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

Learning that works for Colorado CTE®

Colorado CTE Course – Scope and Sequence

Course Name	**Diesel Engines**	**Course Details**	**Credit= 1.0** **Prerequisite: Diesel Technology II** **CTE Credential: CTE Transportation**
		Course = 0.50 Carnegie Unit Credit	
Course Description	Covers the theory and operation of diesel engines with emphasis on cylinder heads and valve trains diagnosis and repair. Also introduces the cooling system's importance with diagnosis and repair. Enables students to diagnose, test, and repair cylinder heads and cooling systems on diesel engines.		
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
Safety		Understands industry expectations for safety in the workplace.	Describe safety practices to be followed when performing engine service. Student is expected to: (A) demonstrate use of personal protective equipment; and (B) demonstrate safe use and operation of all tools, and equipment.		
General Engine Fundamentals		Understand terminology and concepts related to diesel engine systems and components.	Understand terminology and concepts related to diesel engine systems and components. Student is expected to:	Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins.	

			(A) define key engine terms (B) understand the diesel cycle; and (C) identify engine systems and circuits.	Describe engine size measurements based on bore, stroke, displacement, and number. Explain engine compression and how it affects engine performance. Explain engine torque and horsepower ratings. Explain volumetric efficiency, thermal efficiency, mechanical efficiency, and total engine efficiency.	
Diesel Engine Systems		Explain the interaction of diesel engine systems.	Understand the subsystems that affect engine performance. Student is expected to: (A) Understand key components of the engine's fuel system; (B) Understand key components of the engine' air induction and exhaust system; (C) Understand key components of the engine's cooling system; and (D) Understand key components of the engine's lubrication system.		

Preventative Maintenance: • **Establishing a Maintenance Program** • **PMI Scheduling** • **Lubricants** • **Performing a Lube Job** • **Winterizing** • **Out-of-Service or Dead lining a Vehicle**		Describe how preventative maintenance for engines is scheduled and performed.	Student is expected to: (D) define the terms that describe basic diesel engine operation; (E) identify the differences between a: natural aspirated engine and a manifold boosted engine; (F) retrieve and record diagnostic trouble codes, OBD monitor status, and freeze and frame data; clear codes when applicable; (G) diagnose emissions or driveability concerns without store diagnostic trouble codes; (H) explain how to set up a diesel preventive maintenance inspection program; (I) explain how to set up a daily walk around inspection for diesel units; (J) describe the proper steps for preparing the diesel equipment for short and long term stationary storage.		

Engine Powertrain			Identify concerns related to engine powertrain components. Student is expected to: (A) identify piston assemblies (B) identify connecting rods & bearings (C) explain how to measure cylinder and piston wear; (D) explain engine torque, horsepower, and rating for diesel engines; and (E) explain volumetric efficiency, thermal efficiency, and total engine power.		
Engine Lubrication Systems			Apply knowledge of engine lubrication systems to diesel engine service and repair. Student is expected to: A) understand the types of engine oil and their uses B) identify lubrication system components C) evaluate oil measure tests and determine necessary actions.		
Engine Cooling Systems			Understand and apply knowledge of engine cooling systems to diesel service and		

			repair. Student is expected to: (A) understand how engine coolant affect engine function; (B) identify cooling system components; (C) demonstrate techniques for repairing leaks; and (D) demonstrate safe handling of coolant.		
Engine Ignition and Fuel		Understand how the engine regulates fuel and air.	Understand how engines use air and fuel to function. Student is expected to: A) understand how gas flow allows the engine to function B) identify fuel pumps identify air intake system components C) identify exhaust components D) inspect and test fuel pumps and pump control systems for pressure, regulation and volume; E) inspect and/or replace fuel filters;		

			F) demonstrate Inspection and testing of fuel injectors; and G) diagnose ignition system related problems such as no-starting, hard starting, engine misfire, poor driveability, and power loss.		
Diesel Fuel		Explain how energy of the fuels is converted to kinetic energy.	Understand diesel fuel characteristics and how they related to engine performance. Student is expected to: (A) Understand how diesel fuel is stored and used within the engine; (B) Explain fuel deterioration; and (C) understand how fuel issues can affect engine performance.		
Fuel Subsystems			Identify the fuel subsystems. Student is expected to: A) identify the fuel tanks; B) identify the fuel filters;		

			C) identify fuel charging & transfer pumps; and D) Understand how to identify a complete fuel circuit.		
Engine Troubleshooting			Understand engine service levels and steps for service and troubleshooting. Student is expected to: (A) describe the typical difference between a minor tune-up and major tune-up for diesel engines; (B) identify all the steps or procedures to perform a diesel engine tune-up; (C) remove and reinstall different types of diesel pumps and injectors; (D) test, service and analyze the fuel system and electrical circuits; (E) identify and interpret engine concerns; (F) perform cylinder cranking and running compression test; (G) remove cylinder head; inspect gasket	1. Check engine starting/operation (including unusual noises, vibrations, exhaust smoke, etc.); record idle and governed rpm. 2. Inspect vibration damper, belts, tensioners, and pulleys; check and adjust belt tension; check belt alignment. 3. Check engine oil level and condition; check dipstick seal. 4. Inspect engine mounts, fuel tanks, lines, caps, and vents, for looseness and deterioration. 5. Check engine for oil, coolant, air, fuel, and exhaust leaks (Engine Off and Running). 6. Check engine compartment wiring harnesses, connectors, and seals for damage and proper routing. 7. Drain water from fuel system, service water separator/fuel heater;	

			condition; install cylinder head and gasket; tighten according to manufacturer's specifications and procedures; and (H) disassemble engine block; clean and prepare components for inspection and reassembly.	replace fuel filter(s); prime and bleed fuel system. 8. Check engine exhaust system for leaks, loose mountings, proper routing, and damaged or missing components to include exhaust gas recirculation (EGR) system and after-treatment devices, if equipped. 9. Inspect turbocharger, air induction system, piping, charge air cooler, hoses, clamps, mountings and connections, for air restrictions and leaks. 10. Check operation of engine compression/exhaust brake. 11. Service or replace air filter as needed; check and reset air filter restriction indicator. 12. Inspect and service crankcase ventilation system. 13. Inspect radiator (including air flow restriction, leaks, and damage) and mountings. 14. Inspect fan assembly and shroud, and fan clutch operation.	

				15. Inspect water pump, and pressure test cooling system and radiator cap. 16. Inspect coolant hoses, clamps, and coolant recovery system. 17. Check coolant for contamination, additive package concentration, and protection level (freeze point), and service coolant filter. 18. Change engine oil and filters, take an engine oil sample, visually check oil for coolant or fuel contamination; inspect and clean magnetic drain plugs. 19. Inspect key condition and operation of ignition switch. 20. Check warning indicators, and instruments; record oil pressure and system voltage. 21. Check operation of electronic power take off (PTO) and engine idle speed controls (if applicable). 22. Inspect diesel exhaust fluid (DEF) system, to include tanks, lines, gauge pump, and filter. 23. Inspect selective catalyst reduction (SCR) system; including diesel exhaust fluid	

				(DEF) for proper levels, leaks, mounting and connections.	