

Syllabus for the trade
of

MECHANIC DIESEL

(SEMESTER PATTERN)

under
CRAFTSMAN TRAINING SCHEME(CTS)

Designed in: 2013

By
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CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
Directorate General of Employment & Training
Ministry of Labour & Employment
EN-81, SECTOR-V, SALT LAKE CITY
KOLKATA-700091

List of trade committee members approved the syllabus of semester system for the trade of
“Mechanic Diesel ” held at ATI, Chennai

Sl. No.	Name & Designation	Representing Organisation	Remarks
1	Shri R. Senthil Kumar, Director	ATI, Chennai	Chairman
2	Shri S.Harinath Babu, Joint Director of Training	ATI, Chennai	Member
3	Shri E.Balakrishna, Ex_Joint Director of Training	NIMI, Chennai	Member
4	Shri A.Suganthan, Assistant Training officer	Govt, ITI, Arakkonam	Member
5	Shri N. Ramesh Kumar, Training Officer	CTI, Chennai	Member
6	Shri T Nandagopal,	Anna University, Chennai	Member
7	Shri K. Thaniyarasau, Assistant Training officer	Govt . ITI, Trichy	Member
8	Shri P.K. Ramakrishnan Nair	Ram international Industrial Academy (p) Ltd, Chennai	Member
9	Shri S.Arul Selvan , Assistant professor	Dept Auto Engg, M.I.T, Anna University, Chennai.	Member
10	Shri S. Jayaraj, Associate Professor	Dept Auto Engg, M.I.T, Anna University, Chennai.	Member
11	Shri R. Lakshmanan	Bosch Ltd, Bangalore	Member
12	Shri V.ChandraMohan	NATRIP, Global Automotive Research centre, Chennai	Member
13	Shri V.Vadivelan	NATRIP, Global Automotive Research centre, Chennai	Member
14	Shri A.D.Shewale Training Officer	CTI, chennai	Member
15	Shri B. Gridharan	Visa Diesel Service, Chennai	Member
16	Shri K.k.Valasarajan , Vice president	Two Wheeler workshop owners Association, Chennai	Member
17	Shri Jayapal,	Two Wheeler workshop owners Association, Chennai	Member
18	Shri V. Vadivelan	Two Wheeler workshop owners Association, Chennai	Member
19	Shri Syedshwath	Two Wheeler workshop owners Association, Chennai	Member
20	P. Marveldass, Assistant Director of Training (Electronics)	ATI, Chennai	Member
21	K. ArulSelvi, Training Officer (Electronics)	ATI, Chennai	Member
22	Shri Gurcharan Singh, Assistant Director of Training	ATI, Ludhiana	Member
23	Shri O.R. Arjun Mohan, Assistant Executive Engineer	Agricultural Engg. Dept, Chennai	Member
24	Shri R.Murugesan, Assistant Executive Engineer	Agricultural Engg. Dept, Chennai	Member
25	Shri Ramakrishne Gowda, Assistant Director of Training	FTI, Bangalore	Member
26	C.Yuvaraj, Assistant Director of Training	ATI, Chennai	Member

List of members attended the Workshop to finalize the syllabi of existing CTS into Semester Pattern held from 6th to 10th May'2013 at CSTARI, Kolkata.

Sl. No.	Name & Designation	Organisation	Remarks
1.	R.N. Bandyopadhyaya, Director	CSTARI, Kolkata-91	Chairman
2.	K. L. Kuli, Joint Director of Training	CSTARI, Kolkata-91	Member
3.	K. Srinivasa Rao, Joint Director of Training	CSTARI, Kolkata-91	Member
4.	L.K. Mukherjee, Deputy Director of Training	CSTARI, Kolkata-91	Member
5.	Ashoke Rarhi, Deputy Director of Training	ATI-EPI, Dehradun	Member
6.	N. Nath, Assistant Director of Training	CSTARI, Kolkata-91	Member
7.	S. Srinivasu, Assistant Director of Training	ATI-EPI, Hyderabad-13	Member
8.	Sharanappa, Assistant Director of Training	ATI-EPI, Hyderabad-13	Member
9.	Ramakrishne Gowda, Assistant Director of Training	FTI, Bangalore	Member
10.	Goutam Das Modak, Assistant Director of Trg./Principal	RVTI, Kolkata-91	Member
11.	Venketesh. Ch. , Principal	Govt. ITI, Dollygunj, Andaman & Nicobar Island	Member
12.	A.K. Ghate, Training Officer	ATI, Mumbai	Member
13.	V.B. Zumbre, Training Officer	ATI, Mumbai	Member
14.	P.M. Radhakrishna pillai, Training Officer	CTI, Chennai-32	Member
15.	A.Jayaraman, Training officer	CTI Chennai-32,	Member
16.	S. Bandyopadhyay, Training Officer	ATI, Kanpur	Member
17.	Suriya Kumari .K , Training Officer	RVTI, Kolkata-91	Member
18.	R.K. Bhattacharyya, Training Officer	RVTI, Trivandrum	Member
19.	Vijay Kumar, Training Officer	ATI, Ludhiana	Member
20.	Anil Kumar, Training Officer	ATI, Ludhiana	Member
21.	Sunil M.K. Training Officer	ATI, Kolkata	Member
22.	Devender, Training Officer	ATI, Kolkata	Member
23.	R. N. Manna, Training Officer	CSTARI, Kolkata-91	Member
24.	Mrs. S. Das, Training Officer	CSTARI, Kolkata-91	Member
25.	Jyoti Balwani, Training Officer	RVTI, Kolkata-91	Member
26.	Pragna H. Ravat, Training Officer	RVTI, Kolkata-91	Member
27.	Sarbojit Neogi, Vocational Instructor	RVTI, Kolkata-91	Member
28.	Nilotpal Saha, Vocational Instructor	I.T.I., Berhampore, Murshidabad, (W.B.)	Member
29.	Vijay Kumar, Data Entry Operator	RVTI, Kolkata-91	Member

GENERAL INFORMATION

1. Name of the Trade : MECHANIC DIESEL
2. N.C.O. Code No. :
3. Duration : One year (Two Semesters)
4. Power norms : 3 KW
5. Space norms : 84 sq. meters.
6. Entry Qualification : Passed 10th class examination under 10+2 system of education with Science and Mathematics or its equivalent.
7. Unit Size(No. of Student) : 16
8. Instructors Qualification : a) Degree in Automobile/Mechanical Engineering from recognized engg. college/university with one year experience in the relevant field
OR
Diploma in Automobile/Mechanical Engg. From recognized board of technical education with two years experience in the relevant field
OR
10th Passed + NTC/NAC in the Trade of “**Mechanic Diesel**” with 3 years’ post qualification experience in the relevant field

b) Preference will be given to a candidate with Crafts Instructor Certificate (CIC)

* **Note:** At least one Instructor must have Degree/Diploma in Automobile/ Mechanical Engg. when applied for 02 units.

TRADE: "MECHANIC DIESEL"

FIRST SEMESTER

(Semester Code No. MED; SEM-01)

Week No.	Trade Practical	Trade Theory	Engg. Drawing	Workshop calculation & Science
1.	<p>Induction and Safety Training Achievements Expected:</p> <p>(i) Awareness of the role of I.T.I in national building Activity</p> <p>(ii) Scope of trade - Mechanic (Diesel)</p> <p>(iii) Safety rules and Safety Precautions to be observe in the shop floor</p> <p>(iv) Awareness on disciplinary rules and communication channel in the Shop Floor or working Area</p> <p>Familiarization with the institute. Disciplinary Rules & Communication channels. Importance of the Trade Types of work done by students in the Institute shop floor of the Institute</p>	<p>General Introduction to the course - Duration of the course and courses content. Study of the Syllabus - General Rules pertaining to the Institute Facilities Available Hostel. Recreation and Medical Facilities - Library - Working Hours. Time Table</p>		
2.	<p>Description of Safety Equipment - Their use - Safety Rules to be observed in an Automobile Repair Shop. Accidents & Their Causes - upkeep of fire. Fire Extinguishers - Familiarization of the Tools & Machinery Available in the ship - Their use and up keep - Importance of</p>	<p>Importance of Safety and General Precaution to be observed in the shop - Free Extinguishers used for difference types of fire - Storing and handling inflammable Materials - Elementary First Aid.</p>		

	<p>Maintenance & Cleanliness of Workshop, Tools, Jacks, Trays and House.</p> <p>Allied Trade Work - Fitting and Sheet Metal Achievements Expected:</p> <p>(i) Ability to fire surface and make them flat. (ii) Ability to mark and punch. (iii) Ability to use backsaw, drill, reamer, tap and dies. (iv) Ability to make simple sheet metal joints and solder. (v) Ability to bend pies.</p>			
3.	<p>Demonstration of the use of Fitter's Hand Tools - Marking off with steel rules calipers, scribe, dividers, dot and Centre punch - Chipping and marked lines in a given piece - Sharpening of Chisels. Centre punch & Dot punch to correct Angles.</p>	<p>System of Measurement conversion of English into metric measurement and vice-versa - Marking Media - Chalk - Mechanic's Blue Red Lead - and Tools used for Marketing Steel rule. Try Square, caliper and Dividers, Scribe Prick and Centre Punch - Hammer and Chisel - uses and Maintenance - Safety Precautions - in Handling Grinding Machines.</p>	<p>Introduction Engineering Drawing and Blue print reading. Free hand sketching of straight lines. Rectangles, square and circles.</p>	<p>Simple workshop problems involving addition. Subtraction, multiplication and division of whole numbers</p>
4.	<p>Hack sawing filing to given dimensions - filing true and square - practice different types of filing operations - Marking and drilling clear and blind holes. Sharpening of twist drills safety precautions to be observed while using a drilling machine</p>	<p>Types of Hacksaw frames and blades - their selection and uses - types of files and their uses. Care and maintenance of files. Types & sizes of drills - cutting angles and speeds of drills - calculation of tap drill sizes.</p>	<p>Free hand sketching with dimension & proportionate sketching of circles rectangles squares parallelograms. Rhombus, polygons.</p>	<p>Common fractions, addition, subtraction, multiplication and division of common fractions - Vulgar fractions - simple shop problems involving Fractions.</p>

5.	Tapping a clear and blind hole - selection of tap drill size - use of lubrication - 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.	Tapes & dies - description use of different types & dies - use of 'V' threads - Precautions while using taps & dies - description and use of different types of scrapers, Reamers and emery papers	Reading of simple Blue Prints Sketching of simple solids such as cubes. Rectangular Blocks, Cylinders	Applied
6.	Measuring Diameter of pistons Main Journals, Crank pins, Kingpin big end and main bearing s cylinder bores with Micrometers & Vernier Calipers - measuring width and Thickness of machined flat and round bars - Measuring of valve Angles with protractor head - Locating centre of a round bar with centre Head	Construction & Method of Reading Micrometers (internal and external) and Vernier Caliper - Correct handling of Micrometers & Vernier Calipers. Reading of Vernier Scale - Description and use of combination set Care and Maintenance of Micrometers. Vernier calipers, Combination set	-do-	Properties of Ferrous metals - Their uses - Cast Iron. Wrought iron plain and High Carbon Steel High Speed steel & Alloy Steel
7.	Joining of Metal Parts by Soft Soldering - Simple marking out on Sheet Metal and Cutting - Bending and folding.	Sheet Metal Workers Hand Tools - Their Description and uses - Description of Simple soldering and brazing. Fluxes used for common joints- types of sheet metal joints - their uses	Freehand sketching of Nuts - Bolts - Studs - with dimension from samples	-do-
8.	Practice in Silver soldering pipe bending. Annealing of pipers - Fitting Nipples and Unions - Soldering and Brazing of pipes. Engine Repair work Achievements Expected (i) Ability to remove jammed bolts, nuts and prepare maintenance schedule. (ii) Ability to start and stop diesel engine and observe its performance (iii) Ability to test compression and Vacuum and analyze the results. (iv) Ability to use Torque wrenches, remove the	Sheet and wire gauges - the blow tamp and its uses - pipe fitting Explanation of various common Metal Sheets used in Sheet Metal Shop.	Sketching of views of solid bodies - such as square and Rectangular Blocks - Hollow cylinders rings - cones	Properties of Non - Ferrous metals - Their uses - Copper, Zinc, Lead, Tin, Brass, Aluminum, Bronzes, Solder, Bearing Metals,

	<p>cylinder head, decarbonizes and refit</p> <p>(v) Ability to measure bores, piston, ring clearance, valve clearance, bearing clearance, crank shaft Main journal, crank pin journal and filter radius, warp age of cylinder head block.</p> <p>(vi) Ability to overhaul oil filters, oil coolers, oil pump, water pump & radiator. Test Thermostat values.</p> <p>(vii) Ability to fit new shell bearing in main and connecting rod and set bearing</p> <p>(viii) Ability to Reassemble the engine parts, start and adjust idle speed of the engine.</p> <p>(ix) Ability to set timing of fuel injection pump</p> <p>(x) Ability to Diagnose engine noises of different nature and rectify.</p> <p>(xi) Ability to diagnose faults in lubrication and cooling system and rectify</p>			
9.	<p>Exercise involving use of Wrenches, pliers, screw drivers and pullers - cleaning and lubrication of engine parts. Location & identification of engine components</p>	<p>General Description & Construction of diesel & Petrol Engine - Characteristics & Classification working principles of 4 stroke diesel & Petrol engine - comparison between petrol and diesel engine with specific reference to their various characteristics.</p>	<p>Freehand sketching of rivets washers with dimension from samples</p>	<p>Brief description of manufacturing process of non-ferrous metals i.e. copper, aluminum, zinc, and tin.</p>
10.	<p>Practice on unserviceable diesel engine, removing jammed nuts and broken studs reconditioning and damaged stud hold fitting oversized studs</p>	<p>Two stroke cycle diesel engine types of scavenging uniflow and loop flow scavenge opposed piston engine differences between two stroke and 4 strokes cycle diesel engines.</p>	<p>Free hand sketching of Bolts & Nuts with dimensions from samples</p>	<p>-do-</p>

11.	Selection of materials for gaskets and packing - use of locking devices lock nuts, cotters, split pins and Circlip lock rings - location where they are used inspection and checking leakage of air, fuel oil & exhaust in the engine	Engine details - cylinder materials - cylinder arrangements cylinder liners and their advantages, cylinder heads, description function, cares and maintenance - Location combustion chamber in cylinder heads and also heater plugs and ports & valve arrangements	Explanation of simple orthographic projection hand sketching of 4 stroke - two stroke cycles	F.P.S & C.G.S. system Metric weights and measurements, conversion factors, S.I. Units
12.	Practice on starting and stopping of diesel engines - use of speed counter in determining the engine speed - running of engine on load - checking temperature fuel and oil compression testing of cylinders	Combustion chambers - pumps open and closed types, advantages, compression, ratio & compression pressures - compression testing of cylinders and analysis of results & its importance.	Explanation of simple orthographic projection in 3rd angle.	Shop problems on metric system of weights an measurements
13.	Maintenance checks - daily, weekly, monthly for different types of engines - writing up of inspection schedules - Maintenance of log sheets - details of maintenance.	Need for maintenance check up in diesel engine - preparation of maintenance schedule from charts of popular makes of engines	Views of simple hollow & Solid bodes with dimensions	Meaning of tenacity elasticity, malleability brittleness, hardness, compressibility and ductility with example
14.	Remove, rocker are assembly manifolds & cylinder head removing valves & its parts cleaning & decarburizing - checking valve seats & valve guide - reconditioning valve seats & prefacing valves - lapping valves on its sets testing leaks of valve seats for leakage - inspection of cylinder heads & manifold - surfaces for margin & cracks - use of hydraulic valve lifter.	Valves & valve operation - Mechanize - parts & function of each valve timing diagram - camshaft & timing gears - types of drives used in engines chain tension & its importance cylinder head and manifold construction & function water jackets passages. Description of hydraulic valve lifter	Freehand sketching of valve, valve springs, valve assembly with dimension	Effect of alloying elements on properties of cast iron and steel.

15.	Dismantle rocker arm assembly Clean & check shaft - bushes, posts and rocker arm for wear and cracks and reassemble. Check valve springs, tappets, push roads, tappet screws and valve stem cap. Reassemble valve parts in sequence, refit cylinder head and manifold & rocker arm assembly adjustable valve clearances starting engine after decarburizing.	Necessity of valve clearance prescribed by makes f engine - effects of incorrect clearances - common troubles & remedy - reason for margins of cylinder head.	Simple isometric view of objects such as square rectangles and cubes	Square root of perfect square and hold number square root of decimals.
16.	Removing piston & connecting rod from engine - examine - piston ring lands for wear - examine piston skirts for cracks & distortions, clean oil holes - check connecting rod for bend and twist and parent bore for taper and ovality and gudgeon pin bushes for wear - check elongation of cap fixing bolts.	Piston and piston rings function types and material is used - recommended clearances for the rings its necessity precautions while fitting rings - connecting rods - types function and materials used - methods of fixing gudgeon pin on small end method of lubrication provided for small end bushes	Freehand sketching of piston gudgeon pins rings and connecting rod with dimension from samples.	Shop problems involving square roots.
17.	Removing crankshaft and camshaft from engine - checking crankshaft for bend & twist - checking oil retainer and thrust surfaces for wear - measure crank shaft journal for wear checking fly wheel and mounting flanges. Spigot, bearing check vibration damper for defects - check cam shaft for bend & crack.	Crankshaft - construction & functions - materials used - arrangements of crank pins and Main journals - balancing methods - Fly - wheel construction & its function and material used Rim marks and balancing. Elementary knowledge of function of clutch & coupling units attached to fly wheel	Freehand sketching ³ of crankshaft and flywheels with dimension from samples.	Ratio and proportions shop problems.
18.	Checking cylinder blocks surface - measure cylinder bore for taper & ovality - check main bearing parent bore for taper & ovality clean oil gallery passage and oil pipe line - check main bearing cap bolt holes check	Description & function of cylinder block - materials used - cylinder liners & details - crank case and oil pan and their construction water jacket passage & wall thickness - bolt hole dimensions for cylinder	Freehand sketching of cylinder block and cylinder head.	Mass. Unit of mass, force absolute unit of force weight of a body, shop problems.

	cam shaft, bearings and taper bore - decaled water passages and examine Welch plugs check cylinder head for warping	head fixing provision for mounting accessories like oil pump, water pump filters - oil flow passages and cleaning plugs.		
19.	Fixing bearing inserts in cylinder block & cap checking and spread clearance & oil holes & locating lugs fix crank shaft on block - torque bolts - check end play remove shaft - check seating, repeat similarly for connecting rod and Check seating and refit.	Engine bearings - classification and location - materials used & composition of bearing materials - shell bearing and their advantages - special bearing material for diesel engine application bearing failure & its causes - care & maintenance. Meaning of term ovality and trapper in cylindrical parts	Freehand sketching of bearing with dimension from sample.	Mass. Unit of mass, force absolute unit of force weight of a body, shop problems.
20.	Overhauling oil pump, oil filters oil coolers air cleaners and air filters, check and adjust oil pressure relief valves - changing oil in the sump, repairs to oil flow pipe lines and unions	Friction - its meaning and importance, methods to reduce friction in engine oil use of lubricants - oil grease high detergent oil for diesel engine lubrication - properties of lubricants	Freehand sketching of oil filters oil pumps, coolers with dimension from samples	Examples of useful and wasteful friction.
21.	Reassemble all parts of engine in correct sequence and torque all bolts and nuts as per makers recommendations for engines.	Need for lubrication system for diesel engines - types used and layout of the system by pass & full flow arrangement - types of oil pumps, oil filters, oil coolers, common troubles - care and maintenance.	Freehand sketching of oil filters oil pumps, coolers with dimension from samples	Examples of use and wasteful friction in engine, applied problems.
22.	Reassemble all parts of engine in correct sequence and torque all bolts and nuts as per makers recommendations for engine fit accessories & start and run the engine on stands	Engine assembly procedure need for cleanliness and special tools and gauges used for engine assembling. Practice - periods of decarburizing and overhauling engine - in terms of hours of run or mileage - running in procedure of overhauled engines.	Freehand sketching of bolts and nuts with dimension from sample, Freehand sketching of torque wrenches.	Work. Unit of work, Energy power, Unit of Power.
23.	Removing cylinder liner from scrap cylinder block, practice in measuring and refitting new liners as per	Cylinder liners- construction & purpose - material used and finish provided types of liners in use	Freehand sketching of cylinder liners with dimensions	Work, Unit of work energy power - Unit of power shop

	makers recommendations precautions while fitting new liners.		from sample.	problems.
24.	Removing radiator and water pump from engine, cleaning & reversing flushing, radiator testing thermostat and refitting on engine - overhauling - water pump refitting adjusting fan belt tension and connecting water pump with radiator with hoses & flushing cooling system of the engine.	Need for cooling an engine general description and types of air liquids - cooling used in engine layout of cooling system and parts in the layout - function of parts like radiation thermostat and water pumps - purpose of thermostat & need to maintain engine working temperature deliration cooling system no loss tank.	Free hand sketching of water pump thermostatic valve & water jackets in the cylinder block.	Ratio & proportion.
25.	Project work / Industrial visit (optional)			
26.	Examination			

TRADE : “MECHANIC DIESEL”

SECOND SEMESTER

(Semester Code No. MED; SEM-02)

Week No.	Trade Practical	Trade Theory	Engg. Drawing	Workshop Cal. & Science
1.	Dismantling air compressor and exhauster - cleaning - all parts measuring wear i the cylinder and blades reassembling all parts and fitting them in the engine.	Description & operation of air compressor and exhauster attached to transport vehicle engines - common troubles & maintenance of both their specific application for the brakes of the vehicle	Free hand sketching of water pump thermostatic valve & water jackets in the cylinder block.	Ratio and proportions shop problems.
2.	Dismantling a petrol engine in a systematic procedure clean & inspect all parts of wear & re usage check oil clearance reset main and connecting rods bearings - check cylinder wear & examine piston and rings connecting rods - and crank shaft reconditions if necessary - reassemble all parts in sequence as per makers, recommendation - adjusting value tappets - start & adjust slow speed of the engine	Description of internal & external engines different types of I.C. Engines parts of all IC Engine - 4 stroke O T T O cycle engine - Two stroke petrol engine difference between the two - importance of valve timings - and parts if valve operating system description and operation,. Description of Petrol injection in petrol engine.	Freehand sketching of 4 stroke cycle 2 stroke cycle valve lining diagram	Different forms of energy mechanical, electrical, heat, solar, chemical atomic etc.
3.	Practice on engine tune up operations involving testing vacuum and compression of engine, adjusting valve clearance, setting and adjusting ignition timing - adjusting carburetor for slow speeds overhauling AC Pump & testing for its working cleaning spark plugs & testing and setting as per maker's recommendation starting engine, Adjusting slow speed.	Brief Description of engine components - their location and functions cooling and lubrication system - parts and layout of the system - fuel supply system - layout of parts in the system & function of each part Ignition system in a petrol engine system layout & parts of ignition system and functions of each part - working of the system importance of Firing order ind. Adv. retard mechanism.	Freehand sketching of parts of an engine. Freehand sketching of layout of fuel supply system Ignition system lubrication and cooling system.	Conversion of energy from one to another with examples.

4.	Trouble Shooting in cooling and lubrication system / engine checking up and rectifying oil and water leaks changing defective packing and gaskets - testing radiator leaks & testing functioning of thermostat	Step by step method of diagnosis of troubles in the lubrication and cooling system reasons for engine over heating & remedies for the same. Crank case dilution & Crank case ventilation flow test rate recommended for radiator	View of solid & hollow bodies cut sections plane	Measuring of Horse Power. IHP, FHP and applied shop problem.
5.	Diagnosis of engine faults like main bearing - noises, piston pin noise, fly wheel knock & valve noise - and crank noises and diesel knock.	Reasons for development of noises in the engine components - rectification methods of assembling practice to be followed during engine overhauling as per makers shop manual.	View of hollow solid bodies cut section plane	Meaning of horse power IHP, BHP, FHP applied shop problems Description of dynamometers.
6.	Diagnosis of engine faults like smoky, exhaust, overheating, heavy vibration, missing cylinders, exhaust noise, hunting characteristics of engine and erratic of irregular idling	Reasons for excessive exhaust smoke overheating vibration, mission & hunting noises in an engine methods of eliminating these noises for smoothing working of the engine,. Exhaust emission testing and control	Practices of blue print readings	Effects of force on materials like bending, twisting and shearing problems.
7.	Diagnosis of reasons for starting difficulty in a diesel engine and rectifying the faults. Engine Erection Work Achievements Expected (i) Ability to erect diesel engine on function	Starting methods, such as compressor starting, capsule starting & diesel engines and used for transport, agricultural marine, industrial purposes brief description of each method)- methods to eliminate starting difficulty in a diesel engine. Fuel saving - concepts of super charges and turbo charges	Further practice in blue print reading	Torque definition example torque wrenches application - problems involving torque values of engine.
8.	Practice in erecting overhauled engines on stands & functions preparation of templates of foundations holes of the engine base - preparation of hold - down bolt and nuts and boxes for foundation pits	Necessity of strange foundations for diesel engine details of foundations bolts & nuts composition of a good mix for grounding foundation bolts dimension of pits & boxes to suit engine base - purpose of template - need	Free hand sketching of engine mounting, templates & fixing brackets & stands	Menstruation of areas Volumes & Weight calculating sold bodies.

	<p>starting engine on foundation and observing vibrations</p> <p>Fuel Injection system work Achievements Expected:</p> <p>(i) Ability to repair leaks of Diesel, Oil & Air lock in fuel lines and bleed air from the system.</p> <p>(ii) Overhaul filters and bleed them</p> <p>(iii) Ability to follow safety precautions while doing the above work</p> <p>(iv) Ability to adjust slow speed and maximum speed in the renturi control unit.</p> <p>(v) Ability to test functioning of pneumatic and mechanical governor.</p> <p>vi) Ability to check and adjust injector or test.</p>	for aligning the engine on HD Bolts.		
9 & 10	Cleaning fuel tanks - checking leaks in the fuel lines soldering & repairing pipe lines and unions brazing nipples to high pressure line studying the fuel feed system in diesel engines draining of water separator.	Fuel feed system in diesels Air injection and airless injection. Systems their general description & layout importance of water separators - constructional details of water separators - constructional details of water separators.	Freehand sketching of water separators and fuel tanks with dimension from sample	Shop problems on determination of volume & weight of simple bodies.
11 & 12	Bleeding of air from the fuel lines - servicing primary & secondary filters removing filters elements - replacing elements s in pressure filters.	Fuel filters - types & constructional details - reasons for using no. of filters sequence of replacement of filter elements importance of Diesel fuel cleanliness - types of diesel fuel HSD & LSD Description of O.F. valves & their functions	Freehand sketching of fuel feed system and of filters.	Centre of gravity of bodies - stable & unstable Neutrals & equilibrium Example & Problems of centre of gravity.
13 & 14	Dismantling and unserviceable fuel injections pump feed and	Constructional details of fuel injection pumps, feed pumps and governor	Free hand sketching of fuel injection pump with	Simple levers with examples i.e. bell crank lever & other

	governor studying the parts and reassemble general maintenance of F.I. pumps.	explanation of function and operation	dimension from samples	used in engine - advantage - using them problem on lever.
15& 16	Removing a fuel injection pump from an engine refit the pump to the engine - et timing - fill lubricating oil start and adjust slow speed of the engine calibration of fuel injection pumps.	Importance of timing the pumps with engine - closed slot cross coupling marks vernier scale on coupling advancing and retarding methods effect of over advancing timing device and its details - critical adjustments of jerk - pump phasing and calibration adjustment for maximum speed - idle speed & smoke limits.	Lettering numbers & Alphabets and freehand sketching of fed pump	Heat and temperature scales of temperature FH and Kelvin, Celsius their conversions - Temperature measuring devices used in engine shops.
17.	Start engine adjust idling speed and damping device in pneumatic governor and venturi control unit - checking Performance of engine with off load adjusting timings in Dpa System. PT. Pumps and inline pump	Governors - pneumatic mechanical & Hydraulic, their constructions & Operations venturi unit and its purposes and action precautions to be observed in attending to the governor - definition of rated speed maximum speed over run of governors - purpose of auxiliary venturi in the governor principle of idling damper.	Free sketching of a pneumatic governor with dimensions from sample	Definition of stress and strain and modulus of elasticity ultimate strength type of stresses - factor of safety examples & Problems.
18.	Start engine - adjusting idle speed of the engine fitted with mechanical governor checking high speed operation of the engine	Mechanical governors their constructions, function and operation under different load & speed & maintenance common problems and remedies.	Freehand sketching of mechanical governor its dimension from sample	Definition stress strain and modulus of elasticity ultimate strength types of factors of safety stress - example & problems.
19 & 20	Checking performance of missing cylinder by isolating defective injectors & test - dismantle and replace defective parts & reassemble and refit back to the engine importance of correct torque - while	Fuel injection Nozzles description operation of each type spray angles & purifies and their characterizes injector tester - construction & function types of test & their of purpose - Effects in incorrect setting of nozzles	Freehand sketching of different types of nozzles (cut section) lettering practice.	Mechanical advantage velocity ratio & efficiency example & Problems

	assembling the unit and also fitting on to the engine. Repair of shop Floor Equipment Achievements Expected: Ability to Repair and maintain equipments and Instruments used for repairing diesel Engines.	of engine performance.		
21.	Repairing of grease guns oil cans - oil spray guns & Other shop floor equipment maintenance of drill press pedestal grinder valve re-racer and air compressor engine.	Importance of periodical maintenance and un keep of shop equipments - preventive maintenance to avoid screen & Major failure preparing maintenance charts for machineries' & Follow Up.	Freehand sketching of greases gun houses - oil gun & service accessories	Principle and working of simple machines.
22.	Repairing of injector tester hoses, jacks and stand vacuum & Compression gauge maintenance of washing pump and hydraulic presses phasing and calibrating machine Electrical Repair work achievements Expected: i) Ability to do simple repairs in the ignition, charging and starting circuits. ii) Ability to do repair Dynamo, self starter, Alternator and other Accessories.	-do -	Practice of blue print reading of an engine. Freehand sketching of layout of fuel supply system Ignition system lubrication and cooling system	Determination of mechanical advantage velocity ratio efficiency in simple machine i.e. screw jack/ which pulley block wheel & axle & inclined plane.
23.	Removing dynamo or alternator from engine dismantling, cleaning checking for defects, assembling and testing of motoring action of dynamo and fitting to vehicles Studying electrical circuit in the engine assembly checking loose, open and short circuit in ignition	Description of charging circuit operation of dynamo and regulator unit - ignition warning lamp troubles and remedy in charging system. Description of electrical circuits ignition system and the components - purpose of induction coil,	Free hand sketching of charging system Free hand sketching of ignition circuit of vehicle sketching the circuit line	Definition of ampere volts and ohm units of ampere volts, ohm, ohm's law. Magnets - natural and artificial types - poles of magnets - magnetic fields.

	<p>circuits - clearing and testing spark plugs - overhauling distributors assembly checking and setting ignition timing.</p> <p>Practice in joining wires & soldering - forming simple electrical circuits - measuring of current, voltage and resistance cleaning and topping up of a lead and battery - testing battery with hydrometer - cell tester connecting battery to charger.</p>	<p>condenser, spark plug - common troubles in ignition circuit and remedy.</p> <p>Simple electrical circuits series & Parallel circuits identification of alternating - current and direct current meters - insulators and conductors - types of resistance - Ohm's law and its application - common electrical terms and symbols primary and secondary reels - lead acid battery - nickel iron and nickel cadmium and alkaline batteries - their description - construction - common troubles and remedy maintenance procedure for Batteries.</p>	<p>diagram of magneto ignition</p> <p>Freehand sketching of electrical symbols and drawing of simple electrical circuits.</p>	<p>Electricity and its effects static and dynamic electricity AC & DC difference.</p>
24.	<p>Removing dynamo or alternator from engine dismantling, cleaning checking for defects, assembling and testing of motoring action of dynamo and fitting to vehicles</p> <p>Removing starter motor vehicle and overhauling the starter motor testing of starter motor</p>	<p>Description of charging circuit operation of dynamo and regulator unit - ignition warning lamp troubles and remedy in charging system.</p> <p>Description of starter motor circuit - constructional details of starter motor solenoid switches common troubles and remedy in starter circuit . Description of Alternators and Voltage Regulators - Testing Benches for Dynamos</p>	<p>Free hand sketching of charging system</p> <p>Sketching starter motor circuit and solenoid switches circuit.</p>	<p>Definition of ampere volts and ohm units of ampere volts, ohm, ohm's law.</p> <p>Calculation based on ohm's Law.</p>
25.	Revision			
26.	Examination			

**TRADE : MECHANIC DIESEL
LIST OF TOOLS & EQUIPMENTS**

A .TRAINEES TOOL KIT FOR 16 TRAINEES + 1 INSTRUCTOR

Sl. No.	Name of the items	Qty.
1.	Hammer Ball peen 0.75 kg	17 Nos.
2.	Chisel Cold flat 19 mm	17 Nos.
3.	Centre punch 10 cm	17 Nos.
4.	Steel rule 15 cm English and Metric	17 Nos.
5.	Screw driver 30 cm x 9 mm blade	17 Nos.
6.	Screw driver 20 cm x 9 mm blade	17 Nos.
7.	Spanner D.E. set of 12 metric 8 -32 mm	17 Nos.
8.	Pliers combination 15 mm	17 Nos.
9.	Hand file 20 cm second cut	17 Nos.
10.	Feeler Gauge 20 blade	17 Nos.
11.	Ring spanner set of 12 metric 8 -32 mm	17 Nos.
12.	Steel tool box with locks and keys	17 Nos.

B . TOOLS MEASURING INSTRUMENTS AND GENERAL SHOP OUTFIT

Sl. No.	Name of the items	Qty.
13.	Rule Steel 30 cm	1 No.
14.	Dividers spring 15cm	1 No.
15.	Prick punch 15cm	1 No.
16.	Chisel cross cut 9 x 3cm	1 No.
17.	Hammer ball peen 0.5kg	1 No.
18.	Hammer copper 1kg with handle	1 No.
19.	Engineering square 15cm blade	1 No.
20.	Scriber 15cm	1 No.
21.	Scriber block universal	1 No.
22.	Marking out tables 90cm x 60cm x 90 cm (high)	1 No.
23.	Surface plate 60 x 60 cm	1 No.
24.	Hacksaw frame adjustable for 20- 30 cm blades	2 Nos.
25.	V block 75 x 38 cm pair with clamps	2 Nos.
26.	Punch hollow 6,7,8,9,10. 5 and 12mm set	2set
27.	Punch figure set 3m	1set
28.	Punch letters set 3mm	1 set
29.	Hand vise 3 -7 mm	2 Nos.
30.	Screw driver, Electrician type 15m size	2 Nos.
31.	File, flat 35cm bastard	1 No.
32.	File, Flat 25cm second cut	1 No.
33.	File, flat 20cm smooth	1 No.
34.	File , flat safe edge 25cm smooth	1 No.
35.	File, triangular 15cm second cut	1 No.

36.	File round 30cm second cut	1 No.
37.	File square 20cm second cut	1 No.
38.	Drill - twist, metric 3mm x 12mm x 1mm	1 No.
39.	Taps and dies complete set inbox BSW and metric	1set
40.	H.S.S. Hand reamer adjustable 10.5mm to 11.25mm 11.25 mm to 12.75mm 12.78 mm to 14.25mm. 14.25mm to 15.75mm	1set
41.	Scraper , flat 25cm handled	1set
42.	Scraper half round 25cm	1 No.
43.	Scraper triangular 25 cm	1 No.
44.	Scraper bearing	1 No.
45.	Sets of Morse socket 0-1 1-2 and 2-3	1 set
46.	Micrometer, outside 0 to 25mm	1 No.
47.	Micrometer outside 50mm to 75mm, 75mm to 100mm	1 each
48.	Micrometer with extension rod (inside) 50m to 150mm	
49.	Vernier calipers set 25 or 20 cm inside outside depth to read both inches and in mms	1 No.
50.	Safety goggles (clear glass)	2 Pairs
51.	Setting hammer	1 No.
52.	Mallet (Wooden)	1 No.
53.	Scraper , flat 25cm handled	1set
54.	Soldering iron ,25 watt	2 nos.
55.	Blow lamp 0.5 liter	1 No.
56.	Soldering iron 120watts	1 No.
57.	Soldering iron, copper 225 cms (Fire headed)	1 No.
58.	Pliers nose (round and straight)	1 each
59.	snip straight and bent	1 No.
60.	Pot melting	2 Nos.
61.	Poker	2 Nos.
62.	Spanners, double ended set of 12 metric size 8 and 32 mm	1 set
63.	Spanner, double off-set double ended set of 7 w/w from 3mm to 13.5mm	1 set
64.	Double open ended ignition spanner of BA 0 x 1 to 8 x 9 set of 5	1 set
65.	Spanners, Clyburn 15cm	1 No.
66.	Spanners, adjustable 20 cm	1 No.
67.	Spanner ring of set of 6 S.A.E.	1 set
68.	Spanner for sparking plug 14mm	1 set
69.	Magneto spanner set with 8 spanners	1 set
70.	Turbo charger or super charger	2 Nos.
71.	Spanner socket set of 8 handled T. Bar ratchet	2 Nos.
72.	Spanner, T. Flex for screwing up and unscrewing in inaccessible position	1 No.
73.	Double open ended Tapped spanner from 10.5 mm x 12mm to 16.5 mm x18 mm set of four	1 set
74.	Drift. copper 10mm x 150mm	2 Nos.
75.	Gun. paraffin pressure	1 No.
76.	Gun Grease pressure	1 No.

77.	Chain and block 1000 kg capacity	1 No.
78.	Tray cleaning 45 x 30cm	4 Nos.
79.	Drilling machine bench to drill up to 12mm dia	1 No.
80.	Oil can 0.5 liter	1 No.
81.	Lifter, valve spring	1 No.
82.	Tool valve Grinding, suction type (consumable tool)	2 Nos.
83.	Valve seat cutting tools complete with guides & Pilot bard (all angles) in box	1 set
84.	Extractor, atudy ' Ezy out" Type	1 No.
85.	compression gauge to read 120kg/sq. cm and vacuum gauge 0 to 75 cm	1 each
86.	Stone, carborandum 15 x 5 x 3.75 cm wrought and smooth (consumable)	2 Nos.
87.	Cylinder gauge, Bore dial gauge with accessories	1 No.
88.	Ring Expander and remover	1 No.
89.	Torque wrench (0 to 75 kg meter)	1 No.
90.	Work bench 250 x 120 x 75 cm with 4 vices of 12.5cm jaw	2 Nos.
91.	Lockers with 8 drawers (standard size)	2 Nos.
92.	Metal Rack 180 x 150 x 45cm	2 Nos.
93.	Fuel feed pump	2 Nos.
94.	Fuel injection pump	2 Nos.
95.	Carburetor (Two different types)	2 each
96.	Water pump and oil pump	1 each
97.	Filling jig for adjusting the piston ring gap	1 No.
98.	Steel almirah	1 No.
99.	Black board with easel	1 No.
100.	Desk or table	1 No.
101.	Fire extinguisher	2 Nos.
102.	Fire buckets with stand	4 Nos.
103.	Tachometer (Counting type)	1 No.
104.	Compressor Air Piston type) (Vehicular) and exhauster unit	1 each
105.	Clutches, different types such as cone type disc type	1 each
106.	Dynamo and voltage regulator	1 each
107.	Starter motor - Axial type, pre engagement type co-axial type	1 each
108.	Injector different type	2 each
109.	Battery - 12 volt (Lead Acid and alkaline)	2 each
110.	Chair	1 No.
111.	Distributor Assembly	2 Nos.
112.	Pulley set universal for bearing and bushes	1 Set
113.	Lifting jack, Screw type 3048 kg	2 Nos.
114.	Piston ring compressor	2 Nos.
115.	Valve key inserter	1 No.
116.	Connecting rod alignment fixture	1 No.
117.	Valve refacer	1 No.
118.	High rate discharge tester	1 No.
119.	A.V.O. Meter	1 No.

120.	Injector testing set (Hand operated)	1 No.
121.	Injector cleaning kit	2 Sets
122.	Glow plug	1 Set
123.	Nozzle Holder Jigs	1 Set
124.	P.T. Injector	1 No.
125.	Bench vice	4 Nos.
126.	Alternator	1 No.
127.	Fluid fly wheel torque convertor	1 each
128.	Circlip plier	1 No.
129.	Piston Groove cleaner	1 No.
130.	Thread pitch Gauge	2 Nos.
131.	Fillet Radius Gauge	2 Nos.
132.	Stud Removed	2 Nos.
133.	Cut Section Modes for fuel injector	1 No.
134.	Starter test benches	1 No.

C. GENERAL MACHINERY

Sl. No.	Name of the items	Qty.
1.	Grinder with two 18 cm wheels with twist drill grinding attachment	1 No.
2.	Arbor press hand operated 2 ton capacity	1 No.
3.	Light commercial vehicle in running condition (Diesel) Indian make	1 No.
4.	Diesel engine cut away model to show working parts for demonstration (one two stroke & one 4 stroke)	1 No.
5.	Diesel engine 4 stroke multi cylinder 4/6 vehicular type)	1 No.
6.	Petrol engine (Running condition, car type) Indian make - Contemporary model)	1 No.
7.	Diesel engine (Running condition) Stationary type	1 No.
8.	Petrol Engine vertical (2 stroke) Motor cycle / Scooter type 1.5 hp Indian make contemporary model	1 No.
9.	Growler	1 No.
10.	Battery charger	1 No.
11.	Timing lighter	1 No.
12.	Hydrometer (Consumable tool)	2 Nos.
13.	Washing pump - reciprocating type electrically operated with 1 kw motor - 1000 liters tank	1 No.
14.	Portable lifting crane one ton capacity with chain block and tackle arrangement	1 No.
15.	Trolley type portable air compressor 1 single cylinder with 45 liters capacity Air tank all accessories and with working pressure 6.5 kg/sq. cm ³	1 No.
16.	Cell Tester (High rate discharge tester)	1 No.
17.	Smoke tester	1 No.
18.	Hydraulic press 5 tone	1 No.

19.	Fuel injection pump calibration equipment and its accessories and special tools with attachment for distributor pump and in line pump	1 No.
20.	Engine with P.T. System	1 No.

D. TEACHING AIDS

Sl. No.	Name of the items	Qty.
1.	Cut out models on fuel injection pump etc	As required
2.	Wall charts	As required
3.	CD/DVD for demonstration	As required
4.	Display board.	1 No.