

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.)	
			Course = 0.50 Carnegie Unit Credit	Prerequisite= Principles of Transportation or Introduction to Automotive Service	
				CTE Credential= CTE Transportation	
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: <ul style="list-style-type: none"> • 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.	<ul style="list-style-type: none"> • 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	Obtain OSHA 10

				<p>securing hair and jewelry for lab/shop activities.</p> <p>Locate and demonstrate knowledge of safety data sheets (SDS).</p> <p>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.</p>	
Diesel Engines and Systems		<p>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).</p>	<p>The student demonstrates technical knowledge and skills of diesel equipment technology. The student is expected to:</p> <p>(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;</p> <p>(B) describe the function of the chassis components such as braking, steering, transmission, drivetrain,</p>	<p>See NATEF Task list for additional tasks</p>	<p>SkillsUSA Diesel Technology Competition</p>

			<p>suspension systems, pneumatics, and hydraulics;</p> <p>(C) locate, read, and interpret documents such as schematics, charts, diagrams, graphs, parts catalogs, and service-repair information and technical bulletins; and</p> <p>(D) demonstrate precision measurement procedures to diagnose component wear, compare measurements to published specifications, and determine necessary repairs.</p>		
Diesel Service Tools and Equipment		<p>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, fluid/hydraulic and air/pneumatic systems). Demonstrate the practice of personal and occupational</p>	<p>The student learns the functions and applications of the tools, equipment, technologies, and materials used in diesel equipment service. The student is expected to:</p> <p>(A) describe and demonstrate the safe use of hand and power tools and equipment commonly used in the diesel equipment field;</p> <p>(B) discuss the proper handling and disposal of</p>	<p>Demonstrate safe use and application of diesel service tools:</p> <ul style="list-style-type: none"> • 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 maintenance of tools and equipment 	

		<p>safety and protecting the environment by using materials and processes in accordance with manufacturer and industry standards.</p>	<p>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.</p>	<ul style="list-style-type: none"> • Demonstrate proper use of precision measuring tools (i.e., micrometer, dial-indicator, dial-caliper) 	
<p>General Service and Maintenance Information</p>		<p>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 service industry available in print and through electronic retrieval systems to accurately diagnose and repair systems, equipment, and vehicles.</p>	<p>The student applies the technical knowledge and skills of diesel equipment technology to simulated or actual work situations. The student is expected to:</p> <p>(A) describe the parts management procedures such as ordering, stocking, and locating parts;</p> <p>(B) access service and repair information and resources;</p> <p>(C) Perform preliminary engine inspection procedures; and</p> <p>(D) demonstrate an understanding of the process to perform regular audits and</p>	<p>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:</p> <ul style="list-style-type: none"> • Locate and utilize paper and/or electronic service information • Locate and utilize technical service bulletins (TSBs) 	

			<p>inspections to maintain compliance with appropriate regulations in areas such as safety, health, emissions, and environmental protection.</p>	<ul style="list-style-type: none"> • 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 • Demonstrate use of the three C's (concern, cause, and correction) • Review vehicle service history • Complete work order to include customer 	
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				<p>information, vehicle identifying information, customer concern, related service history, cause, and correction</p> <p>Engine Inspection:</p> <ul style="list-style-type: none"> • 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. 	
<p>Engine Components: Cylinder Head and Valve Train; Engine Block</p>		<p>Apply essential technical knowledge and skills common to professions in the diesel repair and service sector, following industry recommended procedures when performing technical tasks.</p> <p>Use tools, equipment, and machines to safely measure, test, diagnose, and analyze components and systems.</p>	<p>Understand and apply technical skills to diesel engine services. Student is expected to:</p> <p>(A) demonstrate procedures for removal, inspection, and replacement of engine components;</p> <p>(B) understand process for cylinder head and valve train service; and</p>	<p>Perform Cylinder Head and Valve Train Service:</p> <ul style="list-style-type: none"> • Inspect cylinder head for cracks/damage; check mating surfaces for warpage; check condition of passages; inspect core/expansion and gallery plugs; determine needed action 	

			<p>(C) understand process for engine block service.</p>	<ul style="list-style-type: none"> • Disassemble head and inspect valves, guides, seats, springs, retainers, rotators, locks, and seals; determine needed action. • Inspect valve train components; determine needed action. • Reassemble cylinder head. • Inspect, measure, and replace/reinstall overhead camshaft; measure/adjust end play and backlash • Adjust valve bridges (crossheads); adjust valve clearances and injector settings. <p>Perform Engine Block Service:</p> <ul style="list-style-type: none"> • Remove, inspect, service, and install pans, covers, gaskets, seals, wear rings, and crankcase ventilation components. • Disassemble, clean, and inspect engine block for cracks/damage; measure mating surfaces for warpage; check condition of passages, 	
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				<p>core/expansion and gallery plugs; inspect threaded holes, studs, dowel pins, and bolts for serviceability; determine needed action.</p> <ul style="list-style-type: none"> • Clean, inspect, and measure cylinder walls or liners for wear and damage; determine needed action. • Inspect in-block camshaft bearings for wear and damage; determine needed action. • Inspect, measure, and replace/reinstall in-block camshaft; measure/adjust end play. • Clean and inspect crankshaft for surface cracks and journal damage; check condition of oil passages; check passage plugs; measure journal diameter; determine needed action. • Inspect main bearings for wear and damage; check bearing 	
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				<p>clearances; check crankshaft end play.</p> <ul style="list-style-type: none"> • Inspect, install, and time gear train; measure gear backlash; determine needed action. • Inspect connecting rod and bearings for wear patterns; measure pistons, pins, retainers, and bushings. • Determine piston-to-cylinder wall clearance; check ring-to-groove fit and end gap; install rings on pistons • Assemble pistons and connecting rods; install in block; install rod bearings and check clearances. • Check condition of piston cooling jets (nozzles); determine needed action. • Inspect crankshaft vibration damper; determine needed action. • Inspect flywheel/flexplate (including ring gear) and mounting surfaces for cracks 	
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				<p>and wear; measure runout; determine needed action.</p> <p>See NATEF Task list for additional tasks.</p>	
<p>Lubrication and Cooling Systems</p>		<p>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).</p>	<p>Student apply knowledge of lubrication and cooling systems for diesel service and repair. Student is expected to:</p> <p>(A) demonstrate and apply the procedures to inspect and maintain cooling and lubrication systems.</p>	<p>Perform lubrication systems service and repair:</p> <ul style="list-style-type: none"> • 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 <p>Perform Cooling Systems service and repair:</p> <ul style="list-style-type: none"> • Check engine coolant type, level, condition, and consumption; test coolant for freeze protection and additive package concentration; determine needed action. • Test coolant temperature and 	

				<p>check operation of temperature and level sensors, gauge, and/or sending unit; determine needed action.</p> <ul style="list-style-type: none"> • Inspect and reinstall/replace pulleys, tensioners and drive belts; adjust drive belts and check alignment. • Recover coolant, refill with recommended coolant/additive package, and bleed cooling system per manufacturers specification. • Inspect coolant conditioner/filter assembly for leaks; inspect valves, lines, and fittings; replace as needed. • Inspect water pump and coolant hoses; replace as needed. • Inspect, clean, and pressure test radiator. Pressure test cap, tank(s), and recovery systems; determine needed action. • Inspect thermostatic cooling fan system (hydraulic, pneumatic, 	
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				and electronic) and fan shroud; replace as needed	
Air Induction and Exhaust		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.	Inspect air induction and exhaust systems	<p>Inspect the air induction and exhaust systems:</p> <ul style="list-style-type: none"> • Check air induction system: piping, hoses, clamps, and mounts; 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. <p>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.</p>	

				<p>Check air induction system: piping, charge air cooler, hoses, clamps, and mountings; check for air restrictions and leaks.</p> <p>Inspect turbocharger for leaks; check mountings and connections.</p> <p>Service or replace air filter as needed; check and reset air filter restriction indicator.</p> <p>Inspect crankcase ventilation system.</p> <p>Inspect diesel exhaust fluid (DEF) system, to include tanks, lines, gauge, pump, and filter.</p>	
Fuel Service		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.	Perform fuel supply Systems Service	<p>Perform fuel supply systems service:</p> <ul style="list-style-type: none"> • Check fuel level, and condition; determine needed action. • 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. 	

				<ul style="list-style-type: none"> • Service water separator/fuel heater; replace fuel filter(s); prime and bleed fuel system. 	
HVAC Systems		Perform service and repairs to diesel vehicle HVAC systems.	Examine heating, ventilation, and air conditioning systems for service. Student is expected to: (A) discuss the proper procedures to inspect and maintain temperature control auxiliary systems such as air-conditioning, heating, and accessory systems.	Examine heating, ventilation, and air conditioning systems for service: <ul style="list-style-type: none"> • Inspect A/C condenser and lines for condition and visible leaks; check mountings. • Inspect A/C compressor and lines for condition and visible leaks; check mountings. • Check A/C system condition and operation; check A/C monitoring system, if applicable. • Check HVAC air inlet filters and ducts; service as needed. 	
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,	State basics of Electron Theory: <ul style="list-style-type: none"> • Conductors, semi-conductors and Insulators • Current flow theory - electron, conventional Demonstrates knowledge of electrical/electronics series, parallel, and series-parallel	

			<p>as related to batteries and charging and starting systems;</p> <p>(B) demonstrate and apply the concepts of wiring diagrams and related symbols and series and parallel circuits.</p> <p>(C) understand batteries and how they work.</p> <p>(D) understand and apply technical skills for the testing of automotive batteries, including digital multimeters and;</p> <p>(E) understand and apply concepts of electrical measurements.</p> <p>Understand the Starting System. Student is expected to:</p> <p>(A) understand the starter current draw test</p> <p>(B) Understand the starter circuit voltage drop tests</p> <p>(C) understand the Starter relays and solenoids</p> <p>(D) understand starter removal and installation</p>	<p>circuits using principles of electricity (Ohm's Law). P-1</p> <p>Uses wiring diagrams to trace electrical/electronic circuits. P-1</p> <p>Demonstrate knowledge of the causes and effects from shorts, grounds, opens, and resistance problems in electrical/electronic circuits. P-2</p> <p>Checks operation of electrical circuits with a test light. P-2</p> <p>Checks operation of electrical circuits with fused jumper wires. P-2</p> <p>Demonstrates proper use of a digital multimeter (DMM) when measuring source voltage, voltage drop (including grounds), current flow, and resistance. P-1</p> <p>Performs starter current draw test; determines necessary action. P-1</p> <p>Perform starter circuit voltage drop tests; determine necessary action. P-1</p> <p>Inspects and tests starter relays and solenoids; determine necessary action. P-2</p>	
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			<p>(E) understand test switches, connectors, and wires of starter control circuits.</p> <p>Understand the Charging System. Student is expected to:</p> <p>(A) Understand the Output test and how it is used;</p> <p>(B) Understand generator drive belts (alternator); and</p> <p>(C) understand charging circuits voltage drop test</p>	<p>Removes and installs starter in a vehicle. P-1</p> <p>Inspects and test switches, connectors, and wires of starter control circuits; determines necessary action. P-2</p> <p>Inspects and tests fusible links, circuit breakers, and fuses; determines necessary action. P-1</p> <p>Performs charging system output test; determines necessary action. P-1</p> <p>Inspects, adjusts, or replaces generator (alternator) drive belts; check pulleys and tensioners for wear; checks pulley and belt alignment. P-1</p> <p>Removes, inspects, and re-installs generator (alternator). P-2</p> <p>Performs charging circuit voltage drop tests; determines necessary action. P-1</p> <p>Inspect alternator, mountings, cable, wiring, and wiring routing; determine needed action.</p> <p>Perform alternator output tests</p>	

