

Colorado CTE Course – Scope and Sequence

Course Name	Diesel Technology		Course Details	Credit = 1.0-2.0 (depending on competencies covered and time on task.) Prerequisite= Principles of Transportation or Introduction to Automotive Service CTE Credential= CTE Transportation	
			Course = 0.50 Carnegie Unit Credit		
Course Description	Focuses on a basic understanding of general maintenance procedures for trucks and outlines the duties and responsibilities of the diesel mechanic. Addresses the use of shop tools, shop equipment and the use of flat-rate and vehicle and shop safety procedures, and tool requirements. Covers preventative maintenance procedures. Provides instruction on the basic fundamentals of hydraulics and their application to diesel technology. Hydraulic pumps, valves, cylinders, motors, and accumulators are discussed. Focuses on the various braking systems incorporated in heavy-duty trucks and heavy equipment. Includes a study of hydraulic, air, and engine brake systems and covers the diagnosis and service of the components.				
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 #	20107	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
Careers in Diesel Technology		Build personal career development by identifying career interests, strengths, and opportunities. Identify employers' expectations and appropriate work habits.	Understand entry level employment requirements. Student is expected to: (A) define employment expectations of entry-level employees in local employment situations (hiring requirements, basic job expectations, etc.); and	Survey local job listings and compare and contrast job listing requirements. Report on hiring trends in the industry, noting: • Tool or tasks listed in the job announcements • Common language for similar or like position announcements	SkillsUSA 4 Pillars SkillsUSA Personal Skills (Framework) Job Skill Requirements Updates to ICAP

			(B) discuss industry certification opportunities and their requirements.	• Common entry-level requirements (education, training, certifications, physical requirements, etc.) • Pay scale variations • Local employment opportunities, including entrepreneurship opportunities, and certification requirements for the field of diesel technology.	
Safety		Understand professional safety standards as required by business and industry. Demonstrate knowledge and skills related to health and safety in the workplace. Perform safety examinations and maintain safety records.	Student demonstrates industry expectations for shop and personal safety. Student is expected to: (A) identify and properly use, maintain, and store diesel service hand tools, power tools, and shop equipment, and (B) demonstrate continuous awareness of potential hazards to self and others and respond appropriately.	Identify and demonstrate knowledge of how to utilize marked safety areas and equipment, such as location and use of eye wash stations; types of fire extinguishers and other fire safety equipment; posted evacuation routes; and proper ventilation procedures for working within the lab/shop area. Comply with the required use of safety glasses, ear protection, gloves, appropriate clothing, and shoes during lab/shop activities; demonstrate knowledge of procedures for securing hair and jewelry for lab/shop activities.	Obtain OSHA 10

				Locate and demonstrate knowledge of safety data sheets (SDS). Adhere to responsibilities, regulations, and Occupational Safety & Health Administration (OSHA) policies to protect coworkers and bystanders from hazards; report accidents and observed hazards; and comply with emergency response procedures.	
Diesel Engines and Systems		Use tools, equipment, and machines to safely measure, test, diagnose, and analyze components and systems (e.g., electrical and electronic circuits, alternating- and direct-current applications, fluid/hydraulic and air/pneumatic systems).	The student demonstrates technical knowledge and skills of diesel equipment technology. The student is expected to: (A) describe the function of the major components of diesel-powered vehicles such as engines, fuel injection systems, lubrication, cooling, electrical, air-conditioning systems, air induction, exhaust, and emissions; (B) describe the function of the chassis components such as braking, steering, transmission, drivetrain,	See NATEF Task list for additional tasks	SkillsUSA Diesel Technology Competition

			suspension systems, pneumatics, and hydraulics; (C) locate, read, and interpret documents such as schematics, charts, diagrams, graphs, parts catalogs, and service-repair information and technical bulletins; and (D) demonstrate precision measurement procedures to diagnose component wear, compare measurements to published specifications, and determine necessary repairs.		
Diesel Service Tools and Equipment		Use scientific principles in relation to chemical, mechanical, and physical functions for various engine and vehicle systems. Use tools, equipment, and machines to safely measure, test, diagnose, and analyze components and systems (e.g., electrical and electronic circuits, alternating- and direct-current applications,	The student learns the functions and applications of the tools, equipment, technologies, and materials used in diesel equipment service. The student is expected to: (A) describe and demonstrate the safe use of hand and power tools and equipment	Demonstrate safe use and application of diesel service tools: • Identify appropriate tools and their usage in diesel service applications • Identify standard and metric designation • Demonstrate safe handling and use of appropriate tools • Demonstrate proper cleaning, storage, and	

		fluid/hydraulic and air/pneumatic systems). Demonstrate the practice of personal and occupational safety and protecting the environment by using materials and processes in accordance with manufacturer and industry standards.	commonly used in the diesel equipment field; (B) discuss the proper handling and disposal of environmentally hazardous materials generated in the service of diesel equipment; (C) describe new and emerging diesel technologies; (D) identify and perform the use of diagnostic tools and equipment; and (E) describe hydraulic/pneumatic properties, controls, and safety.	maintenance of tools and equipment • Demonstrate proper use of precision measuring tools (i.e., micrometer, dial-indicator, dial-caliper)	
General Service and Maintenance Information		Perform and document maintenance procedures in accordance with the recommendations of the manufacturer. Communicate the procedures and practices of various manufacturers regarding service, repair, and maintenance schedules. Use reference books, technical service bulletins, and other documents and materials related to the	The student applies the technical knowledge and skills of diesel equipment technology to simulated or actual work situations. The student is expected to: (A) describe the parts management procedures such as ordering, stocking, and locating parts;	Perform general engine maintenance, diagnosis, service, and repair in accordance with portable national industry standards, such as the National Automotive Technicians Education Foundation and the Equipment and Engine Training Council. (See NATEF Task list for additional tasks). Identify and use vehicle service information to prepare a vehicle for service:	

		service industry available in print and through electronic retrieval systems to accurately diagnose and repair systems, equipment, and vehicles.	(B) access service and repair information and resources; (C) perform preliminary engine inspection procedures; and (D) demonstrate an understanding of the process to perform regular audits and inspections to maintain compliance with appropriate regulations in areas such as safety, health, emissions, and environmental protection.	• Locate and utilize paper and/or electronic service information • Locate and utilize technical service bulletins (TSBs) • Demonstrate knowledge of special service messages, quotes, service campaigns/recalls, vehicle/service warranty applications, and service interval recommendations • Locate vehicle identification number (VIN) and production date code • Analyze vehicle identification number (VIN) information • Research other vehicle information labels (such as tire, emissions, etc.) • Identify information needed and the service requested on a repair order • Identify purpose and demonstrate proper use of fender covers, seat covers, and floor mats	
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				• Demonstrate use of the three C's (concern, cause, and correction) • Review vehicle service history • Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction	
Engine Components: Cylinder Head and Valve Train; Engine Block		Apply essential technical knowledge and skills common to professions in the diesel repair and service sector, following industry recommended procedures when performing technical tasks. Use tools, equipment, and machines to safely measure, test, diagnose, and analyze components and systems.	Understand and apply technical skills to diesel engine services. Student is expected to: (A) identify engine components; and (B) assess engine systems for service.	Engine Inspection: • Check engine starting/operation, record idle and governed rpm • Inspect belts, tensioners, and pulleys; check and adjust belt tension; check belt alignment • Inspect engine mounts for looseness and deterioration Check engine oil level and condition; check dipstick seal Check engine for oil, coolant, air, fuel, and exhaust leaks (engine off and running)	

				• Check engine compartment wiring harnesses, connectors, and seals for damage and proper routing • Inspect fuel, oil, diesel exhaust fluid (DEF) and coolant levels, and condition; determine needed action. • Identify engine fuel, oil, coolant, air, and other leaks; determine needed action. • Observe engine exhaust smoke color and quantity. • Check and record electronic diagnostic codes. See NATEF Task list for additional tasks.	
Lubrication and Cooling Systems		Use tools, equipment, and machines to safely measure, test, diagnose, and analyze components and systems for diesel service and repair.	Student apply knowledge of lubrication and cooling systems for diesel service and repair. Student is expected to: (A) demonstrate and apply the procedures to inspect and maintain cooling and lubrication systems.	Perform lubrication systems service and repair: • Check engine oil level, condition, and consumption; determine needed action. • Inspect and measure oil pump, drives, inlet pipes, and pick-up screens; check drive	

				gear clearances; determine needed action. • Determine proper lubricant and filter requirements. • Perform oil and filter change Perform Cooling Systems service assessment: • Check engine coolant type, level, condition, and consumption; test coolant for freeze protection and additive package concentration; determine needed action. • Test coolant temperature and check operation of temperature and level sensors, gauge, and/or sending unit; determine needed action. • Inspect thermostatic cooling fan system (hydraulic, pneumatic, and electronic)	
Air Induction and Exhaust		Demonstrate an understanding of the process to perform regular audits and inspections to maintain compliance with appropriate	Inspect air induction and exhaust systems. Student is expected to:	Inspect the air induction and exhaust systems: • Check air induction system: piping, hoses, clamps, and mounts;	

		regulations in areas such as safety, health, emissions, and environmental protection.	(A) identify the components of the air induction and exhaust system; and (B) inspect air induction and exhaust systems for service.	service or replace air filter as needed. • Inspect intake manifold, gaskets, and connections; determine needed action. • Inspect charge air cooler assemblies; determine needed action. • Inspect exhaust manifold, piping, mufflers, and mounting hardware; determine needed action. Preventative Maintenance: Check exhaust system mountings for looseness and damage. Check engine exhaust system for leaks, proper routing, and damaged or missing components to include exhaust gas recirculation (EGR) system and after treatment devices, if equipped. Check air induction system: piping, charge air cooler, hoses, clamps, and mountings; check for air restrictions and leaks. Inspect turbocharger for leaks; check mountings and connections.	
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				Service or replace air filter as needed; check and reset air filter restriction indicator. Inspect crankcase ventilation system. Inspect diesel exhaust fluid (DEF) system, to include tanks, lines, gauge, pump, and filter.	
Hydraulic pumps		Understand and apply knowledge of hydraulic systems in diesel vehicles.	Identify system type (closed and open) and verify proper operation of hydraulic systems. Student is expected to: (A) investigate general system operation; (B) identify system fluid type; (C) identify causes of pump failure, unusual pump noises, temperature, flow and leakage problems; (D) determine pump type, rotation, and drive system; and (E) read and interpret systems diagrams and schematics.	Describe procedures for inspection and maintenance of ancillary systems such as braking, steering, suspension, and hydraulic/pneumatic systems.	
Fuel Service		Demonstrate an understanding of the process to perform regular audits and inspections to maintain compliance with appropriate regulations in areas such as	Perform fuel supply systems inspection. Student is expected to: (A) identify fuel system components; and	Perform fuel supply systems service: • Check fuel level, and condition; determine needed action.	

		safety, health, emissions, and environmental protection.	(B) investigate fuel systems service processes.	- Inspect fuel tanks, vents, caps, mounts, valves, screens, crossover system, supply and return lines and fittings; determine needed action. - Inspect primary fuel delivery system; determine needed action. - Drain water from fuel system. - Service water separator/fuel heater; replace fuel filter(s); prime and bleed fuel system.	
Battery, Starting and Charging Systems		Understand the scientific principles related to power and electricity	Student understands and applies concepts of power and electricity to diesel power vehicle systems. Student is expected to: (A) demonstrate and apply the concepts of electrical circuit testing, including Ohm's law, voltage drop, resistance, amperage, and voltage, as related to batteries and charging and starting systems;	State basics of Electron Theory: - Conductors, semi-conductors and Insulators - Current flow theory - electron, conventional Demonstrates knowledge of electrical/electronics series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law). P-1 Uses wiring diagrams to trace electrical/electronic circuits. P-1	

			(B) demonstrate and apply the concepts of wiring diagrams and related symbols and series and parallel circuits. (C) understand batteries and how the work. (D) understand and apply technical skills for the testing of automotive batteries, including digital multimeter(s) and; (E) understand and apply concepts of electrical measurements. Understand the Starting System. Student is expected to: (A) understand the starter current draw test; (B) understand the starter circuit voltage drop tests; (C) understand the Starter relays and solenoids; (D) understand starter removal and installation; and	Demonstrate knowledge of the causes and effects from shorts, grounds, opens, and resistance problems in electrical/electronic circuits. P-2 Checks operation of electrical circuits with a test light. P-2 Checks operation of electrical circuits with fused jumper wires. P-2 Demonstrates proper use of a digital multimeter (DMM) when measuring source voltage, voltage drop (including grounds), current flow, and resistance. P-1 Performs starter current draw test; determines necessary action. P-1 Perform starter circuit voltage drop tests; determine necessary action. P-1 Inspects and tests starter relays and solenoids; determine necessary action. P-2 Removes and installs starter in a vehicle. P-1 Inspects and test switches, connectors, and wires of starter control circuits;	
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			(E) understand test switches, connectors, and wires of starter control circuits. Understand the Charging System. Student is expected to: (A) understand the Output test and how it is used; (B) understand generator drive belts (alternator); and (C) understand charging circuits voltage drop test	determines necessary action. P-2 Inspects and tests fusible links, circuit breakers, and fuses; determines necessary action. P-1 Performs charging system output test; determines necessary action. P-1 Inspects, adjusts, or replaces generator (alternator) drive belts; check pulleys and tensioners for wear; checks pulley and belt alignment. P-1 Removes, inspects, and re-installs generator (alternator). P-2 Performs charging circuit voltage drop tests; determines necessary action. P-1 Inspect alternator, mountings, cable, wiring, and wiring routing; determine needed action. Perform alternator output tests	
Tires and Wheels		Understand and apply knowledge of wheel and tire inspection for diesel service and repair.	Perform basic inspection of tires and wheels. Student is expected to: (A) identify tire wear patterns; (B) check tread depth and pressure;	See NATEF Task list for additional tasks	

			(C) inspect tire for proper application, (size, load range, position, and tread design); (D) inspect wheel/rims for proper application, load range, size, and design; and (E) check operation of tire pressure monitoring system (TPMS).		

Academic Standards Alignment

Colorado CTE courses are required to integrate academic and essential skills into course content. The following academic standards have been identified as aligned to this course and should be integrated throughout instruction.

[CO CTE Academic Standards Resources](#) (Rubrics, integration strategies, etc) [CDE Colorado Academic Standards Online](#) (Online standards lookup tool)

Reading, Writing, & Communicating

Standard 1: Oral Expression and Listening

- **Prepared Graduate 1:** Collaborate effectively as group members or leaders who listen actively and respectfully; pose thoughtful questions, acknowledge the ideas of others; and contribute ideas to further the group's attainment of an objective.

Standard 2: Reading for All Purposes .

- **Prepared Graduate 4:** Read a wide range of informational texts to build knowledge and to better understand the human experience.
- **Prepared Graduate 5:** Understand how language functions in different contexts, command a variety of word-learning strategies to assist comprehension, and make effective choices for meaning or style when writing and speaking.

Standard 3: Writing and Composition

- **Prepared Graduate 9:** Demonstrate mastery of their own writing process with clear, coherent, and error-free polished products.

Standard 4: Research Inquiry and Design

- **Prepared Graduate 10:** Gather information from a variety of sources; analyze and evaluate its quality and relevance; and use it ethically to answer complex questions.

Note: Mathematics and Science standards will be added in the future. Visit the [Colorado Academic Standards](#) page for the most current version.