COMPETENCY BASED CURRICULUM

FOR THE TRADE OF

MECHANIC DIESEL

UNDER

CRAFTSMAN TRAINING SCHEME (CTS)

IN SEMESTER PATTERN

(One year/Two Semesters)

BY

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GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP
DIRECTORATE GENERAL OF TRAINING

CONTENTS

1. INTRODUCTION

The Directorate General of Employment & Training (DGE&T) in Ministry of Labour is the apex organization for development and coordination at National level for the programmes relating to vocational training including Women's Vocational Training and Employment Services. Employment service is operated through a countrywide network of Employment Exchanges. Industrial Training Institutes are under the administrative and financial control of State Governments or Union Territory Administrations. DGE&T also operates Vocational Training Schemes in some of the specialized areas through field institutes under its direct control. Development of these programmes at national level, particularly in the area concerning common policies, common standards and procedures, training of instructors and trade testing are the responsibility of the DGE&T. But, day-to-day administration of employment Exchanges and Industrial Training Institutes rests with the State Governments/ Union Territories Administrations.

CSTARI one of the field institute of DGE&T is mandated to develop curricula for various courses under different schemes viz., CTS, ATS, MES, CoE& CITS. All the courses are certificate level and run on pan India basis under the ageis of NCVT. The curricula developed so far by this institute are skill based which catered the need of the industry manpower there by contributing significantly in the development of technical manpower. Hence vocational training provides country wide manpower and these trained manpower actually builds the wealth for the nation.

The broad concept of industry competency concerns the ability to perform particular tasks and duties to the standard of performance expected in the workplace. Competency requires the application of specified skills, knowledge and attitudes relevant to effective participation in an industry, industry sector or enterprise.

Competency covers all aspects of workplace performance and involves performing individual tasks; managing a range of different tasks; responding to contingencies or breakdowns; and, dealing with the responsibilities of the workplace, including working with others. Workplace competency requires the ability to apply relevant skills, knowledge and attitudes consistently over time and in the required workplace situations and environments.

In line with this concept of competency based curriculum focus on what is expected of a competent individual in the workplace as an outcome of learning, rather than focusing on the learning process itself.

"The Competency Based Training" establishes a direct link between the things which trainees must learn in institutions and knowledge and skills expected from them for employability "The Competency Based Training" is a means of instruction which :

I) Identifies the competencies required for work performance,
II) Prepares the trainees through precise learning objectives,
III) Is based on the realities of the world of work

When learning deals with performance type activities, it is necessary to analyse each job performed under a particular vocation. Skills required for doing a job may be manipulative and may require sequential and chronological order of performance. Therefore, teaching and learning content shall be presented in a psychological and methodological manner. Hence, identification of competencies becomes an essential exercise for planning and design a curriculum for vocational courses.

The elements of competency are the basic building blocks of the unit of competency. They describe in terms of outcomes the significant functions and tasks that make up the competency.

The performance criteria specify the required performance in relevant tasks, roles, skills and in the applied knowledge that enables competent performance. They are usually written in passive voice. Critical terms or phrases may be written in bold italics and then defined in range statement, in the order of their appearance in the performance criteria.

The essential skills and knowledge are either identified separately or combined. Knowledge identifies what a person needs to know to perform the work in an informed and effective manner. Skills describe the application of knowledge to situations where understanding is converted into a workplace outcome.

The procedure followed for this purpose is as follows:

I) listing of job opportunities,
II) identification of duties for each job,
III) analyzing the elements of competencies and setting Performance criteria against each elements of competencies,
IV) determining courses objectives,
V) Preparing course content by projecting elements of competencies, Performance criteria, skills, knowledge and personality traits.

2. JOB ROLES: Reference NOS & NCO

Brief description of Job roles:

- **Mechanic, Diesel;** repairs services and overhauls diesel or oil engines for efficient performance as prime mover to drive machinery and equipment. Examines engine to locate defects, using various tools and instruments.
- Dismantles or partly dismantles it to remove damaged or worn out parts and replaces or repairs them.
- Repairs or overhauls and assembles CRDI Engines such as replacing defective parts, scrapping bearings, setting timing, cleaning injectors, etc. according to maker's specification.
- overhauling of injectors and testing of injector
- Replace valve and assembles parts, doing supplementary tooling and other functions as necessary to ensure accuracy of fit.
- Installs assembled or repaired engine in position and connects pulley or wheel to propulsion system. Starts engine, tunes it up and observes performance noting different meter readings. such as temperature, fuel level, oil pressure, etc. and sets it to specified standard for optimum performance.
- Checks, adjusts and lubricates engine periodically and performs such other functions to keep engine in good working order.
- May solder or braze parts and service diesel fuel pumps and injectors.
- Measures essential parts like cylinder, bores piston, sizes crank pins etc. using gauges, micrometer and other precision tools and gets cylinders re-bored, liners fitted, valve seats refaced, etc..
- Monitoring emissions procedures by use of Engine gas analyser or Diesel smoke meter.
- Checking & cleaning a Positive crank case 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.
- Plan and organize assigned work and detect & resolve issues during execution. Demonstrate possible solutions and agree tasks within the team.
- Communicate with required clarity and understand technical English.
- Sensitive to environment, self-learning and productivity.

Reference NCO & NOS:

i) **NCO-2004: 7233.24**

ii) **A**SC/ Q 1401, (Automotive Service Technician L3)

iii) ASC/ Q 1402 (Automotive Service Technician L4)

3. NSQF LEVEL COMPLIANCE

NSQF level for Mechanic Diesel under CTS: **Level 4**

As per notification issued by Govt. of India dated- 27.12.2013 on National Skill Qualification Framework total 10 (Ten) Levels are defined.

Each level of the NSQF is associated with a set of descriptors made up of five outcome statements, which describe in general terms, the minimum knowledge, skills and attributes that a learner needs to acquire in order to be certified for that level.

Each level of the NSQF is described by a statement of learning outcomes in five domains, known as level descriptors. These five domains are:

a. Process
b. professional knowledge,
c. professional skill,
d. core skill and
e. Responsibility.

The Broad Learning outcome of Mechanic Diesel under ATS mostly matches with the Level descriptor at Level- 4

. The NSQF level-4 descriptor is given below:

LEVEL	Process required	Professional knowledge	Professional skill	Core skill	Responsibility
Level 4	work in familiar, predictable, routine, situation of clear choice	factual knowledge of field of knowledge or study	recall and demonstrate practical skill, routine and repetitive in narrow range of application, using appropriate rule and tool, using quality concepts	language to communicate written or oral, with required clarity, skill to basic Arithmetic and algebraic principles, basic understanding of social political and natural environment	Responsibility for own work and learning.

4. Learning outcome

The following are minimum broad learning outcome after completion of the Mechanic Diesel course of 01 years duration:

A. GENERIC OUTCOME

1. Recognize & comply safe working practices, environment regulation and housekeeping.
2. Work in a team, understand and practice soft skills, technical English to communicate with required clarity.

B. SPCIFIC OUTCOME

1. Demonstrate knowledge of concept and principles of basic arithmetic, algebraic, trigonometric, co-ordinate geometry and statistics and apply knowledge of specific area of perform practical operations.
2. Understand and explain basic science in the field of study including basic electrical, electronics and hydraulics & pneumatics.
3. Read and apply engineering drawing for different application in the field of work.
4. Select appropriate tools, data & information for servicing & overhauling of vehicle.
5. Understand the knowledge of concept in productivity, quality tools, labour & welfare legislation and apply such in day to day work.
6. Explain energy conservation, global warming and pollution and contribute for such in day to day work.
7. Explain personnel finance management, entrepreneurship and manage / organize related task in day to day work.
8. Ascertain and select measuring instrument and measure dimension of components and evaluate for accuracy.
9. Identify and use proper fasteners.
10. Perform sheet metal operations and pipe joints.
11. Trace /troubleshoot different wiring circuits in vehicle and prepare different electrical joints.
12. Service and test battery for proper functioning.
13. Demonstrate practical skill involved in producing different weld joints.
14. Demonstrate practical skill by using appropriate tools for different metal cutting operation to produce finished components and check for accuracy without any assistance.

15. Plan and organize the work in familiar predictable / routine environment for different maintenance of vehicle parts and accessories.
16. Dismantle and assemble of engine components of CRDI System and check for performance.
17. State the importance of Electronic diesel Control system
18. Identify parts of cooling and lubrication system of engine and execute required servicing.
19. State the constructional features and working principles of intake and exhaust systems of vehicle and related troubleshooting.
20. Apply appropriate rule and tools for starting and charging system and diagnose & rectify faults.
21. Recognize and apply factual knowledge of emission control system and Bhart/Euro standards as per norms.
22. Understand the working principle of, Sensors & actuators, their diagnosis with proper tools and scanners and recognize scan tool data using manuals.
23. Understand and explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.
24. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.
25. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.
26. Understand and apply basic computer working, basic operating system and uses internet services to get accustomed & take benefit of IT developments in the industry.

5. GENERAL INFORMATION

GENERAL INFORMATION

1.	Name of the Trade	:	**Mechanic Diesel**
2.	N.C.O. & NOS Code No.	:	**7231.10,** ASC/ Q 1401, ASC/ Q 1402,
3.	NSQF	:	Level - IV
4.	Duration of Craftsmen Training		1 Year (Two Semester having duration of six months each)
5	Entry Qualification	:	Passed 10th class examination with maths and Science.
6.	Unit strength	:	16 + (Max Supernumeraries seats: 5)

7. Distribution of training on Hourly basis:

Total hours /week	Trade practical	Trade theory	Work shop Cal. &Sc.	Engg. Drawing	Employability skills	Extracurricular activity
40 Hours	25 Hours	6 Hours	2 Hours	3 Hours	2 Hours	2 Hours

6. COURSE STRUCTURE

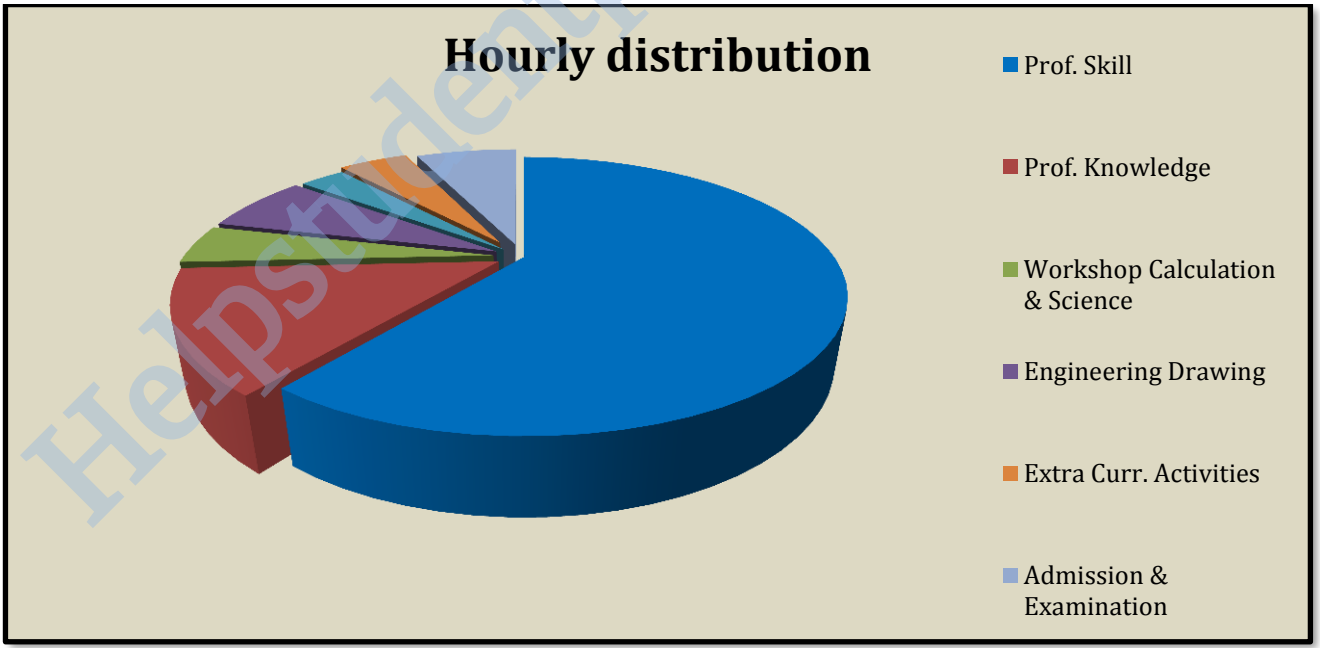
1. **Name of the Qualification :- Mechanic Diesel**

2. **Total duration of the course: - 12 Months**

3. **Training duration details : -**

	COURSE ELEMENTS	HOURLY DISTRIBUTION
A	PROFESSIONAL SKILL	1100HRS
B	PROFESSIONAL KNOWLEDGE	260 HRS
C	WORKSHOP CALCULATION & SCIENCE	90 HRS
D	ENGINEERING DRAWING	130 HRS
E	EMPLOYABILITY SKILLS	110 HRS
F	EXTRA CURRICULAR ACTIVITIES/LIB.	90 HRS
G	INPLANT TRG./PROJECT WORK	120 HRS
H	ADMISSION & EXAMINATION	80 HRS

PIE-CHART



7. General Training Plan, Examination & Pass regulation

General Training Plan

The skills stated in assessment outcome are to be imparted in accordance with the instructions contained within Section 10 in respect of the content and time structure of the vocational education and training (General Training Plan).

Examination

Each Semester examination is to take place after the end of the six months of training. The each semester examination encompasses such skills as are listed for that period of training (Detail in Section -8) and also includes theoretical knowledge, Core skills & E/S. The E/S will be covered in first two semesters only.

Candidates are to demonstrate that they are able to:

1. read& interpret technical parameters/documentation, plan and organize work processes, identify necessary materials and tools;
2. perform task with due consideration to safety rules, accident prevention regulations and environmental protection stipulations;
3. apply professional knowledge, core skills & employability skills while performing the task.
4. check the job as per drawing/assembly for functioning, identify and rectify errors in job/assembly.
5. Document the technical parameters related to the task undertaken.
6. Diagnostic the reported problem and rectify the same with due care.

The details of the examination and assessment standard are as per section-11.

Pass regulation

For the purposes of determining the overall result, weighting of 25 percent is applied to each semester examination. The minimum pass percent for Practical is 60% & minimum pass percent for Theory subjects 40%.

8. ASSESSABLE OUTCOME

Assessable outcome after completion of ONE year Mechanic Diesel course

I. Generic

1. Apply safe working practices.
2. Comply environment regulation and housekeeping
3. Interpret & use Company and technical communication

II. Specific

1. Apply safe working practices in an automotive work shop.
2. Comply environment regulations and housekeeping in the work shop.
3. Perform precision measurements on the components and compare parameters with specifications used in automotive work shop practices.
4. Make choices to carry out marking out the components for basic fitting operations in the work shop.
5. Use different types of tools and work shop equipment in the Auto work shop.
6. Use of different type of fastening and locking devices in a vehicle.
7. Perform basic fitting operations used in the work shop practices and inspection of dimensions.
8. Grinding of cutting tools in the work shop.
9. Perform surface finishing operations in the given job.
10. Produce sheet metal components using various sheet metal operations.
11. Produce components using bending process in the given work piece.
12. Inspect the auto component using Nondestructive testing methods
13. Manufacture components with different types of welding processes in the given job.
14. Identify the hydraulic and pneumatic components in a vehicle.
15. Construct electrical circuits and test its parameters by using electrical measuring instruments.
16. Perform basic electrical testing in a vehicle.
17. Perform battery testing and charging operations.
18. Construct basic electronic circuits and testing.
19. Identify and check functionality of Dashboard Gauges & engine performance.
20. Overhauling of Diesel Engine.
21. Servicing of Cooling and Lubrication system
22. Service Intake and Exhaust System
23. Service Diesel Fuel System
24. Check and adjust Engine Emissions
25. Overhauling Charging and Starting System
26. Diagnose and Troubleshoot Diesel Engines

9. ASSESSABLE OUTCOME WITH ASSESSMENT CRITERIA

ASSESSABLE OUTCOME ALONGWITH ASSESSMENT CRITERIA TO BE ACHIEVED AFTER EACH SEMESTER & COMPLETION OF QUALIFICATION

Semester-I

ASSESSABLE OUTCOME	ASSESSMENT CRITERIA
1. Apply safe working practices in an automotive work shop.	1.1 Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements and according to site policy. 1.2 Recognize and report all unsafe situations according to site policy. 1.3 Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures. 1.4 Identify, handle and store/dispose off dangerous goods and substances according to site policy and procedures following safety regulations and requirements. 1.5 Identify and observe site policies and procedures in regard to illness or accident. 1.6 Identify safety alarms accurately. 1.7 Report supervisor/competent of authority in the event of accidents or sickness of any staff and record accident details correctly according to site accident/injury procedures. 1.8 Identify and observe site evacuation procedures according to site policy. 1.9 Identify personal protective equipment (PPE) and use the same as per related working environment. 1.10 Identify basic first aid and use them under different circumstances. 1.11 Identify different fire extinguishers and use the same as per requirement.
2. Comply environment regulations and housekeeping in the work shop.	2.1 Identify environmental pollution and contribute to the avoidance of instances of environmental pollution. 2.2 Carryout maintenance and cleaning of work shop and lifting equipment. 2.3 Take opportunities to use energy and materials in an environmentally friendly manner. 2.4 Avoid waste and dispose waste as per procedure.

	2.5 Recognize different components of 5S and apply the same in the working environment.
3. Perform precision measurements on the components and compare parameters with specifications used in automotive work shop practices.	3.1 Measure all dimensions in accordance with standard specifications and tolerances by using precision measuring instruments. 3.2 Measure the parameters related with the vehicle components for its effective operation by matching with manufacturer's specification using different gauges
4. Make choices to carry out marking out the components for basic fitting operations in the work shop.	4.1 Mark according to drawings by using marking tools on the work pieces. 4.2 Chip the job in accordance with standard specifications and tolerances. 4.3 Measure all dimensions in accordance with standard specifications and tolerances.
5. Use different types of tools and work shop equipment in the work shop.	5.1 Identify the different types of hand and power tools used in the automotive work shop. 5.2 Operate various tools and work shop equipment.
6. Use of different type of fastening and locking devices in a vehicle	6.1 Identify the different type of fasteners and locking devices used in the vehicle. 6.2 Use different types of locking devices correctly. 6.3 Specify the bolt and nut threads. 6.4 Practice on removing the damaged studs and bolts
7. Perform basic fitting operations used in the work shop practices and inspection of dimensions.	7.1 Mark according to drawing by using marking tools on flat surfaces. 7.2 Hack saw and file the job using different methods and perform in accordance with the standard specifications and tolerances. 7.3 Drilling and reaming on flat surfaces. 7.4 Identify and use hand tools for internal and external threading with taps and dies. 7.5 Measure all dimensions in accordance with standard specification and tolerances.
8. Grinding of cutting tools in the work shop	8.1 Identify cutting tool materials and their application. 8.2 Plan and grind cutting and marking tools. 8.3 Measure the tool angles with gauges.
9.Perform surface finishing operations in the given job.	9.1 Do surface finishing of the job to meet specifications by scraping. 9.2 Sharpen the scraping tool by grinding. 9.3 Check accuracy/correctness of the job using measuring instruments.

10. Produce sheet metal components using various sheet metal operations.	10.1 Ascertain and select tools and materials for the job and make this available for use in a timely manner. 10.2 Plan and organize the work for different types of sheet metal operations. 10.3 Mark according to drawing by using marking tools on flat surfaces. 10.4 Produce components as per the drawing.
11.Produce components using bending process in the given work piece.	11.1 Ascertain and select tools, equipment and materials for the job and make this available for use in a timely manner. 11.2 Plan and organize the work for pipe bending operations. 11.3 Perform bending, soldering and brazing operations in accordance with standard operating procedure using appropriate tools. 11.4 Check accuracy/correctness of the job using appropriate measuring instruments.
12. Inspect the auto component using Nondestructive testing methods	12.1 Classify different vehicle components by its manufacturing processes. 12.2 Ascertain and select tools and equipment to do NDT test the given job. 12.3 Plan and organize the work for nondestructive testing. 12.4 Perform different types of nondestructive tests using appropriate testing equipment. 12.5 Observe safety/precaution during testing the job.
13. Manufacture components with different types of welding processes in the given job.	13.1 Plan and select appropriate method to produce components with welding process. 13.2 Comply with safety rules when performing the above operations. 13.3 Mark according to the drawing using marking tools on the job. 13.4 Select appropriate tools and equipment to perform the above operations. 13.5 Set up and produce component as per standard operating procedure.
14. Identify the hydraulic and pneumatic components in a vehicle.	14.1 Comply with safety rules when performing the following operations. 14.2 Locate and identify the hydraulic components in a vehicle. 14.3 Locate and identify the pneumatic components in a vehicle.
15. Construct electrical circuits and test its parameters by using electrical measuring	15.1 Plan and organize the work for basic electrical operations. 15.2 Select the tools, instruments and materials required to do the job. 15.3 Comply with safety rules when performing the basic electrical operations.

instruments.	15.4 Perform electrical wire joints, form electrical circuits and test basic electrical parameters as per the circuit drawings and operating procedures.
16. Perform basic electrical testing in a vehicle.	16.1 Plan and organize the work for auto electrical component testing. 16.2 Tracing the auto electrical components in a vehicle. 16.3 Test continuity and voltage drop in the electrical circuits. 16.4 Operate the electrical components in a vehicle and test lamps.
17. Perform battery testing and charging operations.	17.1 Ascertain and select tools and materials for the job. 17.2 Comply with safety rules when performing the following operations. 17.3 Plan and select different methods for charging the battery. 17.4 Perform battery testing as per the operating procedure.
18. Construct basic electronic circuits and testing.	18.1 Plan and select different types of basic electronic components and measuring instruments. 18.2 Construct and test the basic electronic gate circuits and its components as per the standard procedure.

Semester-II

ASSESSABLE OUTCOME	ASSESSMENT CRITERIA
19.Identify and check functionality of Dashboard Guages & engine performance	19.1 Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	19.2 Identify different gauges fitted on the dashboard and check for proper functioning.
	19.3 Perform daily checks before starting the engine.
	19.4 Start the engine and allow it to warm up.
	19.5 Identify the problem in functionality of particular Gauge fitted on dashboard and record the reading and compare it with standard reading.
	19.6 Repair / Replace the defective guages as per standard operating practice.
	19.7 Check for proper functionality
	19.8 Stop the engine.
20. Overhauling of Diesel Engine	20.1 Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	20.2 Drain coolant and lubricants from the engine and

	Remove Accessories of engine
	20.3 Service cylinder head assembly.
	20.4 Service Oil Sump and Oil Pump
	20.5 Service Piston and connecting Rod Assembly
	20.6Service Flywheel , Crank shaft, camshaft and its Bearings and gear
	20.7 Service cylinder block.
	20.8 Check and adjust valve clearances as per procedure and recommended specification
	20.9 Refit all the accessories.
	20.10 Refill all the required coolant and lubricants as per standard specification.
	20.11 Start the engine and observe reading of dashboard gauges and record Engine Performance
21. Servicing of Cooling and Lubrication system	21.1 Check Engine Coolant & Reverse flush the cooling system using flushing solution.
	21.2 Service Radiator and radiator cap
	21.3 Check Radiator hoses for crack and replace if necessary.
	21.4 Test Thermostat valve for proper functioning and replace if necessary.
	21.5 Check water pump for serviceability and replace if faulty.
	21.6 Check Fan/Alternator Belt for proper tension.
	21.7 Check and replace Engine Oil and oil filter
	21.8 check and Service Oil Cooler & pressure relief valve
22. Service Intake and Exhaust System	22.1 Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	22.2 Service/Replace Air Cleaner
	22.3 Overhaul Air Compressor & Exhauster Assembly
	22.4 Service Turbocharger/Supercharger
	22.5 Service Intercooler
	22.6 Check Exhaust Leakages and Rubber Mounting of Exhaust System
	22.7 Service Exhaust manifold and catalytic converter
	22.8 Check and Replace Resonator/Muffler
23. Service Diesel Fuel System	23.1 Check leakages in fuel line.
	23.2 Service Fuel Tank
	23.3 Replace Fuel Filter & Feed pump

	23.4 Set Fuel Injection Pump Timing as per manufacturer specification
	23.5 Service Fuel Injectors as per manufacturers guidelines and Bleed the Fuel System to vent out any air trapped.
	23.6 Start the Engine and check for proper functioning.
24. Check and adjust Engine Emissions	24.1 Analyze Engine Emission by using Gas Analyzer or Smoke meter.
	24.2 Service PCV Valve
	24.3 Check and Replace EVAP Canister
	24.4 Check and Replace EGR/SCR Valve
25. Overhauling Charging and Starting System	25.1 Check Charging system for proper functioning as per manufacturer guidelines
	25.2 Service alternator for proper functioning
	25.3 Check starting system for proper functioning as per manufacturer guidelines
	25.4 Check starter for proper functioning
	25.5 Service starter.
26. Diagnose and Troubleshoot Diesel Engines	Carryout the diagnostic procedure by reviewing engine technical workshop manual, following the standard diagnostic procedure for. a) Engine Not Starting. b) High Fuel Consumption c) Engine Overheating d) Low Power Generation e) Excessive Oil Consumption f) Low/High Engine Oil Pressure g) Abnormal Engine Noise.

10. SYLLABUS CONTENT WITH TIME STRUCTURE

10.1 SYLLABUS CONTENT FOR PROFESSIONAL SKILL & KNOWLEDGE

SYLLABUS FOR THE TRADE OF MECHANIC DIESEL

First Semester

(Semester Code no. - 01)

Duration : Six Month

LEARNING OBJECTIVES OF 1ST SEMESTER

Week No.	Professional skills Trade Practical	Professional Knowledge Trade Theory
1	Familiarisation with institute, Job opportunities in the automobile sector, Machinery used in Trade. Types of work done by the students in the shop floor.	**Admission & introduction to the trade:** Introduction to the Course duration, course content, study of the syllabus. General rule pertaining to the Institute, facilities available– Hostel, Recreation, Medical and Library working hours and time table
2	Practical related to Safety and Health, Importance of maintenance and cleanliness of Workshop. Interaction with health centre and fire service station to provide demo on First aid and Fire safety, Use of fire extinguishers. Demonstration on safe handling and Periodic testing of lifting equipment, and Safety disposal of Used engine oil. Energy saving Tips of ITI electricity Usage	**Occupational Safety & Health** Importance of Safety and general Precautions to be observed in the shop. Basic first aid, safety signs - for Danger, Warning, caution & personal safety message. Safe handling of Fuel Spillage, Fire extinguishers used for different types of fire. Safe disposal of toxic dust, safe handling and Periodic testing of lifting equipment, Authorization of Moving & road testing vehicles. **Energy conservation**-Definition, Energy Conservation Opportunities (ECOs)-Minor ECos and Medium ECOs, Major ECOs), Safety disposal of Used engine oil, Electrical safety tips**.**
3-5	Practice using all marking aids, like steel rule with spring calipers, dividers, scriber, punches, Chisel etc., Layout a work piece- for line, circle, arcs and circles. Practice to measure a wheel base of a vehicle with measuring tape. Practice to measure valve spring tension using spring tension tester	**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. Calipers-inside and outside. Dividers, surface gauges, scriber, punches-prick punch**,** center punch, pin punch, hollow punch, number and letter punch. Chisel-flat, cross-cut. Hammer- ball pein, lump, mallet. Screw drivers-blade screwdriver, Phillips screw driver, Ratchet screwdriver. Allen key, bench vice & C-clamps, Spanners- ring spanner, open

	Practice to remove wheel lug nuts with use of an air impact wrench Practice on General workshop tools & power tools.	end spanner & the combination spanner, universal adjustable open end 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, car jet washers Pipe flaring & cutting tool, pullers-Gear and bearing.
6&7	Measuring practice on Cam height, Camshaft Journal dia, crankshaft journal dia, Valve stem dia, piston diameter, and piston pin dia with outside Micrometers. Measuring practice on the height of the rotor of an oil pump from the surface of the housing or any other auto component measurement with depth micrometer. Measuring practice on valve spring free length. Measuring practice on cylinder bore, Connecting rod bore, inside diameter (ID) of a camshaft bearing with Telescope gauges. Measuring practice on cylinder bore for taper and out-of-round with Dial bore gauges. Measuring practice to measure wear on crankshaft end play, crankshaft run out, and valve guide with dial indicator. Measuring practice to check the flatness of the cylinder head is warped or twisted with straightedge is used with a feeler gauge. Measuring practice to check the end gap of a piston ring, piston-to-cylinder wall clearance with feeler gauge. Practice to check engine manifold vacuum with vacuum gauge. Practice to check the air pressure inside the vehicle tires is maintained at the recommended setting.	**Systems of measurement**, Description, care & use of - Micrometers- Outside and depth mirometer, Micrometer adjustments, Vernier calipers, Telescope gauges, Dial bore gauges, Dial indicators, straightedge, feeler gauge, thread pitch gauge, vacuum gauge, tire pressure gauge.
8 & 9	Practice on General cleaning, checking and use of nut, bolts, &	**Fasteners**- Study of different types of screws, nuts, studs & bolts, locking devices, Such as lock

	studs etc., Removal of stud/bolt from blind hole. Practice on cutting tools like Hacksaw, file, chisel, Sharpening of Chisels, center punch, safety precautions while grinding. Practice on Hacksawing and filing to given dimensions.	nuts, cotter, split pins, keys, circlips, lock rings, lock washers and locating where they are used. Washers & chemical compounds can be used to help secure these fasteners. Function of **Gaskets,** Selection of materials for gaskets and packing, oil seals**.** **Cutting tools** :- Study of different type of cutting tools like Hacksaw, File- Definition, parts of a file, specification, Grade, shape, different type of cut and uses., OFF-hand grinding with sander, bench and pedestal grinders, safety precautions while grinding. **Limits, Fits & Tolerances**:-Definition of limits, fits & tolerances with examples used in auto components
10 & 11	Practice on Marking and Drilling clear and Blind Holes, Sharpening of Twist Drills Safety precautions to be observed while using a drilling machine. Practice on Tapping a Clear and Blind Hole, Selection of tape drill Size, use of Lubrication, Use of stud extractor. 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.	**Drilling machine** - Description and study of Bench type Drilling machine, Portable electrical Drilling machine, drill holding devices, Work Holding devices, Drill bits. **Taps and Dies:** Hand Taps and wrenches, Calculation of Tap drill sizes for metric and inch taps. Different type of Die and Die stock. Screw extractors. **Hand Reamers** – Different Type of hand reamers, Drill size for reaming, Lapping, Lapping abrasives, type of Laps.
12	Practice on making Rectangular Tray. Pipe bending, Fitting nipples unions in pipes. Soldering and Brazing of Pipes.	**Sheet metal** - State the various common metal Sheets used in Sheet Metal shop Sheet metal operations - Shearing, bending, Drawing, Squeezing Sheet metal joints - Hem & Seam Joints Fastening Methods - Riveting, soldering, Brazing. fluxes used on common joints. Sheet and wire-gauges. The blow lamp- its uses and pipe fittings.
13	Practice in joining wires using soldering Iron, Construction of simple electrical circuits, Measuring of current, voltage and resistance using digital multimeter, practice continuity test for fuses, jumper wires, fusible links, circuit breakers.	**Basic electricity**, Electricity principles, Ground connections, Ohm's law, Voltage, Current, Resistance, Power, Energy. Voltmeter, ammeter, Ohmmeter Mulitmeter, Conductors & insulators, Wires, Shielding, Length vs. resistance, Resistor ratings

14	Diagnose series, parallel, series-parallel circuits using Ohm's law, Check electrical circuit with a test lamp, perform voltage drop test in circuits using multimeter, measure current flow using multimeter /ammeter, use of service manual wiring diagram for troubleshooting.	Fuses & circuit breakers, Ballast resistor, Stripping wire insulation, cable colour codes and sizes, Resistors in Series circuits , Parallel circuits and Series-parallel circuits, Electrostatic effects, Capacitors and its applications, Capacitors in series and parallel.
15	Cleaning and topping up of a lead acid battery, Testing battery with hydrometer, Connecting battery to a charger for battery charging, Inspecting & testing a battery after charging, Measure and Diagnose the cause(s) of excessive Key-off battery drain (parasitic draw) and do corrective action. Testing of relay and solenoids and its circuit.	Description of Chemical effects, Batteries & cells, Lead acid batteries & Stay Maintenance Free (SMF) batteries, Magnetic effects, Heating effects, Thermo-electric energy, Thermisters, Thermo couples, Electrochemical energy, Photo-voltaic energy, Piezo-electric energy, Electromagnetic induction, Relays, Solenoids, Primary & Secondary windings, Transformers, stator and rotor coils.
16	Identify and test power and signal connectors for continuity, Identify and test different type of Diodes, NPN & PNP Transistors for its functionality, Construct and test simple logic circuits OR, AND & NOT and Logic gates using switches.	**Basic electronics**: Description of Semi conductors, Solid state devices- Diodes, Transistors, Thyristors, Uni Junction Transistors (UJT), Metal Oxide Field Effect Transistors (MOSFETs), Logic gates-OR, AND & NOT and Logic gates using switches.
17& 18	Practice to make straight beads and Butt, Lap & T joints Manual Metal Arc Welding. Setting of Gas welding flames, practice to make a straight beads and joints Oxy – Acetylene welding Film on Heat treatment process	**Introduction to welding and Heat Treatment** **Welding processes** – Principles of Arc welding, brief description, classification and applications. Manual Metal Arc welding -principles, power sources, electrodes, welding parameters, edge preparation & fit up and welding techniques; Oxy – Acetylene welding - principles, equipment, welding parameters, edge preparation & fit up and welding techniques;. Heat Treatment Process– Introduction, Definition of heat treatment, Definition of Annealing, Normalizing, Hardening and tempering. Case hardening, Nitriding, Induction hardening and Flame Hardening process used in auto components with examples.
19 &	Practice on Liquid penetrant testing	**Non-destructive Testing Methods- Importance**

20	method and Magnetic particle testing method. Identification of Hydraulic and pneumatic components used in vehicle. Tracing of hydraulic circuit on hydraulic jack, hydraulic power steering, and Brake circuit. Identification of components in Air brake systems**.**	**of Non-Destructive Testing In Automotive Industry, Definition of NDT,** Liquid penetrant and Magnetic particle testing method – Portable Yoke method **Introduction to Hydraulics & Pneumatics: -** Definition of Pascal law, pressure, Force, viscosity. Description, symbols and application in automobile of Gear pump-Internal & External, single acting, double acting & Double ended cylinder; Directional control valves-2/2, 3/2, 4/2, 4/3 way valve, Pressure relief valve, Non return valve, Flow control valve used in automobile. Pneumatic Symbols, Description and function of air Reciprocating Compressor. Function of Air service unit (FRL-Filter, Regulator & Lubricator).
21	Identification of different type of Vehicle. Demonstration of vehicle specification data; Identification of vehicle information Number (VIN). Demonstration of Garage, Service station equipments.- Vehicle hoists – Two post and four post hoist, Engine hoists, Jacks**,** Stands.	Auto Industry - History, leading manufacturers, development in automobile industry, trends, new product. Brief about Ministry of Road transport & Highways, The Automotive Research Association of India (ARAI), National Automotive Testing and R&D Infrastructure Project (NATRIP), & Automobile Association. Definition: - 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. Brief description and uses of Vehicle hoists – Two post and four post hoist, Engine hoists, Jacks**,** Stands.
22-23	In-plant Training	
24-25	Revision and Test	
26	NCVT Exam	

SYLLABUS FOR THE TRADE OF MECHANIC DIESEL

Second Semester

(Semester Code no. - 02)

Duration : Six Months

LEARNING OBJECTIVES OF 2ND SEMESTER

Week No.	Professional skills Trade Practical (27 Hrs/week)	Professional Knowledge Trade Theory (5 Hrs/week)
1 & 2	Identification of parts in a diesel engine of LMV/ HMV 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.	**Introduction to Engine:** Description of internal & external combustion engines, Classification of IC engines, Principle & working of 2&4-stroke diesel engine (Compression ignition Engine (C.I)), Principle of Spark Ignition Engine(SI), differentiate between 2-stroke and 4 stroke, C.I engine and S.I Engine, Direct injection and Indirect injection, Technical terms used in engine, Engine specification. 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. Different type of starting and stopping method of Diesel Engine Procedure for dismantling of diesel engine from a vehicle..
3 & 4	Overhauling of cylinder head assembly, Use of service manual for clearance and other parameters, Practice on removing rocker arm assembly manifolds. 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. Testing 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,	**Diesel Engine Components:** 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. Importance of Turbulence **Valves & Valve Trains-** 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**,** Valve trains**,** Valve- timing diagram**,** concept of Variable valve timing**.** Description of Camshafts & drives **,** Description of Overhead camshaft**,** importance of Cam

	adjustable valve clearances, starting engine after adjustments.	lobes**,** Timing belts & chains**,** Timing belts & tensioners.
5	Overhauling piston and connecting rod Assembly. Use of service manual for clearance and other parameters:- Practice on removing oil sump and oil pump – clean the sump. Practice on removing the big end bearing, connecting rod with the piston. Practice on 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.	Description & functions of different types of **pistons**, piston rings and piston pins and materials. Used recommended clearances for the rings and its necessity precautions while fitting rings, common troubles and remedy. Compression ratio. Description & function of **connecting rod,** importance of big- end split obliquely, Materials used for connecting rods big end & main bearings. Shells piston pins and locking methods of piston pins.
6	Overhauling of crankshaft, Use of service manual for clearance and other parameters:- Practice on removing damper pulley, timing gear/timing chain, flywheel, main bearing caps, bearing shells and crankshaft from engine checking oil retainer and thrust surfaces for wear, Measure crank shaft journal for wear, taper and ovality, Checking crankshaft for fillet radii, bend & twist.	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 application bearing failure & its causes-care & maintenance. Crank-shaft balancing, Firing order of the engine.
7	Checking of flywheel and mounting flanges, spigot, bearing. Check vibration damper for defects, Practice on removing cam shaft 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 crank shaft on block-torque bolts - check end play remove shaft - check seating, repeat similarly for connecting rod and Check seating and refit.	Description and function of the **fly wheel** and vibration damper. Crank case & oil pump, gears timing mark, Chain sprockets, chain tensioner etc. Function of clutch & coupling units attached to flywheel.
8	Cleaning and Checking of cylinder blocks Surface for any crack, flatness, Measure cylinder bore for taper & ovality, clean oil	Description of **Cylinder block,** Cylinder block construction, and Different type of Cylinder sleeves (liner).

	gallery passage and oil pipe line, Bore - descale water passages and examine Removing cylinder liners from scrap cylinder block, practice in measuring and refitting new liners as per maker's recommendations precautions while fitting new liners.	
9	Reassemble all parts of engine in correct Sequence and torque all bolts and nuts as per workshop manual of the engine. Engine component procedures- Testing cylinder compression**,** Checking idle speed**,** Removing & replacing a cam belt**,** Inspecting & adjusting an engine drive belt**,** Replacing an engine drive belt.	**Engine assembly** procedure with aid of special tools and gauges used for engine assembling. Introduction to Gas Turbine, Comparison of single and two stage turbine engine, Different between gas turbine and Diesel Engine.
10-12	Practice on Checking &Top up coolant, Draining & refilling coolant, Checking / replacing a coolant hose, Testing cooling system pressure, Practice on Removing & replacing radiator/ thermostat. Inspect the radiator pressure cap, Testing of thermostat. Cleaning & reverse flushing. Overhauling water pump and refitting. Practice on Checking engine oil**,** Draining engine oil**,** Replacing oil filter**,** Refilling engine oil**.** 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.	**Need for Cooling systems,** Heat transfer method, Boiling point & pressure, Centrifugal force, Vehicle coolant properties and recommended change of interval, Different type of cooling systems, **Basic cooling system components-** Radiator, Coolant hoses, Water pump, Cooling system thermostat, Cooling fans, Temperature indicators, Radiator pressure cap, Recovery system, Thermo-switch. **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. 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.
13.	Practice on Dismantling air compressor and exhauster and cleaning all parts - measuring wear in the cylinder, reassembling all parts and fitting them in the engine. Dismantling & assembling of turbocharger, check for axial clearance as per service manual. Check Exhaust system for rubber mounting for damage, deterioration and out of position; for leakage, loose connection, dent and	**Intake & exhaust systems** – Description of Diesel induction & Exhaust systems. Description & function of air compressor, exhauster, Super charger, Intercoolers, turbo charger, variable turbo charger mechanism. **Intake system components-** Description and function of Air cleaners, Different type air cleaner, Description of Intake manifolds and material**,**

	damage; Practice on Exhaust manifold removal and installation. Practice on Catalytic converter removal and installation.	**Exhaust system components-** Description and function of Exhaust manifold**,** Exhaust pipe**,** Extractors**,** Mufflers- Reactive, absorptive, Combination.**,** Catalytic converters**,** Flexible connections**,** Ceramic coatings**,** Back-pressure, Electronic mufflers**.**
14 - 16	Practice on removing & 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 separators. Bleeding of air from the fuel lines, Servicing primary & secondary filters. Removing a fuel injection pump from an engine-refit the pump to the engine re- set timing - fill lubricating-oil start and adjust slow speed of the engine. Practice on overhauling of injectors and testing of injector. General maintenance of Fuel Injection Pumps (FIP).	**Diesel Fuel Systems-** Description and function of Diesel fuel injection, fuel characteristics**,** concept of Quiet diesel technology **&** Clean diesel technology. **Diesel fuel system components –** Description and function of Diesel tanks & lines**,** Diesel fuel filters**,** water separator, Lift pump**,** Plunger pump**,** Priming pump**,** Inline injection pump**,** Distributor-type injection pump**,** Diesel injectors**,** Glow plugs**,** Cummins & Detroit Diesel injection. **Electronic Diesel control-** Electronic Diesel control systems**,** Common Rail Diesel Injection (CRDI) system**,** Hydraulically actuated electronically controlled unit injector (HEUI) diesel injection system. Sensors, actuators and ECU (Electronic Control Unit) used in Diesel Engines.
17	Practice on Start engine adjust idling speed and damping device in pneumatic governor and venture control unit checking 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. Checking 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**:- 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.
18	Monitoring emissions procedures by use of Engine gas analyser or Diesel smoke meter. Checking & cleaning a Positive crank case ventilation (PCV) valve**.** Obtaining & interpreting scan tool data. Inspection of EVAP canister purge system by use of scan Tool. EGR /SCR Valve Remove and installation	**Emission Control:-** Vehicle emissions Standards- Euro and Bhart II, III, IV, V Sources of emission, Combustion**,** Combustion chamber design. **Types of emissions**: Characteristics and Effect of Hydrocarbons**,** Hydrocarbons in exhaust gases**,** Oxides of nitrogen**,** Particulates**,** Carbon monoxide**,** Carbon dioxide**,** Sulfur content in fuels

	for inspection.	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
19	Practice on 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 Vehicle and overhauling the starter motor, testing of starter motor	Description .of **charging circuit** operation of alternators, regulator unit, ignition warning lamp- troubles and remedy in charging system. Description of **starter motor circuit,** Constructional details of starter motor solenoid switches, common troubles and remedy in starter circuit.
20 & 21	Practice on 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 :** 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.
22-23	In-plant Training	
24-25	Revision and Test	
26	NCVT Exam	

10.2 SYLLABUS CONTENT OF CORE SKILLS

First Semester
(Semester Code no. - 01)
Duration: Six Month

LEARNING OBJECTIVES OF 1ST SEMESTER

1. Demonstrate basic arithmatic to derive value of unknown quantity / variable.
2. Understand & apply engineering material, their classification, properties and applications in the day to day technical application.
3. Explain & apply speed, velocity, work, power & energy for application in field of work.
4. Understand & explain importance of engineering drawing, drawing instruments, their standard & uses.
5. Draw lines, geometrical figures, free hand sketches.
6. Understand and apply sizes & layout of drawing sheet, method of presentation of engineering drawing & symbolic representation as per BIS standards

Sl. No.	Professional Knowledge Workshop Calculation and Science	Professional Knowledge & Skills Engineering Drawing
1.	**Unit**: Systems of unit- FPS, CGS, MKS/SI unit, unit of length, Mass and time, Conversion of units	Engineering Drawing: Introduction and its importance - Relationship to other technical drawing types - Conventions - Viewing of engineering drawing sheets. - Method of Folding of printed Drawing Sheet as per BIS SP:46-2003
2.	**Fractions** : Fractions, Decimal fraction, L.C.M., H.C.F., Multiplication and Division of Fractions and Decimals, conversion of Fraction to Decimal and vice versa. Simple problems using Scientific Calculator.	Drawing Instruments : their Standard and uses - Drawing board, T-Square, Drafter (Drafting M/c), Set Squares, Protractor, Drawing Instrument Box (Compass, Dividers, Scale, Diagonal Scales etc.), Pencils of different Grades, Drawing pins / Clips.
3.	**Square Root** : Square and Square Root, method of finding out square roots, Simple problem using calculator.	Lines : - Definition, types and applications in Drawing as per BIS SP:46-2003 - Classification of lines (Hidden, centre, construction, Extension, Dimension, Section) - Drawing lines of given length (Straight, curved) - Drawing of parallel lines, perpendicular line - Methods of Division of line segment
4.	**Ratio & Proportion** : Simple calculation on related problems.	Drawing of Geometrical Figures: Definition, nomenclature and practice of - Angle: Measurement and its types, method of

		bisecting. - Triangle -different types - Rectangle, Square, Rhombus, Parallelogram. - Circle and its elements.
5.	**Percentage** : Introduction, Simple calculation. Changing percentage to decimal and fraction and vice-versa.	Lettering and Numbering as per BIS SP46-2003: - Single Stroke, Double Stroke, inclined, Upper case and Lower case.
6.	**Material Science** : properties -Physical & Mechanical, Types –Ferrous & Non-Ferrous, difference between Ferrous and Non-Ferrous metals, introduction of Iron, Cast Iron, Wrought Iron, Steel, difference between Iron and Steel, Alloy steel, carbon steel, stainless steel, Non-Ferrous metals, Non-Ferrous Alloys.	Dimensioning: - Definition, types and methods of dimensioning (functional, non-functional and auxiliary) - Types of arrowhead - Leader Line with text
7.	**Mass, Weight and Density** : Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density, specific gravity of metals.	Free hand drawing of - Lines, polygons, ellipse, etc. - geometrical figures and blocks with dimension - Transferring measurement from the given object to the free hand sketches.
8.	**Speed and Velocity**: Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation, equations of motions, simple related problems.	Sizes and Layout of Drawing Sheets - Basic principle of Sheet Size - Designation of sizes - Selection of sizes - Title Block, its position and content - Borders and Frames (Orientation marks and graduations) - Grid Reference - Item Reference on Drawing Sheet (Item List)
9.	**Work, Power and Energy**: work, unit of work, power, unit of power, Horse power of engines, mechanical efficiency, energy, use of energy, potential and kinetic energy, examples of potential energy and kinetic energy.	Method of presentation of Engineering Drawing - Pictorial View - Orthogonal View - Isometric view
10.	-----	Symbolic Representation (as per BIS SP:46-2003) of : - Fastener (Rivets, Bolts and Nuts) - Bars and profile sections - Weld, brazed and soldered joints. - Electrical and electronics element - Piping joints and fittings

Second Semester
(Semester Code no. - 02)
Duration: Six Month

LEARNING OBJECTIVES OF 2ND SEMESTER

1. Demonstrate basic algebraic, mensuration, trigonometric facts and formulas to derive value of unknown quantity / variable.
2. Apply the factual knowledge of basic heat & temperature, basic electricity for day to day practical application.
3. Explain & apply principles of simple machine & levers for mechanical advantage, efficiency for practical application.
4. Draw & practice dimensioning, construction of solid figures and projections as per IS specifications.

Sl. No.	Professional Knowledge Workshop Calculation and Science	Professional Knowledge & Skills Engineering Drawing
1.	**Algebra** : Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	Construction of Scales and diagonal scale
2.	**Mensuration :** Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle, Volume of solids – cube, cuboids, cylinder and Sphere. Surface area of solids – cube, cuboids, cylinder and Sphere.	Practice of Lettering and Title Block
3.	**Trigonometry:** Trigonometrical ratios, measurement of angles. Trigonometric tables	Dimensioning practice: - Position of dimensioning (unidirectional, aligned, oblique as per BIS SP:46-2003) - Symbols preceding the value of dimension and dimensional tolerance. - Text of dimension of repeated features, equidistance elements, circumferential objects.
4.	**Heat & Temperature**: Heat and temperature, their units, difference between heat and temperature, boiling point, melting point, scale of temperature, relation between different scale of temperature, Thermometer, pyrometer, transmission of heat, conduction, convection, radiation.	Construction of Geometrical Drawing Figures: - Different Polygons and their values of included angles. Inscribed and Circumscribed polygons. - Conic Sections (Ellipse& Parabola)

5.	**Basic Electricity**: Introduction, use of electricity, how electricity is produced, Types of current_ AC, DC, their comparison, voltage, resistance, their units. Conductor, insulator, Types of connections – series, parallel, electric power, Horse power, energy, unit of electrical energy.	Drawing of Solid figures (Cube, Cuboids, Cone, Prism, Pyramid, Frustum of Cone and Pyramid.) with dimensions.
6.	**Levers and Simple Machines:** levers and its types. Simple Machines, Effort and Load, Mechanical Advantage, Velocity Ratio, Efficiency of machine, Relationship between Efficiency, velocity ratio and Mechanical Advantage.	Free Hand sketch of hand tools and measuring tools used in respective trades.
7.		Projections: - Concept of axes plane and quadrant. - Orthographic projections - Method of first angle and third angle projections (definition and difference) - Symbol of 1st angle and 3rd angle projection as per IS specification.
8.		Drawing of Orthographic projection from isometric/3D view of blocks
9.		Orthographic Drawing of simple fastener (Rivet, Bolts, Nuts & Screw)
10.		Drawing details of two simple mating blocks and assembled view.

Employability Skills

11.1 GENERAL INFORMATION

1. **Name of the subject** : **EMPLOYABILITY SKILLS**

2. **Applicability** :
   - CTS- Mandatory for all trades
   - ATS- Mandatory for fresher only

3. **Hours of Instruction** : 110 Hrs.

4. **Examination** : The examination will be held at the end of semesters.

5. **Instructor Qualification** :

MBA OR BBA with two years experience OR Graduate in Sociology/ Social Welfare/ Economics with Two years experience OR Graduate/ Diploma with Two years experience and trained in Employability Skills from DGT institutes

AND

Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above

OR

Existing Social Studies Instructors duly trained in Employability Skills from DGT institutes

6. Instructor : One full time regular instructor shall be engaged on every 240 number of trainees for teaching the subject 'Employability Skills'. One additional full time regular instructor would be required on increase in every 240 trainees. Wherever the trainees are less than 240 or part thereof, a part-time instructor may be engaged to teach the subject. This has been illustrated in the table below:

S. No.	Number of trainees	Instructor (s) required
a)	Less than 240	One part-time Instructor
b)	240	One full-time Instructor
c)	Between 240 and 480	One full-time Instructor + One part-time Instructor
d)	Between 480 and 720	Two full-time Instructors + One part-time Instructor
e)	Between 720 and 960	Three full-time Instructors + One part-time Instructor

11.2 DISTRIBUTION OF TOPICS BETWEEN SEMESTERS FOR EMPLOYABILITY SKILL

Course Duration	Semester1 Topics	Semester2 Topics	Examination
01 Year (Two semesters)	1. English Literacy 2. I.T. Literacy 3. Communication Skills	4. Entrepreneurship Skills 5. Productivity 6. Occupational safety , Health and Environment Education 7. Labour Welfare Legislation 8. Quality Tools	Final examination at the end of second semester
02 Years (Four Semesters)	1. English Literacy 2. I.T. Literacy 3. Communication Skills	4. Entrepreneurship Skills 5. Productivity 6. Occupational safety , Health and Environment Education 7. Labour Welfare Legislation 8. Quality Tools	Final examination at the end of second semester

11.3 SYLLABUS CONTENT OF EMPLOYABILITY SKILL
SEMESTER-I

LEARNING OBJECTIVES OF 1ST SEMESTER

1. Read, write and communicate in English language for day to day work.
2. Communicate in written and oral and with required clarity ensuring that the information communicated is clear, concise and accurate.
3. Understand and apply basic computer working, basic operating system and uses internet services to get accustomed & take benefit of IT developments in the industry.

1. English Literacy **Hours of Instruction: 20 Hrs.** **Marks Allotted: 09**	
Pronunciation	Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech)
Functional Grammar	Transformation of sentences, Voice change, Change of tense, Spellings.
Reading	Reading and understanding simple sentences about self, work and environment
Writing	Construction of simple sentences Writing simple English
Speaking / Spoken English	Speaking with preparation on self, on family, on friends/ classmates, on know, picture reading gain confidence through role-playing and discussions on current happening job description, asking about someone's job habitual actions. Cardinal (fundamental) numbers ordinal numbers. Taking messages, passing messages on and filling in message forms Greeting and introductions office hospitality, Resumes or curriculum vita essential parts, letters of application reference to previous communication.
2. I.T. Literacy **Hours of Instruction: 20 Hrs.** **Marks Allotted: 09**	
Basics of Computer	Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer.
Computer Operating System	Basics of Operating System, WINDOWS, The user interface of Windows OS, Create, Copy, Move and delete Files and Folders, Use of External memory like pen drive, CD, DVD etc, Use of Common applications.
Word processing and Worksheet	Basic operating of Word Processing, Creating, opening and closing Documents, use of shortcuts, Creating and Editing of Text, Formatting the Text, Insertion & creation of Tables. Printing document. Basics of Excel worksheet, understanding basic commands, creating simple worksheets, understanding sample worksheets, use of simple formulas and functions, Printing of simple excel sheets

Computer Networking and INTERNET	Basic of computer Networks (using real life examples), Definitions of Local Area Network (LAN), Wide Area Network (WAN), Internet, Concept of Internet (Network of Networks), Meaning of World Wide Web (WWW), Web Browser, Web Site, Web page and Search Engines. Accessing the Internet using Web Browser, Downloading and Printing Web Pages, Opening an email account and use of email. Social media sites and its implication. Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT – ACT, types of cyber crimes.

3. Communication Skills
Hour of Instruction: 15 Hrs.Marks Allotted: 07

Topic	Contents
Introduction to Communication Skills	Communication and its importance
	Principles of Effective communication
	Types of communication – verbal, nonverbal, written, email, talking on phone.
	Nonverbal communication –characteristics, components-Para-language
	Body – language
	Barriers to communication and dealing with barriers.
	Handling nervousness/ discomfort.
Listening Skills	Listening-hearing and listening, effective listening, barriers to effective listening guidelines for effective listening.
	Triple- A Listening – Attitude, Attention & Adjustment.
	Active Listening Skills.
Motivational Training	Characteristics Essential to Achieving Success
	The Power of Positive Attitude
	Self-awareness
	Importance of Commitment
	Ethics and Values
	Ways to Motivate Oneself
	Personal Goal setting and Employability Planning.
Facing Interviews	Manners, Etiquettes, Dress code for an interview
	Do's & Don'ts for an interview
Behavioral Skills	Problem Solving
	Confidence Building
	Attitude

SEMESTER-II

LEARNING OBJECTIVES OF 2ND SEMESTER

1. Knowledge of business activities, ability to interact with consumers for development of businesses.
2. Understand and apply productivity, its benefits and factors affecting the productivity.
3. Follow and maintain procedures to achieve a safe working environment in line with occupational health, safety, environment regulations and Labour welfare legislation and requirements.
4. Understand and apply quality concepts as per ISO and BIS system and its importance.
5. Recognize different components of 5S and apply the same in the working environment.

4. Entrepreneurship skill Hour of Instruction: 15 Hrs.Marks Allotted: 06	
Topic	**Content**
Business & Consumer:	Types of business in different trades and the importance of skill, Understanding the consumer, market through consumer behavior, market survey, Methods of Marketing, publicity and advertisement
Self Employment:	Need and scope for self-employment, Qualities of a good Entrepreneur (values attitude, motive, etc.), SWOT and Risk Analysis
Govt Institutions :	Role of various Schemes and Institutes for self-employment i.e. DIC, SIDBI, MSME, NSIC, Financial institutions and banks
Initiation Formalities :	Project Formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment Procedure - Loan Procurement - Agencies - banking Process
5. Productivity Hour of Instruction: 10 Hrs.Marks Allotted: 05	
Productivity	Definition, Necessity, Meaning of GDP.

Benefits	Personal / Workman – Incentive, Production linked Bonus, Improvement in living standard. Industry Nation.
Affecting Factors	Skills, Working Aids, Automation, Environment, Motivation How improves or slows down.
Comparison with developed countries	Comparative productivity in developed countries (viz. Germany, Japan and Australia) in selected industries e.g. Manufacturing, Steel, Mining, Construction etc. Living standards of those countries, wages.
Personal Finance Management	Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and Insurance.
6. Occupational Safety, Health & Environment Hour of Instruction: 15 Hrs.Marks Allotted: 06	
Safety & Health :	Introduction to Occupational Safety and Health and its importance at workplace
Occupational Hazards :	Occupational health, Occupational hygiene, Occupational Diseases/ Disorders & its prevention
Accident & safety :	Accident prevention techniques- control of accidents and safety measures
First Aid :	Care of injured & Sick at the workplaces, First-aid & Transportation of sick person
Basic Provisions :	Idea of basic provisions of safety, health, welfare under legislation of India
7.Labour Welfare Legislation Hour of Instruction: 05 Hrs.Marks Allotted: 03	
Labour Welfare Legislation	Benefits guaranteed under various acts- Factories Act, Apprenticeship Act, Employees State Insurance Act (ESI), Payment Wages Act, Employees Provident Fund Act, The Workmen‟ s Compensation Act

8.Quality Tools Hour of Instruction: 10 Hrs.Marks Allotted: 05	
Quality Consciousness :	Meaning of quality, Quality Characteristic
Quality Circles :	Definition, Advantage of small group activity, objectives of Quality Circle, Roles and Functions of Quality Circles in organisation, Operation of Quality Circle, Approaches to Starting Quality Circles, Steps for Continuation Quality Circles
Quality Management System:	Idea of ISO 9000 and BIS systems and its importance in maintaining qualities.
House Keeping :	Purpose of Housekeeping, Practice of good Housekeeping.5**S** Principles of Housekeeping: SEIRI – Segregation, SEITON – Arrangement, SEISO – Cleaning, SEIKETSU – maintenance of Standards, SHITSUKE - Discipline

12. INFRASTRUCTURE

Instructors Qualification

a) Degree in Automobile/ Mechanical Engg. (with specialization in Automobile) from recognised college/University with one year experience in the automobile industry and should possess valid LMV driving license.

OR

Diploma in Automobile/Mechanical (specialization in automobile) from recognized board of technical education with two years experience in the automobile industry and should posses valid LMV driving license.

OR

10th Passed + NTC/NAC in the Trade of "**Mechanic Diesel/MMV)**" with 3 years post qualification experience in the relevant field and should possess valid LMV driving license.

and

b) With "**National Crafts Instructor Certificate".**

2. DESIRABLE QUALIFICATION	:	Preference will be given to a candidate with CIC (Craft Instructor Certificate) MMV Trade
3. SPACE NORMS		: Space Area 130 Sq. Mt.
4. POWER NORMS	:	4.8 KW
5.TOOLS, EQUIPMENT& GENERAL MACHINERY	:	(AS PER ANNEXURE-II)

Note:

(i) Out of two Instructors required for the unit of 2(1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications.

(ii) Instructor qualification for WCS and E.D, as per the training manual.

(iii) The list of Tools, Equipment& General Machinery listed in Annexure – II are for a Particular trade (Mechanic Diesel) comprising of two semesters and not for single semester.

13. ASSESSMENT STANDARD

13.1Assessment guideline:

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking assessment. Due consideration to be given while assessing for team work, avoidance/reduction of scrap/wastage and disposal of scarp/wastage as per procedure, behavioral attitude, sensitive to environment and regularity in training. The sensitivity towards OSHE and self-learning attitude to be considered while assessing competency.

The following marking pattern to be adopted while assessing:

a) Weightage in the range of 60-75% to be allotted during assessment under following performance level:

For performance in this grade, the candidate with occasional guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of an acceptable standard of craftsmanship.

In this work there is evidence of:

- demonstration of good skill in the use of hand tools, machine tools and workshop equipment
- below 70% tolerance dimension achieved while undertaking different work with those demanded by the component/job.
- a fairly good level of neatness and consistency in the finish
- occasional support in completing the project/job.

b) Weightage in the range of above75%- 90% to be allotted during assessment under following performance level:

For this grade, the candidate, with little guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of a reasonable standard of craftsmanship.

In this work there is evidence of:

- good skill levels in the use of hand tools, machine tools and workshop equipment
- 70-80% tolerance dimension achieved while undertaking different work with those demanded by the component/job.
- a good level of neatness and consistency in the finish
- little support in completing the project/job

c) Weightage in the range of above 90% to be allotted during assessment under following performance level:

For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship.

In this work there is evidence of:

- high skill levels in the use of hand tools, machine tools and workshop equipment
- above 80% tolerance dimension achieved while undertaking different work with those demanded by the component/job.
- a high level of neatness and consistency in the finish.
- minimal or no support in completing the project

13.2. INTERNAL ASSESSMENTS (FORMATIVE ASSESSMENT)

SL NO.	ASSESSABLE OUTCOME	INTERNAL ASSESSMENT MARKS
1.	Apply safe working practices in an automotive work shop	
2.	Comply environment regulations and housekeeping in the work shop.	
3.	Perform precision measurements on the components and compare parameters with specifications used in automotive work shop practices.	
4.	Make choices to carry out marking out the components for basic fitting operations in the work shop.	
5.	Use different types of tools and work shop equipment in the Auto work shop.	
6.	Use of different type of fastening and locking devices in a vehicle	
7.	Perform basic fitting operations used in the work shop practices and inspection of dimensions.	
8.	Grinding of cutting tools in the work shop.	
9.	Perform surface finishing operations in the given job.	
10.	Produce sheet metal components using various sheet metal operations	
11.	Produce components using bending process in the given work piece.	
12.	Inspect the auto component using Nondestructive testing methods	
13.	Manufacture components with different types of welding processes in the given job.	
14.	. Identify the hydraulic and pneumatic components in a vehicle.	
15.	Construct electrical circuits and test its parameters by using electrical measuring instruments.	
16.	Perform basic electrical testing in a vehicle.	
17.	Perform battery testing and charging operations.	
18.	Construct basic electronic circuits and testing	
Sub-Total of Internal assessment for Semester- I		
19.	Identify and check functionality of Dashboard Gauges & engine performance.	
20.	Overhauling of Diesel Engine.	
21.	Servicing of Cooling and Lubrication system	
22.	Service Intake and Exhaust System	
23.	. Service Diesel Fuel System	
24.	Check and adjust Engine Emissions	
25.	Overhauling Charging and Starting System	
26.	Diagnose and Troubleshoot Diesel Engines	
Sub-Total of Internal assessment for Semester- II		
	Total of Internal assessment	

13.3 FINAL ASSESSMENT- ALL INDIA TRADE TEST (SUMMATIVE ASSESSMENT)

a) There will be a single objective type Examination paper for the subjects Engineering drawing and Workshop Calculation & Science.

b) There will be a single objective type Examination paper for the subjects Trade Theory and Employability Skills.

c) The two objective type Examination papers as mentioned above will be conducted by National Council for Vocational Training (NCVT), whereas examination for the subject Trade Practical will be conducted by the State Government. NCVT shall supply the Question Paper for the subject Trade Practical.

Marking Pattern

Sl. No.	Subject for the trade test	Maximum marks for the each subject
a)	Practical	**300**
b)	Trade Theory	**200** Objective type Written test of 200 marks (Trade Theory 150 marks & Employability Skills 50 marks)
c)	Employability Skills	
d)	Work shop Calculation and Science.	**100** Objective Type Written test of 100 marks (Engineering Drawing 50 marks & Work shop Calculation and Science 50 marks)
e)	Engineering Drawing	
f)	Internal assessment	**100**
TOTAL:		**700**

14. LIST OF TRADE COMMITTEE MEMBERS

Sl. No.	Name S/Shri	Designation	Organization	Mentor Council Designation
1.	A. Ramesh	Professor	IIT Chennai	Chairman
2.	TC Saravanabava	DDG(AT)	DGE&T, HQ, New Delhi	Mentor
3.	K Srinivasa Rao	JDT	CSTARI, Kolkata	Team Leader
4.	Yuvaraj C	DDT	ATI, Chennai	Member
5	V.Krishna Shankar	GM	Ashok Leyland	Member
6	G.Sathiskumar	Senior Mgr	Ashok Leyland	Member
7	Dr.Abhjit KR Mandal	Consultant	NATRIP	Member
8	M.Sivaraman	Consultant	Delphi TVS	Member
9	Mohan Kumar	Manager	TAFE, Chennai	Member
10	Kanchi Purushotham,	Manager Quality	Prabha Engineers, Hosur	Member
11	Sunil Bagwe,	Paint shop Head	Prabha Engineers, Hosur	Member
12	G.M.Cholanrajan	Sr.Manager-Technical Training	Lanson Toyota, Chennai-107	Member
13	Sunil Kumar S.R,	Assistant Manager	Toyota Kirloskar Motor Pvt Ltd Karnataka, 562 109	Member
14	Shri S.Arul Selvan	Asst Professor	Dept Auto Engg, M.I.T, Anna University, Chennai.	Member
15	Shri S. Jayaraj,	Asst Professor	Dept Auto Engg, M.I.T, Anna University, Chennai.	Member
16	Shri R. Lakshmanan	Training Mgr	Bosch Ltd, Bangalore	Member
17	Shri V.Vadivelan	Consultant	NATRIP, Global Automotive Research centre, Chennai	Member
18	Shri B. Gridharan	Managing Director	Visa Diesel Service, Chennai	Member
19	Shri VKR. Vadivelan	President	Two Wheeler workshop owners Association, Chennai	Member
20	P. Marveldass,	DDT (Electronics)	ATI, Chennai	Member
21	Swamy S.M ,.	Senior Officer, Training Dept	Toyota Kirloskar Motor Pvt Ltd Karnataka, 562 109	Member
22	Shri Suresh Babu	Service Manager, Body & Paint shop	ABT Maruti, Chennai-32	Member
23	M. Veerasamy	Works Manager	Vishnu Cars Pvt Ltd, Chennai-43	Member
24	P.Senthil Kumar,	Service Manager	DSC Motor Pvt Ltd., Chennai-15	Member
25	Shri T.Selvan,	Manager Body shop	DSC Motor Pvt Ltd., Chennai-15	Member
26	G Venkatesh	ADT	ATI(V), Hyderabad	Member
27	SP Rewaskar	ADT	ATI(V), Hyderabad	Member
28	N Ramesh kumar	TO	CTI, Chennai	Member
29	R Rajeshkanna	TO	ATI, Chennai	Member
30.	Akhilesh Pandey	TO	ATI, Mumbai	Member
31	TN Rudra	TO	ATI, Howrah	Member
32	A. Duraichamy	Assistant Training Officer (ATO)	Govt ITI Coimbatore	Member
33	Gurcharan Singh,	ADT	ATI, Ludhiana	Member
34	O.R. Arjun Mohan,	AE	Agricultural Engg. Dept, Chennai	Member
35	R.Murugesan,	AE	Agricultural Engg. Dept, Chennai	Member

36	K.Thaniyarasu	ATO	Govt ITI Trichy	Member
37	W. Nirmal Kumar Israel	ATO	Govt ITI Trichy	Member
38.	N. Duraimurugan	ATO	Govt ITI Guindy	Member
39.	K. Ravindranath	ATO	Govt. ITI, Ambattur	Member
40.	K. Veerappan	ATO	Govt. ITI, Nagapattinam	Member
41	V.Palanikumar	ATO	Govt ITI, Pudukottai.	Member
42	H.S.Kalra	Principal	Govt ITI Chandigarh	Member
43	B Ramarao	ATO	Govt ITI, Vizag , AP	Member
44	Suresh Naik	ATO	Govt ITI, Mangalore , Karnataka	Member
45	ND Zaware	Principal	ITI, Pimpri-Chinchwad	Member
46	RM Gotmare	TO	ITI, Gowandi, Maharastra	Member
47	Pranjit Das,	DDT	Govt ITI Assam	Member
48	M. Madaswamy	Principal	Ramco, ITC, Rajapalayam, TN	Member
49	Damachadramouli	Agricultural Er	SFMT & TI Hyderabd	Member
50	V. Gopalakrishnan	Training Officer,	Co-ordinator, NIMI, Chennai.	

Annexure - I

TRADE: Mechanic Diesel

LIST OF TOOLS & EQUIPMNT (REVISED)

A. TRAINEES TOOL KIT per 4 Trainees FOR 20 TRAINEES +1 ISTRUCTOR

Sl.No.	Item with specification	Qty (Nos.)
1.	Allen Key set of 12 pieces (2mm to 14mm)	(5+1)
2.	Caliper inside 15 cm Spring	6
3.	Calipers outside 15 cm spring	6
4.	Center Punch 10 mm. Dia. x 100 mm.	6
5.	Dividers 15 cm Spring	6
6.	Electrician Screw Driver 250mm	6
7.	Hammer ball peen 0.5 kg with handle	6
8.	Hands file 20 cm. Second cut flat	6
9.	Philips Screw Driver set of 5 pieces (100 mm to 300 mm)	6
10.	Pliers combination 20 cm.	6
11.	Screw driver 20cm.X 9mm. Blade	6
12.	Screw driver 30 cm. X 9 mm. Blade	6
13.	Scriber 15 cm	6
14.	Spanner D.E. set of 12 pieces (6mm to 32mm)	6
15.	Spanner, ring set of 12 metric sizes 6 to 32 mm.	6
16.	Spanners socket with speed handle, T-bar, ratchet and universal upto 32 mm set of 28 pieces with box	6
17.	Steel rule 30 cm inch and metric	6
18.	Steel tool box with lock and key (folding type) 400x200x150 mm	6
19.	Wire cutter and stripper	6

B. Tools Instruments and General Shop outfits

Sl.No.	Item with specification	Qty. (Nos)
1.	Adjustable spanner (pipe wrench 350 mm)	2
2.	Air blow gun with standard accessories	1
3.	Air impact wrench with standard accessories	4
4.	Air ratchet with standard accessories	4
5.	Allen Key set of 12 pieces (2mm to 14mm)	4
6.	Ammeter 300A/ 60A DC with external shunt	4
7.	Angle plate adjustable 250x150x175	1
8.	Angle plate size 200x100x200mm	2
9.	Anvil 50 Kgs with Stand	1
10.	Auto Electrical test bench	1
11.	Battery –charger	2
12.	Belt Tensioner gauge	1
13.	Blow Lamp 1 litre	2
14.	Caliper inside 15 cm Spring	4
15.	Calipers outside 15 cm spring	4

16.	Car Jet washer with standard accessories	1
17.	Chain Pulley Block-3 ton capacity with tripod stand	1
18.	Chisel 10 cm flat	4
19.	Chisels cross cut 200 mm X 6mm	4
20.	Circlip pliers Expanding and contracting type 15cm and 20cm each	4
21.	Clamps C 100mm	2
22.	Clamps C 150mm	2
23.	Clamps C 200mm	2
24.	Cleaning tray 45x30 cm.	4
25.	Compression testing gauge suitable for diesel Engine with standard accessories	2
26.	Connecting rod alignment fixture	1
27.	Copper bit soldering iron 0.25 Kg	4
28.	Cylinder bore gauge capacity 20 to 160 mm	4
29.	Cylinder liner- Dry & wet liner, press fit & slidefit liner	1 each
30.	DC Ohmmeter 0 to 300 Ohms, mid scales at 20 Ohms	2
31.	Depth micrometer 0-25mm	4
32.	Dial gauge type 1 Gr. A (complete with clamping devices and with magnetic stand)	4
33.	Different type of Engine Bearing model	1 set
34.	Different type of piston model	1each
35.	Dividers 15 cm Spring	4
36.	Drift Punch Copper 15 Cm	4
37.	Drill point angle gauge	1
38.	Drill twist 1.5 mm to 15 mm (various sizes) by 0.5 mm	4
39.	Electric Soldering Iron 230 V 60 watts 230 V 25 watts	2 each
40.	Electric testing screw driver	4
41.	Engineer's square 15 cm. Blade	4
42.	Engineers stethoscope	1
43.	Feeler gauge 20 blades (metric)	4
44.	File flat 20 cm bastard	4
45.	File, half round 20 cm second cut	4
46.	File, Square 20 cm second cut	4
47.	File, Square 30 cm round	4
48.	File, triangular 15 cm second cut	4
49.	Files assorted sizes and types including safe edge file (20 Nos)	2 set
50.	Flat File 25 cm second cut	4
51.	Flat File 35 cm bastard	4
52.	Fuel feed pump for Diesel	1
53.	Fuel injection pump (Diesel) inline	1
54.	Fuel injection pump dismantling tool kit /Universal Vice	1
55.	Fuel injection pump VE pump / Distributor fuel rotary pump (DPC) pumps / along with special tools and accessories.	1 each
56.	Gloves for Welding (Leather and Asbestos)	5 sets
57.	Glow plug tester	2
58.	Granite surface plate 1600 x 1000 with stand and cover	1
59.	Grease Gun	2
60.	Grease Gun heavy duty trolley type 10 kg capciaty	1

61.	Growler	2
62.	Hacksaw frame adjustable 20-30 cm	10
63.	Hammer Ball Peen 0.75 Kg	4
64.	Hammer Chipping 0.25 Kg	5
65.	Hammer copper 1 Kg with handle	4
66.	Hammer Mallet	4
67.	Hammer Plastic	4
68.	Hand operated crimping tool (i) for crimping up to 4mm and (ii) for crimping up to 10mm	2
69.	Hand reamers adjustable 10.5 to 11.25 mm, 11.25 to 12.75 mm, 12.75 to 14.25 mm and 14.25 to 15.75 mm	2sets
70.	Hand Shear Universal 250mm	2
71.	Hand vice – 37 mm	2
72.	Hollow Punch set of seven pieces 6mm to 15mm	2 sets each
73.	Injector – Multi hole type, Pintle type	4 each
74.	Injector cleaning unit	1
75.	Injector testing set (Hand tester)	1
76.	Insulated Screw driver 20 cm x 9mm blade	4
77.	Insulated Screw driver 30 cm x 9mm blade	4
78.	Left cut snips 250mm	4
79.	Lifting jack screw type 3 ton, 5ton & 20 Ton capacity	1 each
80.	Magneto spanner set with 8 spanners	1 set
81.	Magnifying glass 75mm	2
82.	Marking out table 90X60X90 cm.	1
83.	Multimeter digital	5
84.	Oil can 0.5/0.25 liter capacity	4
85.	Oil pump for dismantling and assembling.	2
86.	Oil Stone 15 cm x 5 cm x 2.5 cm	1
87.	Oscilloscope 20MHz	2
88.	Outside micrometer 0 to 25 mm	4
89.	Outside micrometer 25 to 50 mm	4
90.	Outside micrometer 50 to 75 mm	1
91.	Outside micrometer 75 to 100 mm	1
92.	Philips Screw Driver set of 5 pieces (100 mm to 300 mm)	2
93.	Pipe cutting tool	2
94.	Pipe flaring tool	2
95.	Piston ring compressor	2
96.	Piston Ring expander and remover.	2
97.	Piston Ring groove cleaner.	1
98.	Pliers combination 20 cm.	2
99.	Pliers flat nose 15 cm	2
100.	Pliers round nose 15 cm	2
101.	Pliers side cutting 15 cm	2
102.	Portable electric drill Machine	1
103.	Prick Punch 15 cm	4
104.	Punch Letter 4mm (Number)	2 set
105.	Radiator cut section-cross flow	1

106.	Radiator cut section-down flow	1
107.	Radiator pressure cap	2
108.	Right cut snips 250mm	2
109.	Rivet sets snap and Dolly combined 3mm, 4mm, 6mm	2
110.	Scraper flat 25 cm	2
111.	Scraper half round 25 cm	2
112.	Scraper Triangular 25 cm	2
113.	Scriber 15 cm	2
114.	Scriber with scribing black universal	2
115.	Set of stock and dies -Metric	2 sets
116.	Shear Tin Man's 450 mm x 600mm	2
117.	Sheet Metal Gauge	2
118.	Sher Tinmans 300mm	4
119.	Soldering Copper Hatchet type 500gms	2
120.	Solid Parallels in pairs (Different size) in Metric	2
121.	Spanner Clyburn 15 cm	1
122.	Spanner D.E. set of 12 pieces (6mm to 32mm)	4
123.	Spanner T. flocks for screwing up and up-screwing inaccessible	2
124.	Spanner, adjustable 15cm.	2
125.	Spanner, ring set of 12 metric sizes 6 to 32 mm.	4
126.	Spanners socket with speed handle, T-bar, ratchet and universal upto	2
127.	Spark lighter	2
128.	Spark plug spanner 14mm x 18mm x Size	2
129.	Starter motor axial type, pre-engagement type & Co-axial type	1each
130.	Steel measuring tape 10 meter in a case	4
131.	Steel rule 15 cm inch and metric	4
132.	Steel rule 30 cm inch and metric	4
133.	Straight edge gauge 2 ft.	2
134.	Straight edge gauge 4 ft.	2
135.	Stud extractor set of 3	2 sets
136.	Stud remover with socket handle	1
137.	Surface gauge with dial test indicator plunger type i.e. 0.01 mm	4
138.	Tachometer (Counting type)	1
139.	Tandem master cylinder with booster	4
140.	Taps and Dies complete sets (5 types)	1 set
141.	Taps and wrenches - Metric	2 sets
142.	Telescope gauge	4
143.	Temperature gauge with sensor 0-100 deg c	2
144.	Thermostat	2
145.	Thread pitch gauge Metric,	2
146.	Timing lighter	2
147.	Torque wrenches 5-35 Nm, 12-68 Nm & 50-225 Nm	1 each
148.	Trammel 30 cm	2
149	Turbocharger cut sectional view	1
150	Tyre pressure gauge with holding nipple	2
151	Universal puller for removing pulleys, bearings	1
152	V' Block 75 x 38 mm pair with Clamps	2
153	Vacuum gauge to read 0 to 760 mm of Hg.	2

154	Valve Lifter	1
155	Valve spring compressor universal.	1
156	vernier caliper 0-300 mm with least count 0.02mm	4
157	Vice grip pliers	2
158	Water pump for dismantling and assembling	4
159	Wire Gauge (metric)	2
160	Work bench 250 x 120 x 60 cm with 4 vices 12cm Jaw	4

C. General Installation/ Machineries

Sl.No.	Item with specification	Qty (Nos.)
1	Arbor press hand operated 2 ton capacity	1
2.	Automotive exhaust 5 gas analyzer (petrol & Diesel) or Diesel Smoke	1
3.	Bench lever shears 250mm Blade x 3mm Capacity	1
4.	Diesel Engine – CRDI - 4 stroke for Dismantling and assembling with	1
5.	Diesel engine (running condition) stationery type 2 cylinder.	
6.	Discrete Component Trainer / Basic Electronics Trainer	1
	Drilling machine bench to drill up to 12mm dia along with accessories	1
7.	Dual Magnetization Yoke : AC / HWDC, 230 VAC, 50Hz	1 set
8.	*Gas Welding Table 1220mm x760mm	2
9.	Grinding machine (general purpose) D.E. pedestal with 300 mm dia	1
10.	Hydraulic jack HI-LIFT type -3 ton capacity, and 5 Ton capacity	1 each
11.	Liquid penetrant Inspection kit	1 set
12.	Multi Scan Tool with oscilloscope	1
14.	Pipe Bending Machine (Hydraulic type) 12mm to 30mm	1
15.	Pneumatic rivet gun with standard accessories	2
16.	Spring tension tester	1
17.	Tin smiths bench folder 600 x 1.6mm	1
18.	Trolley type portable air compressor single cylinder with 45 liters	1
19.	*Welding plant Oxy-Acetylene complete (high pressure)	1
20.	*Welding Transformer (150-300 Amps)	1
21.	Working condition of diesel engine – crdi 4 stroke, 6 cylinder engine assembly with fault simulation board.	

Note: * Sl.No 8, 19,20 **Institutes having Welding trade can utilize the existing resources**.

D. List of consumable:

Sl. No.	Description	Quantity
1.	Battery- SMF	As required
2.	Brake fluids	As required
3.	Chalk, Prussian blue.	As required
4.	Chemical compound for fasteners	As required

5.	Diesel	As required
6.	Different type gasket material	As required
7.	Different type of oil seal	As required
8.	Drill Twist (assorted)	As required
9.	Emery paper - 36–60 grit , 80–120	As required
10.	Engine oil & Engine coolant	As required
11.	Gear oils	As required
12.	Gloves for Welding (Leather and Asbestos)	5 sets
13.	Hacksaw blade (consumable)	As required
14.	Hand rubber gloves tested for 5000 V	5 pair
15.	Holders, lamp teakwood boards, plug sockets,	As required
16.	Hydrometer	8
17.	Lapping abrasives	As required
18.	Leather Apron	5
19.	Petrol	As required
20.	Power steering oil	As required
21.	Radiator Coolants	As required
22.	Safety glasses	As required
23.	Steel wire Brush 50mmx150mm	5

E. Workshop Furniture

Sl. No.	Description	Quantity
1.	Book shelf (glass panel) 6½ ‘ x 3’ x 1½’	As required
2.	Computer Chair	1+1
3.	Computer Table	1+1
4.	Desktop computer and related MS office software	1+1
5.	Discussion Table 8’ x 4’ x 2½ ‘	2
6.	Fire Extinguishers, first- aid box	As required
7.	Instructional Material – NIMI Books/Ref.books	As required
8.	Internet connection with all accessories	As required
9.	Laser printer	1
10.	LCD projector/ LED /LCD TV (42”)	1
11.	Multimedia DVD for Automotive application/subjects	As required
12.	Online UPS 2KVA	1
13.	Stools	21
14.	Storage Rack 6½ ‘ x 3’ x 1½’	As required
15.	Storage shelf 6½ ‘ x 3’ x 1½’	As required.
16.	Suitable class room furniture	As required
17.	Suitable Work Tables with vices	As required
18.	Tool Cabinet - 6½ ‘ x 3’ x 1½’	2
19.	Trainees locker 6½ ‘ x 3’ x 1½’	2 Nos. to accommodate 20 Lockers

GUIDELINES FOR INSTRUCTORS AND PAPER SETTERS

1. Allthequestionsoftheorypaperforthetradewillbeinobjectivetypeformat.

2.Due care to be taken for proper & inclusive delivery among the batch. Some of the following method of delivery may be adopted:

A) LECTURE
B) LESSON
C) DEMONSTRATION
D) PRACTICE
E) GROUP DISCUSSION
F) DISCUSSION WITH PEER GROUP
G) PROJECT WORK
H) INDUSTRIAL VISIT

3. Maximum utilization of latest form of training viz., audio visual aids, integration of IT, etc. May be adopted.

4. The total hours to be devoted against each topic may be decided with due diligence to safety & with prioritizing transfer of required skills.

5. Questions may be set based on following instructions:-

Sl. No.	Question on different aspect	Weightage in %age	Key Words may be like
1	Information received	25	What, Who, When
2	Knowledge	50	Define, Identify, Recall, State, Write, List & Name
3	Understanding	15	Describe, Distinguish, Explain, Interpret & Summarize
4	Application	10	Apply, Compare, Demonstrate, Examine, Solve & Use

6. Due weightage to be given to all the topics under the syllabus while setting the question paper.