenging 6. Engine teardown and reassembly	5			

F. Carburetion 1. Theory and principles of operation 2. Carburetor types a. Float, vacuum, pump diaphragm 3. Idle circuits and power circuits 4. Chokes 5. Governors	5	Transportation Industry Sector Vehicle Mtnc., Svc., & Repair Pathway C4.3, C4.4, C6.1, C7.2, C7.3	S. 9-10; Physics; 3a,b&g. S. 9-10; Chem.; 4c S. 9-10; Physics; 5a,b&c. ELA. 9-10; W; 2.6	**M. 8-12; Alg.; 10.0**
G. Air Cleaners 1. Oil bath, polyurethane, pleated paper, dual element, foil	2			
H. Ignition 1. Theory 2. Magneto Ignition - Breaker Points 3. Solid state Ignition – Breakerless 4. Battery Ignition	3			
I. Cranking, Charging, and Electrical Auxiliary Systems 1. Manual Starters a. Rope wind b. Recoil 2. Electrical Starters 3. Charging Systems	9			
J. Preventive Maintenance 1. Engine Service 2. Compression system a. Cylinder reconditioning b. Bearing Service c. Piston and piston ring service d. Head and Head gasket service	10			
K. Ordering Replacement Parts a. Identifying Manufacturer b. Utilizing Parts Manuals and/or Catalogs i. Print & Digital c. Completing Order Form/Ordering over the phone.	1			
L. Engine Safety 1. Proper eye protection and appropriate clothing 2. Safe use of fuels and lubricants 3. Correct use of hand and proper tools 4. Proper engine starting procedures 5. Safe engine operation a. Governor adjustment to attain proper RPM for rotary mower type applications	5			

M.	Diesel Engines 1. Comparison of spark ignition and compression ignition engines 2. Diesel fuel systems a. Pumps b. Distributors c. Injectors 3. Engine teardown and reassembly	15	Transportation Industry Sector Foundation Standards 10.5 Vehicle Mtnc., Svc., & Repair Pathway C3.0, C3.1, C3.4, C3.5, C3.6 Energy & Utilities Industry Sector Energy & Environmental Technology Pathway B2.0, B2.1, B2.3	ELA 9-10; R; 2.1, 2.2 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**
N.	Tractors 6. Types and their uses a. Two wheel and four wheel drive b. Articulated tractors c. Wheel and crawler 2. Tractor Power a. Diesel engines 3. Transmissions and power trains 4 Rear ends and final drives 5. Tractor service and maintenance	15			
O.	Shop Performance Skills 7. Engine disassembly and reassembly 8. Carburetor disassembly and service 9. Ignition testing, adjustment, and service 10. Air cleaner service techniques 11. Servicing electric starter and charging systems 12. Engine service skills	15			
P.	Chain Saws 1. Nomenclature 2. Starting and safe operation 3. Bar, chain, and sprocket service 4. Servicing the power head 5. Teardown and reassembly	10			
Q.	Basics of Physics and Power 1. Mechanics of power and work 2. Turning electricity into motion 3. Work, energy, and power 4. Energy storage	5			
R.	Conversion Components 1. The electric motor 2. Battery system and charger 3. Wheels and tires 4. Braking 5. Suspension 6. Gauges and instruments 7. Accessories and safety features	5			
S.	Conversion Process 1. Work area safety 2. Conversion sequence	35			

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. Quizzes, Tests & Final Exam
            d. Guest Speakers
            e. Field Trips
            f. Laboratory
    d. Instructional materials: Teacher Generated
    e. Certificates: None