Colorado CTE Course – Scope and Sequence

Course Name	Compact Engines	Course Details Course = 0.50 Carnegie Unit Credit	Credit = 1.0 Prerequisites= none
Course Description	Provides students with safety instruction in compact engine repair and preventative maintenance. Students also learn the operation and theory of 2-stroke and 4-stroke engines as well as instruction on the proper methods on engine diagnosis, repair and engine overhaul. Additional coursework includes instruction on basic electrical theory, magnetism, basic circuitry, circuit testing, starting systems diagnosis and repair charging systems diagnosis and repair and ignition systems diagnosis and repair.		
Note:	This is a suggested scope and sequence for the course content. The content will work with any textbook or instructional resource. If locally adapted, make sure all essential knowledge and skills are covered.		
SCED Identification #	20110	Schedule calculation based on 60 calendar days of a 90-day semester. Scope and sequence allows for additional time for guest speakers, student presentations, field trips, remediation, or other content topics.	

All courses taught in an approved CTE program must include Essential Skills embedded into the course content. The Essential Skills Framework for this course can be found at **https://www.cde.state.co.us/standardsandinstruction/essentialskills**

Instructional Unit Topic	Suggested Length of Instruction	CTE or Academic Standard Alignment	Competency / Performance Indicator	Outcome / Measurement	CTSO Integration
Compact Engine Industry		Identify and discuss historical and current issues affecting the small engine technology industry. Understand how laws, regulations, safety, environmental issues, and emerging technologies may affect the small engine technology industry in the future.	The student describes the historical, current, and future significance of the small engine technology industry. The student is expected to: (A) describe emerging technologies and their impact on the small engine technology industry; (B) identify issues affecting the small engine technology industry related to employment,	Research and report on significant developments to scientific theory or technology that impacted compact engine technology. Examples may include: • How have advanced in technology impacted local or global agriculture systems. • How has modern engine theory evolved. • Which scientific principles impacted	

			safety, and environmental issues; (C) discuss regulations and laws and their impact on the small engine technology industry; and (D) read appropriate written material to stay abreast of current issues impacting the small engine technology industry.	the development of engines. • Analyze how compact engines are used in various industries. • How have regulations or environmental concerns impacted the compact equipment industry.	
Safety		Identify employers' expectations regarding safe and appropriate work habits, ethical conduct, and legal responsibilities in the workplace. Practice safe behavior in the classroom, laboratory, and workplace environment. Discuss health and safety scenarios in the workplace as well as response plans to potential emergency situations. Use information technology resources specific to the small engine technology industry to access, manage, integrate, and create information.	The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to: (A) apply competencies related to resources, information, interpersonal skills, problem solving, critical thinking, and systems of operation in the small engine technology industry; (B) demonstrate skills and knowledge related to personal and occupational health and safety in the workplace; (C) discuss response plans to emergency situations; and	Identify the benefits of knowing and applying basic safety procedures in both an education laboratory and workplace. Interpret current Occupational Safety and Health Administration (OSHA) guidelines to conduct a compliance review of the education laboratory, including a written summary justifying the findings with recommendations for improving the safety of working conditions. Review common laboratory safety procedures for tool and equipment operation in the education mechanics laboratories, including but not limited to accident prevention and control procedures. Demonstrate the ability to follow safety and operational procedures	SkillsUSA Workplace skills development Obtain OSHA 10 certification

			(G) identify employers' expectations, appropriate work habits, ethical conduct, legal responsibilities, and good citizenship skills. (4) The student participates in opportunities for leadership development and personal growth. The student is expected to: (A) participate in the planning and development of leadership and skill development activities such as conducting effective meetings, team building activities, and strategic planning.	in a lab setting and complete a safety test with 100 percent accuracy. Consult industry manuals to ascertain the specific safety prevention and control standards governing the agricultural equipment and compact engine repair industry. Demonstrate adherence to recognized standards, and apply occupational safety concepts across all coursework, such as but not limited to procedures surrounding general safety, personal safety (such as the use of personal protective equipment), lifting, transporting, alerting, and reporting.	
Engine and Motor Mechanic Theory and Mathematics Applications		Understand and apply scientific principles as they relate to compact engine function and repair. Demonstrate and apply relevant problem-solving and mathematical skills in-context as they identify, describe, and perform engine calculations and use diagnostic tools and other materials and equipment. Analyze and explain the effects of heating and	The student demonstrates an understanding of scientific and mechanical knowledge of small engine technology. The student is expected to: (A) apply Ohm's law to small engine electrical circuits using a digital multimeter; (B) compare and contrast the characteristics of two- and four-cycle engines;	Compare and contrast the first and second laws of thermodynamics as applied to the study of combustion engines. Analyze the theory of operation and efficiency of internal combustion engines with regard to fuels, engine displacement, ignition, lubrication, and cooling. Compare and contrast the chief features, functions, and applications of two-cycle	

		cooling on small engines in simulated or actual work situations.	(C) identify and discuss the functions of the major small engine components; (D) explain the relationship between an electric current and magnetic field in ignition, charging, and starting systems; and (E) analyze the effects of heating and cooling on small engines. The student applies problem-solving, mathematical, and organizational skills to maintain financial and logistical records. The student is expected to: (C) describe mathematical formulas used to perform engine calculations such as calculating cylinder volume, engine displacement, combustion chamber volume, compressed head gasket volume, piston and deck height, piston dish volume, dome volume, cylinder volume, compression ratio, and horsepower; and (D) describe mathematical formulas	engines, Four-cycle engines, and electric motors. Citing technical references, recommend a maintenance schedule specific to the working environment (such as indoor/outdoor conditions, exposure to heat or cold) of the engine and/or motor.: • Explain the differences and similarities between 2-cycle and 4-cycle engines. • Intake and exhaust ports on 2-cycle engines versus valves on 4-cycle engines. Evaluate and optimize engine performance under load and no-load operation, considering the effects of air temperature, humidity, fuel quality, and engine tuning.	

			used to perform electrical calculations such as calculating electrical resistance, current, and voltage in engines.		
Basic Engine Maintenance and Repair Tools and Techniques		Demonstrate proper ways to perform preventative maintenance and use preventative maintenance schedules, determine repair or replacement needs and estimate associated costs. Locate, read, and interpret service repair information and manuals from a variety of sources. Understand and apply common industry communication practices in the workplace.	The student applies technical knowledge and skills in simulated or actual work situations. The student is expected to: (A) demonstrate knowledge of electrical testing tools and equipment commonly used in small engine maintenance; (B) perform measurements using precision instruments; and (C) inspect and measure small engine parts for wear tolerances. The student identifies the skills used to maintain and operate a small engine maintenance facility. The student is expected to: (A) perform preventative maintenance schedule plans and systems to keep facility, tools, and	Locate and identify basic engine components: • Block, crankshaft, camshaft, piston, cylinder head, connecting rod, valve train, timing components • Fuel systems: carburetor, filter, lines, tank. • Ignition systems: spark plug, magneto, coil. • Cooling system: cooling fins, shroud, and flywheel. • Lubrication system: dip stick, oil slinger or pump, oil plug, oil. • Exhaust system: muffler, exhaust gasket. Conduct the appropriate maintenance with adherence to specifications outlined in the schedule. Citing technical data and documentation of prior work, develop a written recommendation outlining a	SkillsUSA Technical Skills Grounded in Academics development

			equipment operating safely and properly; (B) use the preventative maintenance schedule of the facility, tools, and equipment to determine repair or replacement needs; (C) complete repair orders and paperwork related to the small engine technology industry to properly document work needed or completed; (D) estimate parts and labor costs on repair orders for small engine repair; and (E) locate, read, and interpret service repair information such as small engine schematics, charts, and service-repair manuals and bulletins. The student demonstrates an understanding of technical knowledge and skills of small engine technology. The student is expected to: (A) identify the use and application of small	specific task or procedure for a given engine or motor (such as using a three-phase 5 hp electric motor in order to drive a 125-foot conveyor belt for lifting grain to a 60-foot silo). Demonstrate the ability to troubleshoot single-cylinder engines and electric motors. Create a written estimate of repairs, including parts, labor, time, and total cost. Understand basic hand tools, fasteners, and shop equipment: • identify, size, and measure metric and standard fasteners. • Correctly identify and use basic hand tools. • Identify and demonstrate use of basic measuring tools (accurate to 1/32 or 1mm). • Use reference manuals or information systems to find service procedures and specifications.	

			engines and their components; (B) identify the components of electrical-electronic systems; (C) demonstrate awareness of engine designs, components, and applications; (D) identify and use engine measuring tools and test equipment; (E) use tools used in the operation, maintenance, and repair of small engines.		
Measurements, Fuels, and Preventative Maintenance		Demonstrations ways to troubleshoot and repair small engines, as well as how to perform preventative maintenance, installations, and inspections. Demonstrate knowledge of electrical testing tools and equipment with hands-on presentations, discussions, and performance of precision measurements and inspections.	The student applies technical knowledge and skills in simulated or actual work situations. The student is expected to: (A) troubleshoot and repair small engines; (B) assess the proper fuel mixtures and analyze the efficiency of various fuels used in small engines; (C) distinguish between valve arrangement positions and analyze valve timing with respect to crankshaft rotation;	Complete a preventative maintenance and service. List the service steps included for: engine lubrication, cooling, starting, fuel, and ignition systems and associated fluids and filters. Identify and demonstrate use of basic measuring tools (accurate to 1/32 or 1mm: • Micrometers, rulers, feeler gauges compression gauges, and digital multi meter (DMM) Change engine oil and filter on a small engine/equipment. Use	

			(D) perform preventative maintenance and service engine lubrication, cooling, starting, fuel, and ignition systems and associated fluids and filters; and (E) perform routine installations, inspections, adjustments, and maintenance on small engines using testing tools and equipment.	proper disposal methods for waste oil: • Check fuel filter. • Check air filter. • Change and gap spark plug. • Remove and sharpen lawn mower blade • Check oil level. • Perform an oil change.	
				Hydraulics Write an explanatory text to summarize the components and operational theory of a basic hydraulic system used in an agriculture setting. Design a hydraulic system to perform a specific task, applying the principles of fluid kinematics and hydrostatics to outline how the system functions. The design should include specifications for pumps, pipes, and flow rates.	
Career Development			The student demonstrates professional standards/employability skills as required by	Use local news media, organizational websites, and real-time labor market information to investigate occupations in compact engine repair and	Updates to Student ICAP

			business and industry. The student is expected to: (A) identify career development and entrepreneurship opportunities in the small engine technology industry; (B) identify careers in the small engine technology industry; (C) discuss certification opportunities; and (D) develop personal goals, objectives, and strategies as part of a plan for future career and educational opportunities. The student demonstrates appropriate personal and communication skills. The student is expected to: (A) demonstrate proper etiquette and behavior. The student participates in opportunities for leadership development and personal growth. The student is expected to: (A) use resources available through an organization such as a career and technical student	agricultural power and equipment career pathways. Compare and contrast the knowledge, skills, and abilities necessary for employment, as well as the typical level of education required. Gather and analyze information from multiple authoritative sources such as the United States Bureau of Labor Statistics (BLS) or ONet and CO LMI gateway to develop a written projection of the occupational trends related to agriculture power and equipment. Supplement the narrative with relevant and properly cited charts, graphs, and other visual representations.	

			organization to develop employability skills.		