

CRAFTSMEN TRAINING SCHEME (CTS)

ANNUAL INSTRUCTIONAL PLAN

MECHANIC DIESEL TRADE (42 WEEKS)

Curriculum as per DGT / CSTARI Guidelines for Mechanic Diesel CTS Scheme

Trade Name	MECHANIC DIESEL (Engineering Trade)
NSQF Level & Duration	NSQF Level-3 / 4 One Year (42 Weeks Plan)
Academic Session	20____ - 20____
Institute Name & Address	
Instructor Name & Designation	
Group Instructor (GI) Name	
Principal / Supt. Name	

WEEKLY INSTRUCTIONAL PLAN (WEEK 1 TO WEEK 42)

Week No.	Trade Practical (Professional Skills)	Trade Theory (Professional Knowledge)
Week 1	- Demonstration of Machinery used in the trade. - Identify safety Gear/PPE (Personal Protective Equipments) and their uses. - Importance of maintenance of safety equipment used in Workshop. - Demonstration on safe handling and Periodic testing of lifting equipment, and Safety disposal of used engine oil.	- Importance & scope of Mechanic Diesel Trade Training. - General discipline in the Institute. - Elementary First Aid, Occupational Safety & Health. - Knowledge of Personal Safety & Safety precautions in handling Diesel machine. - Concept about House Keeping & 5S method. - Safety disposal of Used engine oil, Electrical safety tips. - Safe handling of Fuel Spillage, Safe disposal of toxic dust, safe handling and Periodic testing of lifting equipment.
Week 2	- Demonstration on health hazards, occupational safety & first Aid. - Demonstration fire service station to provide demo on Fire safety. - Perform use of fire extinguishers. - Perform marking using all marking aids, like steel rule with spring callipers, dividers, scribe, punches, chisel etc. on MS Flat/Sheet Metal.	Hand & Power Tools: - Marking scheme, marking material chalk, Prussian blue. - Cleaning tools - Scraper, wire brush, Emery paper. - Description, care and use of Surface plates, steel rule, measuring tape, try square. - Callipers - inside and outside. - Dividers, surface gauges, scribe. - Punches - prick punch, centre punch, pin punch, hollow punch, number and letter punch. - Chisel - flat, cross-cut. - Hammer - ball pein, lump, mallet. - Screwdrivers - blade Screwdriver, Phillips screwdriver, Ratchet screwdriver. - Allen key, bench vice & C-clamps.
Week 3	- Measure a wheel base of a vehicle with measuring tape. - Perform to remove wheel lug nuts with use of an air impact wrench. - Operate General workshop tools & power tools.	- Spanners - ring spanner, open end spanner & the combination spanner, universal adjustable open ends spanner. - Sockets & accessories. - Pliers - Combination pliers, multi grip, long nose, flat-nose, Nippers or pincer pliers, Side cutters, Tin snips, Circlip pliers, external circlips pliers. - Air impact wrench, air ratchet, wrenches - Torque wrenches, pipe wrenches, Pipe flaring & cutting tool, pullers - Gear and bearing.
Week 4	- Perform measuring practice on Cam height, Camshaft Journal dia, crankshaft journal dia, Valve stem dia, piston diameter, and piston pin dia with outside Micrometres. - Perform measuring practice on cylinder bore for taper and out-of-round with Dial bore gauges.	Systems of measurement: - Description, Least Count calculation, care & use of - Micrometers: Outside, and depth micrometer, Micrometer adjustments. - Description, Least Count calculation, care & use of Vernier Calliper. - Telescope gauges, Dial bore gauges.
Week 5	- Perform measuring practice to measure wear on crankshaft end play, crankshaft run out, and valve guide with dial indicator and magnetic stand. - Perform measuring practice to check the flatness of the cylinder head is warped or twisted with straightedge is used with a feeler gauge. - Perform measuring practice to check the end gap of a piston ring, piston-to-cylinder wall clearance with feeler gauge. - Perform practice to check engine manifold vacuum with vacuum gauge. - Perform practice to check the air pressure inside the vehicle tyre is maintained at the recommended setting.	- Dial indicators, straightedge, feeler gauge, thread pitch gauge, vacuum gauge, tire pressure gauge. - Different types of metal joint (Permanent, Temporary), methods of Soldering, etc.

Week No.	Trade Practical (Professional Skills)	Trade Theory (Professional Knowledge)
Week 6	- Perform removal of stud/bolt using stud extractor. - Perform practice on cutting tools like Hacksaw, file, chisel, Sharpening of Chisels, center punch, safety precautions while grinding.	Fasteners: 27. Study of different types of screws, nuts, studs & bolts, locking devices such as lock nuts, cotter, split pins, keys, circlips, lock rings, lock washers and locating where they are used. 28. Washers & chemical compounds can be used to help secure these fasteners.
Week 7	Perform practice on Hacksawing and filing to given dimensions.	29. Function of Gaskets, Selection of materials for gaskets and packing, oil seals. 30. Types of Gaskets: paper, multilayered metallic, liquid, rubber, copper and printed. 31. Thread Sealants: Various types like locking, sealing, temperature resistance, antilocking, lubricating etc. Cutting tools: 32. Study of different type of cutting tools like Hacksaw, File - Definition, parts of a file, specification, Grade, shape, different type of cut and uses. 33. OFF-hand grinding with sander, bench and pedestal grinders, safety precautions while grinding.
Week 8	Perform practice on Marking and Drilling clear and Blind Holes, Sharpening of Twist Drills. Safety precautions to be observed while using a drilling machine.	Drilling machine: 34. Description and study of Bench type Drilling machine, Portable electrical Drilling machine, drill holding devices, Work Holding devices, Drill bits.
Week 9	- Perform practice on Tapping a Clear and Blind Hole, Selection of tap drill Size, use of Lubrication, Use of stud extractor. - Perform practice cutting Threads on a Bolt/Stud. Adjustment of two piece Die, Reaming a hole/Bush to suit the given pin/shaft, scraping a given machined surface.	Taps and Dies: 35. Hand Taps and wrenches, Calculation of Tap drill sizes for metric and inch taps. 36. Different type of Die and Die stock. Screw extractors. Hand Reamers: 37. Different Type of hand reamers, Drill size for reaming, Lapping, Lapping abrasives, type of Laps.
Week 10	- Perform practice in joining wires using soldering Iron. - Prepare simple electrical circuits, measuring of current, voltage and resistance using digital multimeter.	Basic electricity: 38. Electricity principles, Ground connections, Ohm's law, Voltage, Current, Resistance, Power, Energy. 39. Voltmeter, ammeter, Ohmmeter, Multimeter, Conductors & insulators, Wires, Shielding, Length vs. resistance, Resistor ratings.
Week 11	- Perform practice continuity test for fuses, relay and diodes. - Check circuit using of service manual wiring diagram for troubleshooting.	40. Fuses & circuit breakers, Ballast resistor, Stripping wire insulation, Cable colour codes and sizes, Resistors in Series circuits, Parallel circuits and Series-parallel circuits.
Week 12	- Execute cleaning and topping up of a lead acid battery. - Perform testing battery with hydrometer. - Perform connecting battery to a charger for battery charging and checking & testing a battery after charging.	41. Description of Chemical effects, Batteries & cells, Lead acid batteries & Stay Maintenance Free (SMF) batteries.
Week 13	Perform test of relay and solenoids and its circuit.	42. Magnetic effects, Heating effects, Thermo-electric energy, Thermistors, Thermocouples, Electrochemical energy, Photo-voltaic energy, Piezo-electric energy. 43. Electromagnetic induction, Relays, Solenoids, Primary & Secondary windings, Transformers, stator and rotor coils.
Week 14	- Identify of Hydraulic and pneumatic components used in vehicle. - Tracing of hydraulic circuit on hydraulic jack, hydraulic, and Brake circuit. - Identify components in Air brake systems.	Introduction to Hydraulics & Pneumatics: 44. Description, symbols and application in automobile of Gear pump - Internal & External, single acting, double acting & Double ended cylinder; Directional control, Pressure relief valve, Non return valve, Flow control valve used in automobile.

Week No.	Trade Practical (Professional Skills)	Trade Theory (Professional Knowledge)
Week 15	- Identify of different types of Vehicle. - Demonstrate of vehicle specification data. - Identify of vehicle information Number (VIN). - Demonstrate of Garage, Service station equipments - Vehicle hoists - Two post and four post hoist, Engine hoists, Jacks, Stands.	45. Classification of vehicles on the basis of load as per central motor vehicle rule, wheels, final drive, and fuel used, axles, position of engine and steering transmission, body and load. 46. Brief description Uses of Vehicle hoists - Two post and four post hoist, Engine hoists, Jacks, Stands.
Week 16	- Identify the different parts of IC Engine. - Identify the different parts in a diesel engine of LMV/HMV.	Introduction to Engine: 47. Description of internal & external combustion engines, Classification of IC engines, Principle & working of 2 & 4-stroke diesel engine (Compression ignition Engine (C.I)). 48. Principle of Spark Ignition Engine (SI), differentiate between 2-stroke and 4-stroke, C.I engine and S.I Engine. 49. Main Parts of IC Engine.
Week 17	- Perform practice on starting and stopping of diesel engines. Observe and report the reading of Tachometer, Odometer, temp and Fuel gauge under ideal and on load condition. - Practice on dismantling Diesel engine of LMV/HMV as per procedure.	50. Direct injection and indirect injection, Technical terms used in engine, Engine specification. 51. Study of various gauges/instrument on a dash board of a vehicle - Speedometer, Tachometer, Odometer and Fuel gauge, and Indicators such as gearshift position, Seat belt warning light, Parking-brake-engagement warning light and an Engine-malfunction light. 52. Different type of starting and stopping method of Diesel Engine. 53. Procedure for dismantling of diesel engine from a vehicle.
Week 18	- Perform Overhauling of cylinder head assembly, Use of service manual for Clearance and other parameters. - Perform practice on removing rocker arm assembly manifolds.	Diesel Engine Components: 54. Description and Constructional feature of Cylinder head, Importance of Cylinder head design, Type of Diesel combustion chambers, Effect on size of Intake & exhaust passages, Head gaskets. 55. Importance of Turbulence.
Week 19	- Perform practice on removing the valves and its parts from the cylinder head, cleaning. - Inspection of cylinder head and manifold surfaces for warping, cracks and flatness. Checking valve seats & valve guide - Replacing the valve if necessary.	Valves & Valve Actuating Mechanism: 56. Description and Function of Engine Valves, different types, materials, Type of valve operating mechanism, Importance of Valve seats, Valve seats inserts in cylinder heads, importance of Valve rotation, Valve stem oil seals, size of Intake valves.
Week 20	- Check leaks of valve seats for leakage - Dismantle rocker shaft assembly - clean & check rocker shaft - and levers, for wear and cracks and reassemble. - Check valve springs, tappets, push rods, tappet screws and valve stem cap. Reassembling valve parts in sequence, refit cylinder head and manifold & rocker arm assembly, adjustable valve clearances, starting engine after adjustments.	57. Valve trains, Valve-timing diagram, concept of Variable valve timing. 58. Description of Camshafts & drives, Description of Overhead camshaft (SOHC and DOHC), importance of Cam lobes, Timing belts & chains, Timing belts & tensioners.
Week 21	- Perform Overhauling piston and connecting rod assembly. Use of service manual for clearance and other parameters. - Perform Practice on removing oil sump and oil pump - clean the sump. - Perform removing the big end bearing, connecting rod with the piston.	Piston & Connecting Rod: 59. Description & functions of different types of pistons, piston rings and piston pins and materials. 60. Used recommended clearances for the rings and its necessity precautions while fitting rings, common troubles and remedy. 61. Compression ratio.

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Week 22	• Perform removing the piston rings; Dismantle the piston and connecting rod. • Check the side clearance of piston rings in the piston groove & lands for wear. Check piston skirt and crown for damage and scuffing, clean oil holes. • Measure - the piston ring close gap in the cylinder, clearance between the piston and the liner, clearance between crank pin and the connecting rod big end bearing. • Check connecting rod for bend and twist. Assemble the piston and connecting rod assembly.	62. Description & function of connecting rod, importance of big-end split obliquely. 63. Materials used for connecting rods big end & main bearings. Shells piston pins and locking methods of piston pins.
Week 23	• Perform Overhauling of crankshaft, Use of service manual for clearance and other parameters. • Perform removing damper pulley, timing gear/timing chain, flywheel, main bearing caps, bearing shells and crankshaft from engine.	Crankshaft & Flywheel: 64. Description and function of Crank shaft, camshaft, Engine bearings - classification and location - materials used & composition of bearing materials - Shell bearing and their advantages - special bearings material for diesel engine. 65. Application bearing failure & its causes - care & maintenance.
Week 24	• Inspect oil retainer and thrust surfaces for wear. • Measure crankshaft journal for wear, taper and ovality. • Demonstrate crankshaft for fillet radii, bend & twist. • Inspect flywheel and mounting flanges, spigot and bearing. • Check vibration damper for defect.	66. Crank-shaft balancing, firing order of the engine. 67. Description and function of the fly wheel and vibration damper. 68. Crankcase & oil pump, gears timing mark, Chain sprockets, chain tensioner etc. Function of clutch & coupling units attached to flywheel.
Week 25	• Perform removing camshaft from engine block, Check for bend & twist of camshaft. Inspection of cam lobe, camshaft journals and bearings and measure cam lobe lift. • Fixing bearing inserts in cylinder block & cap check nip and spread clearance & oil holes & locating lugs fix crankshaft on block - torque bolts - check end play remove shaft - check seating, repeat similarly for connecting rod and Check seating and refit.	Cylinder Block: 69. Description of Cylinder block, Cylinder block construction, Different type of Cylinder sleeves (liner).
Week 26	• Perform cleaning and checking of cylinder blocks. Surface for any crack, flatness measure cylinder bore for taper & ovality, clean oil gallery passage and oil pipe line. • Perform reassembling all parts of engine in correct sequence and torque all bolts and nuts as per workshop manual of the engine. • Perform testing cylinder compression, Check idle speed.	70. Reassembly procedure of engine components and torque specifications. 71. Testing cylinder compression and idle speed checking methods.
Week 27	• Perform removing & replacing a cam belt, and adjusting an engine drive belt, replacing an engine drive belt. • Perform practice on checking & top up coolant, draining & refilling coolant, checking/replacing a coolant hose. • Perform test cooling system pressure.	Cooling System: 72. Need for Cooling systems, Heat transfer method, Boiling point & pressure, Centrifugal force, properties of coolant. 73. Vehicle coolant properties and recommended change interval, Different type of cooling systems.
Week 28	• Execute on removing & replacing radiator/thermostat check the radiator pressure cap. • Test of thermostat. • Perform cleaning & reverse flushing. • Perform overhauling water pump and refitting.	74. Basic cooling system components: Radiator, Coolant hoses, Water pump, Cooling system thermostat, Cooling fans, Temperature indicators, Radiator pressure cap, Recovery system, Thermo-switch.
Week 29	• Perform checking engine oil, draining engine oil, replacing oil filter, & refilling engine oil. • Execute overhauling of oil pump, oil coolers, air cleaners and air filters and adjust oil pressure relief valves, repairs to oil flow pipe lines and unions if necessary.	Lubrication System: 75. Need for lubrication system, Functions of oil, Viscosity and its grade as per SAE, Oil additives, Synthetic oils, The lubrication system, Splash system, Pressure system, Corrosion/noise reduction in the lubrication system. 76. Lubrication system components: Description and function of Sump, Oil collection pan, Oil tank, Pickup tube, different type of Oil pump & Oil filters, Oil pressure relief valve, Spurt holes & galleries, Oil indicators, Oil cooler.

Week No.	Trade Practical (Professional Skills)	Trade Theory (Professional Knowledge)
Week 30	Execute dismantling air compressor and exhauster and cleaning all parts - measuring wear in the cylinder, reassembling all parts and fitting them in the engine.	Intake & Exhaust Systems: 77. Description of Diesel induction & Exhaust systems. 78. Description & function of air compressor, exhauster, Super charger, Intercoolers, turbo charger, variable turbo charger mechanism. 79. Intake system components: Description and function of Air cleaners, Different type air cleaner, Description of Intake manifolds and material.
Week 31	- Execute dismantling & assembling of turbocharger, check for axial clearance as per service manual. - Examine exhaust system for rubber mounting for damage, deterioration and out of position; for leakage, loose connection, dent and damage; - Perform practice on exhaust manifold removal and installation, practice on Catalytic converter removal and installation.	80. Exhaust system components: Description and function of Exhaust manifold, Exhaust pipe, Extractors, Mufflers - Reactive, absorptive, Combination of Catalytic converters, Flexible connections, Ceramic coatings, Back-pressure, Electronic mufflers.
Week 32	- Perform work on removing & cleaning fuel tanks, checking leaks in the fuel lines. - Execute overhauling of Feed Pumps (Mechanical & Electrical). - Perform bleeding of air from the fuel lines, servicing primary & secondary filters.	Fuel Feed System in IC Engine (Petrol & Diesel): 81. Gravity feed system, Forced feed system, main parts, Fuel Pumps - Mechanical & Electrical Feed Pumps. 82. Knowledge about function, working & types of Carburetor. 83. Diesel fuel system components: Description and function of Diesel tanks & lines, Diesel fuel filters, water separator, Lift pump, Plunger pump, Priming pump.
Week 33	- Execute removing a fuel injection pump from an engine - refit the pump to the engine - reset timing - fill lubricating oil - start and adjust slow speed of the engine. - General maintenance of Fuel Injection Pumps (FIP).	Diesel Fuel Systems: 84. Description and function of Diesel fuel injection, fuel characteristics, concept of Quiet diesel technology & Clean diesel technology. 85. Inline injection pump, Distributor-type injection pump, Glow plugs, Cummins & Detroit Diesel injection.
Week 34	- Execute overhauling of injectors and testing of injector. - Practice testing and diagnostic procedures on CRDI / HEUI circuits.	86. Diesel injectors. Electronic Diesel Control: 87. Electronic Diesel control systems, Common Rail Diesel Injection (CRDI) system, hydraulically actuated electronically controlled unit injector (HEUI) diesel injection system. 88. Sensors, actuators and ECU (Electronic Control Unit) used in Diesel Engines.
Week 35	- Execute Start engine adjust idling speed and damping device in pneumatic governor and venture control unit checking. - Verify performance of engine with off load adjusting timings. Start engine - adjusting idle speed of the engine fitted with mechanical governor checking - high speed operation of the engine. - Check performance for missing cylinder by isolating defective injectors and test - dismantle and replace defective parts and reassemble and refit back to the engine.	Marine & Stationary Engine: 89. Types, double acting engines, opposed piston engines, starting systems, cooling systems, lubricating systems, supplying fuel oil, hydraulic coupling, Reduction gear drive, electromagnetic coupling, Electrical drive, generators and motors, supercharging.

Week No.	Trade Practical (Professional Skills)	Trade Theory (Professional Knowledge)
Week 36	- Monitor emissions procedures by use of Engine gas analyser or Diesel smoke meter. - Checking & cleaning Positive crankcase ventilation (PCV) valve. Obtaining & interpreting scan tool data. Inspection of EVAP canister purges system by use of scan Tool. - EGR/SCR Valve Remove and Installation for inspection.	Emission Control: 90. Vehicle emissions Standards - Euro and Bharat II, III, IV, V. 91. Sources of emission, Combustion, Combustion chamber design. 92. Types of emissions: Characteristics and Effect of Hydrocarbons, Hydrocarbons in exhaust gases, Oxides of nitrogen, Particulates, Carbon monoxide, Carbon dioxide, Sulphur content in fuels. 93. Description of Evaporation emission control, Catalytic conversion, Closed loop, Crankcase emission control, Exhaust gas recirculation (EGR) valve, controlling air-fuel ratios, Charcoal storage devices, Diesel particulate filter (DPF), Selective Catalytic Reduction (SCR), EGR VS SCR.
Week 37	- Perform removing alternator from vehicle dismantling, cleaning checking for defects, assembling and testing for motoring action of alternator & fitting to vehicles. - Practice on removing starter motor from vehicle and overhauling the starter motor, testing of starter motor.	94. Basic Knowledge about DC Generator & AC Generator. 95. Constructional details of Alternator, Description of charging circuit, operation of alternators, regulator unit, ignition warning lamp - troubles and remedy in charging system. 96. Description of starter motor circuit, Constructional details of starter motor solenoid switches, common troubles and remedy in starter circuit.
Week 38	Execute troubleshooting in LMV/HMV for Engine Not starting - Mechanical & Electrical causes, High fuel consumption, Engine overheating, Low Power Generation, Excessive oil consumption, Low/High Engine Oil Pressure, Engine Noise.	Troubleshooting: 97. Causes and remedy for Engine Not starting - Mechanical & Electrical causes, High fuel consumption, Engine overheating, Low Power Generation, Excessive oil consumption, Low/High Engine Oil Pressure, Engine Noise.
Week 39	On the Job Training (OJT) / Group Project Work	On the Job Training (OJT) / Group Project Work
Week 40	On the Job Training (OJT) / Group Project Work	On the Job Training (OJT) / Group Project Work
Week 41	On the Job Training (OJT) / Group Project Work	On the Job Training (OJT) / Group Project Work
Week 42	On the Job Training (OJT) / Group Project Work	On the Job Training (OJT) / Group Project Work

APPROVAL & SIGNATURES

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Sign of Instructor	Sign of Group Instructor (GI)	Sign of Superintendent / Principal