CareerClusters™ PATHWAYS TO COLLEGE & CAREER READINESS
Transportation, Distribution & Logistics

Learning that works for Colorado CTE®

Colorado CTE Course – Scope and Sequence

Course Name	Compact Engines II	Course Details Course = 0.50 Carnegie Unit Credit	Credit = 1.0
Course Description	Compact Engine Technology II includes advanced knowledge of the function, diagnosis, and service of the systems and components of all types of compact engines such as outdoor power equipment, motorcycles, generators, and irrigation engines. This course is designed to provide hands-on and practical application for employment in the small engine technology industry. Instruction includes the repair and service of cooling, air, fuel, lubricating, electrical, ignition, and mechanical systems and compact engine overhauls.		
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
Career Exploration		Discuss certification opportunities and employers' expectations to develop personal goals and strategic plans for a successful career in the small engine technology industry. Use resources available through Career and Technical Student Organizations (CTSO) or other extracurricular organization(s) to further develop employability skills. Demonstrate proficiency in a career technical pathway that leads to certification,	The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to: (A) identify career development and entrepreneurship opportunities in the small engine technology industry;	Prepare a resume and research the application process for a local employer. Research effective communication in the workplace. Analyze current trends and identify how employers are using information on personal communication preferences to build strong teams.	SkillsUSA Career Essentials Certification

		licensure, and/or continued learning at the postsecondary level.	(B) identify careers in the small engine technology industry; (C) apply competencies related to resources, information, interpersonal skills, problem solving, critical thinking, and systems of operation in the small engine technology industry; (D) discuss certification opportunities; (E) identify employers' expectations, appropriate work habits, ethical conduct, legal responsibilities, and good citizenship skills; and (F) 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) participate in the planning and development of leadership and skill development activities such as conducting effective meetings, team building activities, and strategic planning; (B) use resources available through an organizations such as a career and technical student organizations to develop employability skills; and (C) record individual progress to document achievements.		
Engine Components		Develop and evaluate preventative maintenance plans and systems, complete repair orders and related paperwork, estimate costs,	e and identify basic engine onents: Identify engine mponents.	Identify and disassemble a small gas engine: • Cylinder block • Side cover • Cylinder	

		and describe common business management principles related to the industry. Identify small-engine parts and explain the various systems (e.g., fuel, ignition, compression, cooling, and lubrication systems).	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.	• Crankshaft and crank gear • Connecting rod • Bearing • Piston • Piston-pin (wrist-pin) • Rings (compression ring/oil control ring) • Tappets/lifters • Valves (intake/exhaust) • Valve spring and valve retainer • Camshaft • Cylinder head • Head gasket • Reed valve (2-stroke)	
Advanced Compact Engine Repair		Demonstrate technical knowledge of small engine designs, components, and applications. Look up and order parts, apply repair and maintenance recommendations from a repair manual, and complete appropriate forms, including work orders. Disassemble, inspect, adjust, and reassemble a small engine.	The student demonstrates **advanced** technical knowledge and skills of small engine technology. The student is expected to: (A) demonstrate the use and application of small engines and components; (B) demonstrate the components of electrical-electronic systems; (C) demonstrate knowledge of engine	Demonstrate technical ability. Examples include: • distinguish between valve arrangement positions and analyze valve timing with respect to crankshaft rotation; • perform preventative maintenance and service engine lubrication, cooling, starting, fuel, and ignition systems and associated fluids and filters;	

		Differentiate among types of small engines and their applications. Understand the theory and operation of 12-volt DC electronic and electrical systems (e.g., circuit design, starting, charging, and safety circuits).	designs, components, and applications; and (D) demonstrate the correct use of engine measuring tools and test equipment.	• perform routine installations, inspections, adjustments, and maintenance on small engine testing tools and equipment; • demonstrate knowledge of electrical testing tools and equipment commonly used in small engine maintenance such as digital multimeters; • perform measurements using precision instruments such as micrometers, dial indicators, and Vernier calipers; and • inspect and measure small engine parts for wear tolerances and compare to specifications.	
Hydraulics		Understand the principles and applications of various engines and machinery used in various settings. Explain the theory, operation, and	Understand the principles of hydraulics as they relate to compact power equipment. Student is expected to: (A) Understand hazards	Write an explanatory text to summarize the components and operational theory of a basic hydraulic system used in an agriculture setting.	

		troubleshooting of hydraulic systems.	of hydraulic and pneumatic circuits and be able to work safely. (B) Understand the concepts of fluid statics and dynamics as applied to commercial and industrial compact equipment. (C) Recognize standard schematic symbols for common fluid power components. (D) Understand and troubleshoot basic fluid power, electro-hydraulic circuits using schematic diagrams. (E) Understand the operation, application, and maintenance of common fluid power components such as pumps, compressors, valves, cylinders, motors, rotary actuators, accumulators, pipe, hose, and fittings.	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.	
Agriculture Equipment		Locate and apply technical information to gather information and produce products and services.	Students use reference manuals or information systems to find service	Recommend the appropriate machinery for a given agricultural application by matching the mechanical need	FFA Agriculture Mechanics Competition

		Demonstrate the use of appropriate tools and technology used in the Agriculture and Natural Resources sector to occupations in the compact engines pathway.	procedures and specifications: (A) Computer oriented. (B) Printed manuals. (C) Owner's manuals. Understand the principles and applications of various engines and machinery used in agriculture. Students is expected to: (A) identify common agricultural machinery and implements; (B) calibrate, operate, and maintain equipment safely and efficiently; (C) summarize the theory, operation, and troubleshooting of various types of engines found on agricultural machinery, including cooling, fuel, and lubrication systems.	to the scale and magnitude of the specific task. Using clear and coherent writing, justify the recommendation based on availability of parts, operational costs, maintenance, safety, and total cost. For example, recommend the appropriate tractor for a specified task based on power ratings, engine and transmission systems, hydraulic capabilities, hitching, and ballasting. Demonstrate the ability to maintain, troubleshoot, and repair agricultural equipment and create a written estimate of repairs including itemization of parts, labor, time, and total cost.	
Troubleshooting		Use a variety of resources to research, troubleshoot, diagnose, and repair small engine concerns and failures.	The student applies appropriate research methods to small engine	Perform a diagnosis on a small engine. Create an estimate for repairs and present the findings to a customer.	

		Solve predictable and unpredictable work-related problems using various types of reasoning (inductive, deductive) as appropriate.	technology topics. The student is expected to: (A) use a variety of resources to research, trouble shoot, and diagnose concerns and failures; and (B) apply the scientific method of research to small engine technology. The student demonstrates advanced technical knowledge and skills in simulated or actual work situations. The student is expected to: (A) troubleshoot fuel system problems- (i) carburetor (ii) fuel tank/filter (iii) fuel lines/pumps (iv) air filter/box (v) color of exhaust (B) troubleshoot ignition system problems- (i) perform spark test; (ii) remove and replace spark plug; (iii) check and gap spark plug;	Research a small engine mechanical issue; present and provide a practical demonstration on possible troubleshooting applications. Assess the proper fuel mixtures and analyze the efficiency of various fuels used in small engines. Apply electrical principles to diagnose and repair small engine components such as generators, electric motors, power supplies, electronic amplifiers, relays, and circuits. Describe the application of the scientific method of research to small engine technology such as identifying a problem, establishing a procedure, performing direct and indirect observation, collecting and interpreting data, and drawing conclusions by verifying the complaint, determining the related symptoms, analyzing the symptoms, isolating the trouble, correcting the trouble, and checking for proper operation.	

			(iv) check magneto, air gap, and kill-wire; and (v) timing (C) troubleshoot compression problems- (i) perform a compression test; (ii) define a wet test; and (iii) perform a cylinder leak-down test. (D) troubleshoot lubrication system- (i) oil specifications; (ii) burnt oil; (iii) inspection for the crankcase; and (iv) color of exhaust. (E) understand combustion, internal and external, as it relates to the four elements of combustion- (i) troubleshoot fuel system problems; (ii) troubleshoot ignition system problems; (iii) troubleshoot compression problems; and (iv) troubleshoot lubrication system.		
Mathematic Applications		Apply relevant problem-solving and mathematical skills in-context as they	The student applies problem-solving,	Student demonstrates the ability to analyze and apply appropriate academic	CTSO Competitions-SkillsUSA

		collect, organize, and analyze data associated with small engine technology. Understand and explain engine theory, including the application of mathematical and/or physical science laws for both two- and four-stroke cycle engines.	mathematical, and organizational skills to maintain financial and logistical records. The student is expected to: (A) collect and organize data in graphs, tables, and charts; (B) analyze and interpret data from graphs, tables, and charts; (C) use mathematical formulas to perform engine calculations such as calculating cylinder volume, engine performance and enhancement, engine displacement, combustion chamber volume, compressed head gasket volume, piston and deck height, piston dish volume, dome volume, cylinder volume, compression ratio, and horsepower;	standards required for successful industry sector pathway completion leading to postsecondary education and employment.	Related Technical Math

			(D) use mathematical formulas to perform electrical calculations such as calculating and measuring electrical resistance, current, and voltage in engines; and apply Ohm's law to small engine electrical circuits using a digital multimeter.		