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

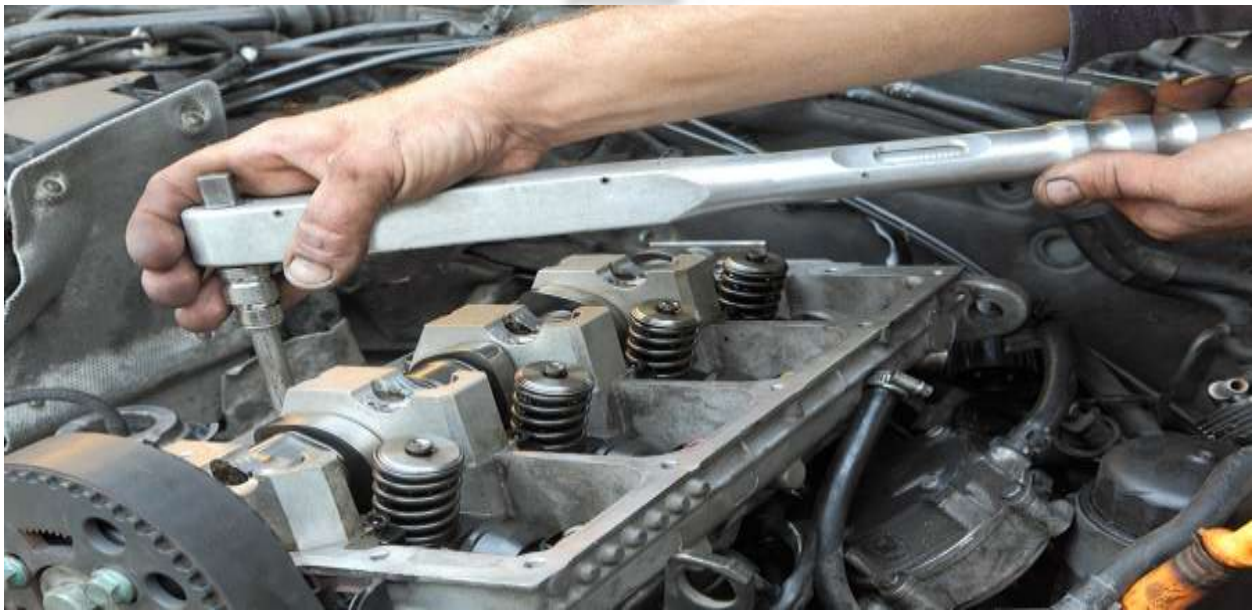
COMPETENCY BASED CURRICULUM

MECHANIC DIESEL

(Duration: One Year)

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL- 4



SECTOR – AUTOMOTIVE

MECHANIC DIESEL

(Engineering Trade)

(Revised in 2018)

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL - 4

Developed By

Ministry of Skill Development and Entrepreneurship

Directorate General of Training
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
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List of Expert members contributed/ participated for finalizing the course curriculum of Mechanic Diesel trade held on 16.05.17 at Govt. ITI- Aundh, Pune			
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CONTENTS

1. COURSE INFORMATION

During one year duration of "Mechanic Diesel" trade, a candidate is trained on Professional Skill, Professional Knowledge and Employability Skill. In addition to this, a candidate is entrusted to undertake project work, extracurricular activities and on-the-job training to build up confidence. The broad components covered related to the trade are categorized in two semesters each of six months duration. The semester wise course coverage is categorized as below: -

Semester-I:- This semester will cover the safety aspect in general and specific to the trade, identification of tools & equipment, raw materials used. In this semester the trainee will perform Measuring & marking by using various Measuring & Marking tools. The trainee will be able to plan and perform basic fastening and fitting operations. Familiarize with basics of electricity, test and measure the electrical parameter. Skilling practice on maintenance of batteries being done. Practice making various welding joints by using Arc and gas welding. Trace and identify various hydraulics and pneumatics components and identify components in Air and Hydraulic Brake system. Identify various types of vehicle.

Semester-II:- In this semester the candidate will be able to perform practice on dismantling Diesel Engine of LMV as per given standard procedures. Able to achieve skill on Overhauling of Cylinder Head , valve train , Piston, connecting rod assembly, crankshaft, flywheel and mounting flanges, spigot and bearings, camshaft etc. practice reassembling all parts of engine in correct sequence as per workshop manual. Perform testing on engine. Also the trainee practice on repair and maintenance of Cooling, lubrication, Intake & Exhaust system of Engine. Perform maintenance of diesel fuel system, FIP, Governor and monitor emission of vehicle. Practice on repair, maintenance and overhaul of Starter, alternator and perform Execute troubleshooting in engine of LMV/HMV

2. TRAINING SYSTEM

2.1 GENERAL

The Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers a range of vocational training courses catering to the need of different sectors of the economy/ labour market. The vocational training programs are delivered under the aegis of National Council of Vocational Training (NCVT). Craftsman Training Scheme (CTS) and Apprenticeship Training Scheme (ATS) are two pioneer programs of NCVT for propagating vocational training.

Mechanic Diesel trade under CTS is one of the popular courses delivered nationwide through a network of ITIs. The course is of one-year (02 semester) duration. It mainly consists of Domain area and Core area. In the Domain area, Trade Theory & Practical impart professional skills and knowledge, while Core area (Employability Skills) imparts requisite core skill, knowledge and life skills. After passing out of the training programme, the trainee is awarded National Trade Certificate (NTC) by NCVT which is recognized worldwide.

Candidates broadly need to demonstrate that they are able to:

- Read & interpret technical parameters/documentation, plan work, identify necessary materials and tools;
- Perform task with due consideration to safety rules, accident prevention regulations and environmental protection stipulations;
- Apply professional knowledge, core skills & employability skills while performing the job.
- Check the components as per workshop manual, identify and rectify errors and repair/replace components.
- Document the technical parameters related to the task undertaken.

2.2 CAREER PROGRESSION PATHWAYS

- Can join Apprenticeship programme in different types of industries leading to National Apprenticeship certificate (NAC).
- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming instructor in ITIs.

2.3 COURSE STRUCTURE

Table below depicts the distribution of training hours across various course elements during a period of one-year (02 semesters):

S No.	Course Element	Notional Training Hours
1	Professional Skill (Trade Practical)	1075
2	Professional Knowledge (Trade Theory)	258
3	Workshop Calculation & Science	86
4	Engineering Drawing	129
5	Employability Skills	110
6	Library & Extracurricular Activities	62
7	Project Work	80
8	Revision & Examination	280
	Total	**2080**

2.4 ASSESSMENT & CERTIFICATION

The trainee will be tested for his skill, knowledge and attitude during the period of the course and at the end of the training program as notified by the Government of India (GoI) from time to time. The employability skills will be tested in the first two semesters itself.

a) The **Internal Assessment** during the period of training will be done by **Formative Assessment Method** by testing for assessment criteria listed against learning outcomes. The training institute has to maintain an individual trainee portfolio as detailed in assessment guideline. The marks of internal assessment will be as per the template (Annexure – II).

b) The final assessment will be in the form of summative assessment method. The All India Trade Test for awarding NTC will be conducted by NCVT at the end of each semester as per the guideline of Government of India. The pattern and marking structure is being notified by Govt. of India from time to time. **The learning outcome and assessment criteria will be the basis for setting question papers for final assessment. The examiner during final examination will also check** the individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

2.4.1 PASS REGULATION

The minimum pass percentage for practical is 60% & minimum pass percentage of theory subjects is 40%. For the purposes of determining the overall result, 50% weightage is applied to the result of each semester examination.

2.4.2 ASSESSMENT 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 the assessment. Due consideration should be given while assessing for teamwork, avoidance/reduction of scrap/wastage and disposal of scrap/waste as per procedure, behavioral attitude, sensitivity to the environment and regularity in training. The sensitivity towards OSHE and self-learning attitude are to be considered while assessing competency.

Assessment will be evidence based comprising the following:

- Job carried out in labs/workshop
- Record book/ daily diary
- Answer sheet of assessment
- Viva-voce
- Progress chart
- Attendance and punctuality
- Assignment
- Project work

Evidences of internal assessments are to be preserved until forthcoming semester examination for audit and verification by examining body. The following marking pattern to be adopted while assessing:

Performance Level	Evidence
(a) Weightage in the range of 60%-75% to be allotted during assessment	
For performance in this grade, the candidate should produce work which demonstrates attainment of an acceptable standard of craftsmanship with occasional guidance, and due regard for safety procedures and practices	• 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 75%-90% to be allotted during assessment	
For this grade, a candidate should produce work which demonstrates attainment of a reasonable standard of craftsmanship, with little guidance, and regard for safety procedures and practices	• 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 more than 90% to be allotted during assessment	
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.	• 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.

3. JOB ROLE

Brief description of job roles:

Mechanic Diesel can learn about diesel engine fundamentals and power generation. The trainees have to participate in hands-on work and begin repairing diesel engine vehicles.

Mechanic, Diesel Engine; Oil Engine, Fitter repairs services and overhauls diesel or oil engines for efficient performance as prime mover to drive machinery and equipment. Examine 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.

Grinds 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.

Additionally, since diesel engines are starting to incorporate electronic components, programs usually give students a chance to take courses in electrical systems and computer diagnostic software.

Plan and organize assigned work and detect & resolve issues during execution in his own work area within defined limit. 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-2015: 7233.0400

4. GENERAL INFORMATION

Name of the Trade	**MECHANIC DIESEL**
NCO - 2015	7233.0400
NSQF Level	Level-4
Duration of Craftsmen Training	One year (Two semesters each of six months duration)
Entry Qualification	Passed 10th class examination with Mathematics and Science.
Unit Strength (No. Of Student)	16 (Max. Supernumeraries seats: 5)
Space Norms	Space Area 210 Sq. Mt. (Including parking area)
Power Norms	4.8 KW
Instructors Qualification for	
1. Mechanic Diesel Trade	a) Degree in Automobile/ Mechanical Engg. (with specialization in Automobile) from recognized 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 Automobile industry and should possess valid LMV driving license. **OR** NTC/NAC in the Trade of "**Mechanic Diesel"** with 3 years post qualification experience in the relevant field and should possess valid LMV driving license. **and** b) With "**National Crafts Instructor Certificate".** **Note**: 1) At least one Instructor must have Degree/Diploma in Automobile/ Mechanical Engg. (With specialization in Automobile) when applied for 02 units. ***Out of two Instructors required for the unit of 2(1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications.***
2. Workshop Calculation & Science	2) Instructor Qualification for WCS & E.D, as per the Training Manual Degree in Engineering with one year experience.

	OR Diploma in Engineering with two-year experience. **Desirable:** Craft Instructor Certificate in RoD&A course under NCVT.
3. Engineering Drawing	2) Instructor Qualification for WCS & E.D, as per the Training Manual Diploma in Engineering with two-year experience. **OR** NTC/ NAC in the Draughtsman (Mechanical / Civil) with three-year experience.
4. Employability Skill	MBA OR BBA with two-year experience OR Graduate in Sociology/ Social Welfare/ Economics with two-year experience OR Graduate/ Diploma with two-year 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.**
List of Tools and Equipment	As per Annexure – I

Distribution of training on Hourly basis: (Indicative only)

Total Hours/Week	Trade Practical	Trade Theory	Workshop Cal. &Sc.	Engg. Drawing	Employability Skills	Extra-curricular Activity
40 Hours	25 Hours	6 Hours	2 Hours	3 Hours	2 Hours	2 Hours

5. NSQF LEVEL COMPLIANCE

NSQF level for Mechanic Diesel trade 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
e. Responsibility

The Broad Learning outcome of the Mechanic Diesel trade under CTS 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	Job that requires well developed skill, with clear choice of procedures in familiar context.	Knowledge of facts, principles, processes and general concepts, in a field of work or study.	A range of cognitive and practical skills required to accomplish tasks and solve problem by selecting and applying basic methods, tools, materials and information.	Desired mathematical skill, understanding of social, political and some skill of collecting and organizing information, communication.	Responsibility for own work and learning and some responsibility for other's works and learning.

6. LEARNING/ ASSESSABLE OUTCOME

Learning outcomes are a reflection of total competencies of a trainee and assessment will be carried out as per the assessment criteria.

6.1. GENERIC LEARNINGOUTCOME

1. Recognize & comply with safe working practices, environment regulation and housekeeping.
2. Understand and explain different mathematical calculation & science in the field of study including basic electrical. *[Different mathematical calculation & science-Work, Power & Energy, Algebra, Geometry & Mensuration, Trigonometry, Heat & Temperature, elasticity]*
3. Interpret specifications, different engineering drawing and apply for different application in the field of work. *[Different engineering drawing-Geometrical construction, Dimensioning, Layout, Method of representation, Symbol, Different Projections, Assembly drawing, Sectional views, Estimation of material]*
4. Select and measure dimension of components and record data.
5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day-to-day work to improve productivity & quality.
6. Explain energy conservation, global warming and pollution and contribute in day-to-day work by optimally using available resources.
7. Explain personnel finance, entrepreneurship and manage/organize related task in day-to-day work for personal & societal growth.
8. Plan and execute the work related to the occupation.

6.2. SPECIFIC LEARNING OUTCOME

Semester – I

9. Check & perform Measuring & marking by using various Measuring & Marking tools (Vernier Callipers, Micrometre, Telescope gauges, Dial bore gauges, Dial indicators, straightedge, feeler gauge, thread pitch gauge, vacuum gauge, tire pressure gauge.)
10. Plan & perform basic fastening & fitting operation by using correct hand tools, Machine tools & equipment.
11. Trace and Test all Electrical & Electronic components & circuits and assemble circuit to ensure functionality of system.
12. Join components by using Arc & Gas welding.
13. Trace & Test Hydraulic and Pneumatic components

14. Check & Interpret Vehicle Specification data and VIN. Select & operate various Service Station equipment.

Semester – II

15. Understand basics of engine types construction, working.
16. Dismantle & assemble of Diesel Engine from vehicle (LMV/HMV) along with other accessories (torqueing methods, handling parts).
17. Overhaul, service and testing Diesel Engine, its parts and check functionality.
18. Trace, Test & Repair Cooling and Lubrication System of engine (types of coolants and oils relevant to the engines).
19. Trace & Test Intake and Exhaust system of engine.(cleaning egr valves, exhaust inlet valves, ports and manifolds)
20. Service Diesel Fuel System and check proper functionality (calibration of mechanical and electronic pumps, checking injectors, filters)
21. Plan & overhaul the stationary engine and Governor and check functionality.
22. Monitor emission of vehicle and execute different operation to obtain optimum pollution as per emission norms.
23. Carryout overhauling of Alternator and Starter Motor.
24. Diagnose & rectify the defects in LMV/HMV to ensure functionality of vehicle
25. Checking the condition of hoses, mounts, radiators and fans.
26. Electronic control diagnostics of CR engines.

7. LEARNING OUTCOME WITH ASSESSMENT CRITERIA

GENERIC LEARNING/ ASSESSABLE OUTCOME	
LEARNING/ ASSESSABLE OUTCOME	**ASSESSMENT CRITERIA**
1. Recognize & comply with safe working practices, environment regulation and housekeeping.	1. 1. Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements.
	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 of dangerous/unsalvageable goods and substances according to site policy and procedures following safety regulations and requirements.
	1. 5. Identify and observe site policies and procedures withregard to illness or accident.
	1. 6. Identify safety alarms accurately.
	1. 7. Report supervisor/ Competent of authority in the event of accident 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 Productive 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 extinguisher and use the same as per requirement.
	1. 12. Identify environmental pollution & contribute to avoidance of same.
	1. 13. Take opportunities to use energy and materials in an environmentally friendly manner.
	1. 14. Avoid waste and dispose waste as per procedure.
	1. 15. Recognize different components of 5S and apply the same in the working environment.
2. Understand and explain	2.1 Explain concept of basic science related to the field such as

different mathematical calculation & science in the field of study including basic electrical. *[Different mathematical calculation & science - Work, Power & Energy, Algebra, Geometry, Mensuration, Trigonometry, Heat & Temperature, elasticity]*		Material science, Mass, weight, density, heat & temperature, heat treatment.
	2.2	Measure dimensions as per drawing
	2.3	Use scale/ tapes to measure for fitting to specification.
	2.4	Comply with given tolerance.
	2.5	Prepare list of appropriate materials by interpreting detail drawings and determine quantities of such materials.
	2.6	Ensure dimensional accuracy of assembly by using different instruments/gauges.
	2.7	Explain basic electricity, insulation and earthing.
3. Interpret specifications, different engineering drawing and apply for different application in the field of work. *[Different engineering drawing-Geometrical construction, Dimensioning, Layout, Method of representation, Symbol, Different Projections, Assembly drawing, Sectional views, Estimation of material]*	3. 1.	Read and interpret the information on drawings and apply in executing practical work.
	3. 2.	Read & analyse the specification to ascertain the material requirement, tools, and assembly/maintenance parameters.
	3. 3.	Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/ parameters to carry out the work.
4. Select and measure dimension of components and record data.	4.1	Select appropriate measuring scale/tape/gauges.
	4.2	Measure dimension of the components/assembly & compare with given drawing/measurement.
5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day-to-	5.1	Explain the concept of productivity and quality tools and apply during execution of job.
	5.2	Understand the basic concept of labour welfare legislation and adhere to responsibilities and remain sensitive towards such laws.

day work to improve productivity & quality.	5.3 Knows benefits guaranteed under various acts.
6. Explain energy conservation, global warming and pollution and contribute in day-to-day work by optimally using available resources.	6.1 Explain the concept of energy conservation, global warming, pollution and utilize the available recourses optimally & remain sensitive to avoid environment pollution.
	6.2 Dispose waste following standard procedure.
7. Explain personnel finance, entrepreneurship and manage/organize related task in day-to-day work for personal & societal growth.	7. 1. Explain personnel finance and entrepreneurship.
	7. 2. Explain role of various schemes and institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non-financing support agencies to familiarize with the Policies/Programmes & procedure & the available scheme.
	7. 3. Prepare Project report to become an entrepreneur for submission to financial institutions.
8. Plan and execute the work related to the occupation.	8. 1. Use documents, drawings and recognize hazards in the work site.
	8. 2. Plan workplace/ assembly location with due consideration to operational stipulation.
	8. 3. Communicate effectively with others and plan project tasks.
	8. 4. Execute the task effectively.

SPECIFIC LEARNING/ ASSESSABLE OUTCOMES	
SEMESTER-I	
LEARNING/ ASSESSABLE OUTCOMES	**ASSESSMENT CRITERIA**
9. Check & perform Measuring & marking by using various Measuring & Marking tools (Vernier Caliper, Micrometer, Telescope gauges, Dial bore gauges, Dial indicators, straightedge, feeler gauge, thread pitch gauge, vacuum gauge, tire pressure gauge.)	9. 1 Plan the working principles of measuring instruments and special tools required for auto workshop.
	9. 2 Select, care and use of measuring instrument.
	9. 3 Set up the measured value with workshop manual and quality concepts and proper safety.
	9. 4 Carry out decision on whether to replace or not.
10. Plan & perform basic fastening & fitting operation by using correct hand tools, Machine tools & equipments.	10.1 Describe the purpose, use of auto hand tools.
	10.2 List the safety rules for hand tools.
	10.3 Select the correct tool for the job.
	10.4 Set up the tacked pieces in specific position.
	10.5 Joint components by Brazing, Soldering, Riveting as per given drawing.
	10.6 Produce components by different operation (Drilling, Reaming, Taping, Dieting)
11. Trace and Test all Electrical & Electronic components & circuits and assemble circuit to ensure functionality of system. Charge and test batteries used in vehicle.	11.1 Plan and prepare as per procedure and safety methods of soldering the cable ends using an electric soldering iron.
	11.2 Use crimping tool to make a circuit joint.
	11.3 Explain the connection of an ammeter, voltmeter, and ohmmeter in a circuit trouble shooting.
	11.4 State open & short circuit, series and parallel circuits.
	11.5 Verify DC series & parallel circuits and its characteristics.
	11.6 Check out the open and short circuits in the lighting circuits.
	11.7 Verify ohm's law and measure resistance using rheostat.
	11.8 Check the voltage drop in the auto electrical system by using multimeter.
	11.9 Trace the auto electrical components by using vehicle wiring circuits.
	11.10 Check the condition of the solenoid switch in the starting

	system.
	11.11 Determine the forward to reverse resistance ratio of diodes and identify good / bad diodes.
	11.12 Perform battery charging and check
12. Join components by using Arc & Gas welding.	12.1. Determine the principles, process of different welding process applicable in automobile industry.
	12.2. Demonstrate the edge preparation for butt and fillets welds.
	12.3. Select the type and size of filler rod and flux/electrode, size of nozzle and gas pressure/welding current, preheating method and temperature as per requirement.
	12.4. Set and tack metals as per drawing.
	12.5. Deposit the weld maintaining appropriate technique and safety aspects.
	12.6. Cool the welded joint by observing appropriate cooling method. Use post heating, peening etc. as per requirement.
	12.7. Clean the joint and inspect the weld for its uniformity and different types of surface defects.
13. Trace & Test Hydraulic and Pneumatic components.	13. 1 Demonstrate Brake System (Hydraulic & Air).
	13. 2 Demonstrate Hydraulic Power Steering.
14. Check & Interpret Vehicle Specification data and VIN. Select & operate various Service Station Equipments	14. 1 Identify of different type of vehicle.
	14. 2 Identify the different vehicle specification data and information
	14. 3 Demonstrate the garage, service station different equipment
SEMESTER-II	
15. Dismantle & assemble of Diesel Engine from vehicle (LMV/HMV) along with other accessories. Vehicle performance Test	15. 1 Demonstrate safe handling of lifting equipments.
	15. 2 Identify the problems in the vehicle
	15. 3 Perform the periodic testing of lifting equipments.
	15. 4 Judge whether this Engine needs overhaul or not
	15. 5 Perform dispose the used engine oil and safety measures in disposal.
	15. 6 Perform on vehicle Engine Tests to analyze need of Overall

	15. 7 Perform sequencing and identifying parts at the time of dismantle and assemble.
	15. 8 Then Dismantle of Engine & Overhaul is ok, refer below attached screen shot for your reference
16. Overhaul & service Diesel Engine, its parts and check functionality.(Judge weather this Engine needs overhaul or not)	16.1 Remove accessories fitted to the engine prior to engine removal.
	16.2 Align the left hook of the crane with engine lifting bracket.
	16.3 Remove the engine mountings
	16.4 Remove the engine from vehicle.
	16.5 Mount the engine on the vehicle.
	16.6 Align and fit the gear box to the engine.
	16.7 Refit the accessories to the engine.
	16.8 Set the Timing of the Engine
	16.9 Overhaul Valve Actuating Mechanism (Hydraulic latch actuator).
17. Trace, Test & Repair Cooling and Lubrication System of engine	17.1 Overhauling of Radiator/ Recovery tank water pump, oil pump, air cleaner
	17.2 Check the engine oil pressure at different r.p.ms.
	17.3 Overhaul the Oil Pump.
	17.4 Set Checking &Top up coolant, Draining & refilling coolant.
	17.5 Testing cooling system pressure & Thermostat
	17.6 Cleaning & reverse flushing. Overhauling water pump and refitting and repairs to oil flow pipe lines and unions if necessary.
	17.7 Check proper functioning of radiator fan (Mechanical/ Electrical / viscous / belt drive).
18. Trace & Test Intake and Exhaust system of engine	18. 1 Overhauling of manifolds, silencer and tail pipe, air compressor, air exhauster and inspect parts of air exhauster, turbo charger from vehicle.
	18. 2 Overhauling of air filter, clean & refit air cooler, fuel filter assembly and replace filter elements
	18. 3 Remove and replace EGR valve, Use Smoke meter to test emission from engine.

19. Service Diesel Fuel System and check proper functionality.	19. 1 Overhauling fuel feed pump, fuel injector pump.
	19. 2 Test injectors, check the injection timing by the spill cut off method
20. Plan & overhaul the stationary engine and Governor and check functionality	20. 1 Start engine, adjust idling speed.
	20. 2 Overhaul the Governor (Mechanical & Pneumatic)
	20. 3 Set the Engine Timing.
	20. 4 Check performance of engine off load.
	20. 5 Servicing of the cylinder and replace the defective parts.
21. Monitor emission of vehicle and execute different operation to obtain optimum pollution as per emission norms.	21. 1 Check vacuum pump for its functioning.
	21. 2 Perform troubleshooting of EVAP Canister.
	21. 3 Inspect PCV hose, inspect PCV Valve and check for vacuum.
	21. 4 Clean the PCV valve and replace if required.
	21. 5 Inspect & clean EGR.
22. Carryout overhauling of Alternator and Starter Motor.	22. 1 Trace the circuit from the alternator to the battery.
	22. 2 Perform servicing of starter motor.
	22. 3 Perform servicing of alternator and test its performance.
	22. 4 Check belt condition and replace as per requirement.
23. Diagnose & rectify the defects in LMV/HMV to ensure functionality of vehicle.	23. 1 Plan and diagnose the problem if engine not starting.
	23. 2 Diagnose high fuel consumption and engine overheating.
	23. 3 Diagnose for excessive oil consumption and low/high engine oil pressure.
	23. 4 Diagnose for abnormal engine noise.
	23. 5 Diagnose for engine's poor performance.

SYLLABUS FOR MECHANIC DIESEL TRADE			
FIRST SEMESTER - 6 MONTHS			
Week No.	**Learning Outcome**	**Professional Skills (Trade Practical) With Indicative Hours**	**Professional Knowledge (Trade Theory)**
1-2	Apply safe working practices in an automotive work shop.	1. Demonstration of Machinery used in the trade. (05 hrs) 2. Identify safety Gear/PPE (Personal Protective Equipments) and their uses (10 hrs) 3. Importance of maintenance and cleanliness of Workshop. (05 hrs) 4. Demonstration on safe handling and Periodic testing of lifting equipment, and Safety disposal of used engine oil. (10 hrs.) 5. Demonstration on health hazards, occupational safety &first Aid. (05 hrs) 6. Demonstration fire service station to provide demo on Fire safety. (05 hrs) 7. Perform use of fire extinguishers. (05 hrs) 8. Energy saving Tips of ITI electricity Usage. (05 hrs)	- Importance& scope of Mechanic Diesel Trade Training. - General discipline in the Institute - Elementary First Aid, Occupational Safety & Health - Knowledge of Personal Safety &Safety precautions in handling Diesel machine - Concept about House Keeping & 5S method. - Energy conservation process - Safety disposal of Used engine oil, - Electrical safety tips. - Safe handling of Fuel Spillage, - Knowledge of Fire Safety &Fire extinguishers used for different types of fire. - Safe disposal of toxic dust, - safe handling and Periodic testing of lifting equipment
3-4	Check & perform Measuring & marking by using various Measuring & Marking tools(Vernier Calliper, Micrometer, Telescope gauges, Dial bore gauges, Dial indicators, straightedge, feeler gauge, thread pitch gauge, vacuum gauge,	9. Perform marking using all marking aids, like steel rule with spring callipers, dividers, scriber, punches, chisel etc. on MS Flat/Sheet Metal. (17 hrs) 10. Measure a wheel base of a vehicle with measuring tape. (08 hrs) 11. Measure valve spring tension using spring tension tester (10 hrs)	**Hand & Power Tools:-** - Marking scheme, **marking material-**chalk, Prussian blue. - Cleaning tools- Scraper, wire brush, Emery paper**,** - Description, care and use of Surface plates, steel rule, measuring tape, try square. Callipers-inside and outside. Dividers, surface gauges, scriber,

	tire pressure gauge.)	12. Perform to remove wheel lug nuts with use of an air impact wrench (08 hrs) 13. Operate General workshop tools & power tools. (07 hrs)	- Punches-prick **punch,** centre 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 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, Pipe flaring & cutting tool, pullers-Gear and bearing.
5-6	-do-	14. Perform measuring practice on Cam height, Camshaft Journal dia, crankshaft journal dia, Valve stem dia, piston diameter, and piston pin dia with outside Micrometres. (05 hrs) 15. Perform 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. (05 hrs) 16. Perform measuring practice on valve spring free length. (05 hrs) 17. Perform measuring practice on cylinder bore, Connecting rod	**Systems of measurement**, -Description, Least Count calculation, care & use of - Micrometers- Outside, and depth micrometer, - Micrometer adjustments, - Description, Least Count calculation, care & use of Vernier Calliper. - Telescope gauges, Dial bore gauges, Dial indicators, straightedge, feeler gauge, thread pitch gauge, vacuum gauge, tire pressure gauge.

		bore, inside diameter (ID) of a camshaft bearing with Telescope gauges. (05 hrs) 18. Perform measuring practice on cylinder bore for taper and out-of-round with Dial bore gauges. (05 hrs) 19. Perform measuring practice to measure wear on crankshaft end play, crankshaft run out, and valve guide with dial indicator. (05 hrs) 20. Perform measuring practice to check the flatness of the cylinder head is warped or twisted with straightedge is used with a feeler gauge. (05 hrs) 21. Perform measuring practice to check the end gap of a piston ring, piston-to-cylinder wall clearance with feeler gauge. (05 hrs) 22. Perform practice to check engine manifold vacuum with vacuum gauge. (05 hrs) 23. Perform practice to check the air pressure inside the vehicle tyre is maintained at the recommended setting. (05 hrs)	
7-8	Plan & perform basic fastening & fitting operation by using correct hand tools, Machine tools & equipments.	25. Perform practice on general cleaning, checking and use of nut, bolts, & studs etc. (05 hrs) 26. Perform removal of stud/bolt from blind hole. (05 hrs) 27. Perform practice on cutting tools like Hacksaw, file, chisel, Sharpening of Chisels, center punch, safety precautions while grinding. (10 hrs) 28. Perform practice on Hacksawing and filing to given dimensions. (15 hrs) 29. Perform on Soldering & Brazing.	- Different types of metal joint (Permanent, Temporary), methods of Bolting, Riveting, Soldering, Brazing, Seaming etc. **Fasteners** - Study of different types of screws, nuts, studs & bolts, locking devices, Such as lock nuts, cotter, split pins, keys, circlips, lock rings, lock washers and locating where they are used. Washers & chemical compounds can be used to help

		(10 hrs) 30. Perform practice on making various Gaskets like oil sump, intake manifold, water pump, tappet cover etc. (05 hrs)	secure these fasteners. Function of **Gaskets,** Selection of materials for gaskets and packing, **oil seals. Types of Gaskets** – paper, multilayered metallic, liquid, rubber, copper and printed. Thread Sealants-Various types like, locking, sealing, temperature resistance, antilocking, lubricating etc. **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
9-10	-do-	31. Perform practice on Marking and Drilling clear and Blind Holes, Sharpening of Twist Drills Safety precautions to be observed while using a drilling machine. (10 hrs) 32. Perform practice on Tapping a Clear and Blind Hole, Selection of tape drill Size, use of Lubrication, Use of stud extractor. (15 hrs) 33. Perform practice cutting Threads on a Bolt/ Stud. Adjustment of two piece Die, Reaming a hole/ Bush to suit the given pin/ shaft, scraping a	**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,

		given machined surface. (25 hrs)	Lapping, Lapping abrasives, type of Laps.
11	-do-	34. Perform practice on making Rectangular Tray. (08 hrs) 35. Perform pipe bending, fitting nipples union in pipes (08 hrs) 36. Perform Soldering and Brazing of Pipes. (09 hrs)	**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.
12	Trace and Test all Electrical & Electronic components & circuits and assemble circuit to ensure functionality of system.	37. Perform practice in joining wires using soldering Iron. (08 hrs) 38. Prepare simple electrical circuits, measuring of current, voltage and resistance using digital multimeter. (08 hrs) 39. Perform practice continuity test for fuses, jumper wires, fusible links and circuit breakers. (09 hrs)	**Basic electricity** - Electricity principles, - Ground connections, - Ohm's law, - Voltage, Current, Resistance, Power, Energy. - Voltmeter, ammeter, Ohmmeter, Multimeter, - Conductors & insulators, Wires, Shielding, Length vs. resistance, Resistor ratings
13	-do-	40. Perform diagnose series, parallel, series-parallel circuits using Ohm’s law. (05 hrs) 41. Check electrical circuit with a test lamp. (05 hrs) 42. Perform voltage drop test in circuits using multimeter, measure current flow using multimeter /ammeter. (07 hrs) 43. Check circuit using of service manual wiring diagram for troubleshooting (08 hrs)	- 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.
14	-do-	44. Execute cleaning and topping	- Description of Chemical

		up of a lead acid battery. (05 hrs) 45. Perform testing battery with hydrometer. (02 hrs) 46. Perform connecting battery to a charger for battery charging and checking & testing a battery after charging. (08 hrs) 47. Measure and Diagnose the cause(s) of excessive Key-off battery drain (parasitic draw) and do corrective action. (05 hrs) 48. Perform test of relay and solenoids and its circuit. (05 hrs)	effects, Batteries & cells, Lead acid batteries & Stay Maintenance Free (SMF) batteries, - Magnetic effects, Heating effects, Thermo-electric energy, Thermistors, Thermo couples, - Electrochemical energy, Photo-voltaic energy, Piezo-electric energy, Electromagnetic induction, - Relays, Solenoids, Primary & Secondary windings, Transformers, stator and rotor coils.
15	-do-	49. Identify and test power and signal connectors for continuity (05 hrs) 50. Perform test and identify different type of Diodes, NPN & PNP Transistors for its functionality (10 hrs) 51. Construct and test simple logic circuits OR, AND & NOT and Logic gates using switches. (10 hrs)	**Basic electronics**: - Description of Semiconductors, 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.
16-18	Join components by using Arc & Gas welding.	52. Perform practice to make straight beads and Butt, Lap & T joints Manual Metal Arc Welding. (50 hrs) 53. Set Gas welding flames and perform practice to make a straight beads and joints by Oxy – Acetylene welding (25 hrs)	**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;. - Basic knowledge about advance welding process & equipments like MIG, TIG, Spot Welding, Plasma Cutter. **Heat Treatment Process** - Introduction, Definition of heat treatment, - - Definition of Annealing, Normalizing, Hardening and tempering. – - Case hardening, Nitriding, Induction hardening - Flame Hardening process used in auto components with examples.
19-20	Trace & Test Hydraulic and Pneumatic components.	54. Perform liquid penetrant testing method and Magnetic particle testing method. (15 hrs) 55. Identify of Hydraulic and pneumatic components used in vehicle. (10 hrs) 56. Tracing of hydraulic circuit on hydraulic jack, hydraulic power steering, and Brake circuit. (15 hrs) 57. Identify components in Air brake systems (10 hrs)	**Non-destructive Testing Methods** - Importance 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.

21	Check & Interpret Vehicle Specification data and VIN Select & operate various Service Station Equipments.	58. Identify of different types of Vehicle. (05 hrs) 59. Demonstrate of vehicle specification data . (05 hrs) 60. Identify of vehicle information Number (VIN). (05 hrs). 61. Demonstrate of Garage, Service station equipments.- Vehicle hoists – Two post and four post hoist, Engine hoists, Jacks**,** Stands**.** (10 hrs)	- 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. - 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 - Uses of Vehicle hoists – Two post and four post hoist, Engine hoists, Jacks**,** **Stands.**
22-23	Project Work/ Industrial Visit- Broad area: a) Maintenance of cooling system (radiator leakage by brazing and precautionary measures) b) Maintenance of intake and exhaust system. c) Maintenance of Battery. d) Electrical Wiring harness of a vehicle e) Vehicle brake system (Hydraulic & Air) & Hydraulic Power Steering		
24-25	**Revision**		
26	**Examination**		

Note: *More emphasis to be given on video/real-life pictures during theoretical classes. Some real-life pictures/videos of welded items like boiler drum, ship building, heavy welded structures etc., may be shown to the trainees to give a feel of Industry and their future assignment.*

SYLLABUS FOR MECHANIC DIESEL TRADE			
SECOND SEMESTER – 06 Months			
Week No.	**Learning Outcome Reference**	**Professional Skills (Trade Practical) With Indicative Hours**	**Professional Knowledge (Trade Theory)**
27-28	Dismantle & assemble of Diesel Engine from vehicle (LMV/HMV) along with other accessories.	62. Identify the different parts of IC Engine(10 hrs) 63. Identify the different parts in a diesel engine of LMV/ HMV (10 hrs) 64. Perform practice on starting and stopping of diesel engines. Observe and report the reading of Tachometer, Odometer, temp and Fuel gauge under ideal and on load condition. (10 hrs) 65. Practice on dismantling Diesel engine of LMV/HMV as per procedure. (20 hrs)	**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, - Main Parts of IC 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.

29-30	Overhaul & service Diesel Engine, its parts and check functionality.	66. Perform Overhauling of cylinder head assembly, Use of service manual for clearance and other parameters,(10 hrs) 67. Perform practice on removing rocker arm assembly manifolds. (07 hrs) 68. Perform practice on removing the valves and its parts from the cylinder head, cleaning. (07 hrs) 69. Inspection of cylinder head and manifold surfaces for warping, cracks and flatness. Checking valve seats & valve guide – Replacing the valve if necessary. (07 hrs) 70. Check leaks of valve seats for leakage – Dismantle rocker shaft assembly -clean & check rocker shaft-and levers, for wear and cracks and reassemble. (07 hrs) 71. Check valve springs, tappets, push rods, tappet screws and valve stem cap. Reassembling valve parts in sequence, refit cylinder head and manifold & rocker arm assembly, adjustable valve clearances, starting engine after adjustments. (12 hrs)	**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 Actuating Mechanism -** - 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 (SOHC and DOHC)**,** importance of Cam lobes**,** Timing belts & chains**,** Timing belts & tensioners.
31	-do-	72. Perform Overhauling piston and connecting rod assembly. Use of service manual for clearance and other parameters (05 hrs)	- Description & functions of different types of **pistons**, piston rings and piston pins and materials. - Used recommended clearances for the rings and

		73. Perform Practice on removing oil sump and oil pump – clean the sump. 74. Perform removing the big end bearing, connecting rod with the piston. (05 hrs) 75. Perform removing the piston rings; Dismantle the piston and connecting rod. Check the side clearance of piston rings in the piston groove & lands for wear. Check piston skirt and crown for damage and scuffing, clean oil holes. (05 hrs) 76. 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. (05 hrs) 77. Check connecting rod for bend and twist. Assemble the piston and connecting rod assembly. (05 hrs)	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.
32	-do-	78. Perform Overhauling of crankshaft, Use of service manual for clearance and other parameters (05 hrs) 79. Perform removing damper pulley, timing gear/timing chain, flywheel, main bearing caps, bearing shells and crankshaft from engine(05 hrs) 80. Inspect oil retainer and thrust surfaces for wear. (05 hrs) 81. Measure crank shaft journal	- 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.

		for wear, taper and ovality. (05 hrs) 82. Demonstrate crankshaft for fillet radii, bend & twist. (05 hrs)	
33	-do-	83. Inspect flywheel and mounting flanges, spigot and bearing.(05 hrs) 84. Check vibration damper for defect. (02 hrs) 85. Perform 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. (07 hrs) 86. 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. (11 hrs)	- 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.
34	-do-	87. Perform cleaning and checking of cylinder blocks. (04 hrs) 88. Surface for any crack, flatness measure cylinder bore for taper & ovality, clean oil gallery passage and oil pipe line. (05 hrs) 89. Perform bore - descale water passages and examine. (05 hrs) 90. Removing cylinder liners from	- Description of **Cylinder block,** - Cylinder block construction, - Different type of Cylinder sleeves (liner).

		scrap cylinder block. (04 hrs) 91. Perform practice in measuring and refitting new liners as per maker's recommendations precautions while fitting new liners. (07 hrs)	
35	-do-	92. Perform reassembling all parts of engine in correct sequence and torque all bolts and nuts as per workshop manual of the engine. (12 hrs) 93. Perform testing cylinder compression, Check idle speed. (08 hrs) 94. Perform removing & replacing a cam belt, and adjusting an engine drive belt, replacing an engine drive belt. (05 hrs)	- **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.
36-38	Trace, Test & Repair Cooling and Lubrication System of engine.	95. Perform practice on checking &top up coolant, draining & refilling coolant, checking / replacing a coolant hose. (10 hrs) 96. Perform test cooling system pressure. (05 hrs) 97. Execute on removing & replacing radiator/ thermostat check the radiator pressure cap. (10 hrs) 98. Test of thermostat. (5 hrs) 99. Perform cleaning & reverse flushing. (10 hrs) 100. Perform overhauling water pump and refitting. (10 hrs) 101. Perform checking engine oil, draining engine oil, replacing oil filter, & refilling engine oil (10 hrs)	**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 ,

		102. Execute overhauling of oil pump, oil coolers, air cleaners and air filters and adjust oil pressure relief valves, repairs to oil flow pipe lines and unions if necessary. (15 hrs)	- 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.
39	Trace & Test Intake and Exhaust system of engine.	103. Execute dismantling air compressor and exhauster and cleaning all parts - measuring wear in the cylinder, reassembling all parts and fitting them in the engine. (6 hrs) 104. Execute dismantling & assembling of turbocharger, check for axial clearance as per service manual. (05 hrs) 105. Examine exhaust system for rubber mounting for damage, deterioration and out of position; for leakage, loose connection, dent and damage; (05 hrs) 106. Perform practice on exhaust manifold removal and installation, practice on Catalytic converter removal and installation. (05 hrs) 107. Check Exhaust system for	**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, **Exhaust system components-** - Description and function of Exhaust manifold, Exhaust pipe, Extractors, Mufflers- Reactive, absorptive, Combination of Catalytic converters, Flexible connections, Ceramic coatings, Back-pressure, - Electronic mufflers.

		rubber mounting for damage, deterioration and out of position; for leakage, loose connection, dent and damage. (04 hrs)	
40-42	Service Diesel Fuel System and check proper functionality.	108. Perform work on removing &cleaning fuel tanks, checking leaks in the fuel lines. (10 hrs) 109. Perform soldering & repairing pipe lines and Unions, brazing nipples to high pressure line studying the fuel feed system in diesel engines, draining of water separators. (10 hrs) 110. Execute overhauling of Feed Pumps (Mechanical & Electrical). (10 hrs) 111. Perform bleeding of air from the fuel lines, servicing primary & secondary filters. (10 hrs) 112. Execute 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. (15 hrs) 113. Execute overhauling of injectors and testing of injector. (10 hrs) 114. General maintenance of Fuel Injection Pumps (FIP). (10 hrs)	**Fuel Feed System in IC Engine(Petrol & Diesel)** - Gravity feed system, Forced feed system, main parts, Fuel Pumps- Mechanical & Electrical Feed Pumps. - Knowledge about function, working & types of Carburettor. **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.
43	Plan & overhaul the stationary engine and Governor and check functionality.	115. Execute Start engine adjust idling speed and damping device in pneumatic governor and venture control unit checking. (06 hrs) 116. Verify performance of engine with off load adjusting timings. Start engine- adjusting idle speed of the engine fitted with mechanical governor checking- high speed operation of the engine. (07 hrs) 117. Check performance for missing cylinder by isolating defective injectors and test- dismantle and replace defective parts and reassemble and refit back to the engine. (12 hrs)	**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.
44	21.. Monitor emission of vehicle and execute different operation to obtain optimum pollution as per emission norms.	118. Monitor emissions procedures by use of Engine gas analyser or Diesel smoke meter. (10 hrs) 119. 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. (10 hrs) 120. EGR /SCR Valve Remove and installation for inspection. (05 hrs)	**Emission Control:- Vehicle emissions** - Standards- Euro and Bharat 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**,** Sulphur content in fuels 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
45	Carryout overhauling of Alternator and Starter Motor.	121. Perform removing alternator from vehicle dismantling, cleaning checking for defects, assembling and testing for motoring action of alternator & fitting to vehicles. (15 hrs) 122. Practice on removing starter motor Vehicle and overhauling the starter motor, testing of starter motor (10 hrs)	Basic Knowledge about DC Generator & AC Generator. - Constructional details of Alternator - 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.
46-47	23. Diagnose & rectify the defects in LMV/HMV to ensure functionality of vehicle.	123. Execute troubleshooting in LMV/HMV for Engine Not starting – Mechanical & Electrical causes, High fuel consumption, Engine overheating, Low Power Generation, Excessive oil consumption, Low/High Engine Oil Pressure, Engine Noise. (50 hrs)	**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.
49-50	In-plant training / Project work Projects viz. a. Overhauling of Pressure Lubrication system b. Maintenance of cooling system. c. Overhauling of FIP. d. Cleaning & Testing of Injectors. e. Overhauling of Alternator		

	f. Overhauling of Starter Motor g. Study on Diagnosis Tool/Scanner Tool for ECU of CRDI engine
51	**Revision**
52	**Examination**

Note: -

1. *Some of the sample project works (indicative only) are given against each semester.*
2. *Instructor may design their own project and also inputs from local industry may be taken for designing such new project.*
3. *The project should broadly covered maximum skills in the particular trade and must involve some problem solving skill. Emphasis should be on Teamwork: Knowing the power of synergy/ collaboration, Work to be assigned in a group (Group of at least 4 trainees). The group should demonstrate Planning, Execution, Contribution and application of Learning. They need to submit Project report.*
4. *If the instructor feels that for execution of specific project more time is required than he may plan accordingly to produce components/ sub-assemblies in appropriate time i.e., may be in the previous semester or during execution of normal trade practical.*
5. *More emphasis to be given on video/real-life pictures during theoretical classes. Some real-life pictures/videos of welded items like boiler drum, ship building, heavy welded structures etc., may be shown to the trainees to give a feel of Industry and their future assignment.*

9.1 WORKSHOP CALCULATION SCIENCE & ENGINEERING DRAWING

First Semester **Duration: Six Months**		
S No.	**Workshop Calculation and Science**	**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.	**Ratio &Proportion**: Simple calculation on related problems.	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.	**Percentage**: Introduction, Simple calculation. Changing percentage to fraction and decimal & vice-versa.	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.
5.	**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.	Lettering and Numbering as per BIS SP46-2003: - Single Stroke, Double Stroke, inclined, Upper case and Lower case.
6.	**Mass, Weight and Density**: Mass, Unit of Mass, Weight, difference between mass and weight. Density, unit of density. Relation between mass, weight & density. Simple problems related to mass, weight, and density.	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.
7.	**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 energyand kinetic energy.	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)
8.	-----	Method of presentation of Engineering Drawing - Pictorial View - Orthographic View - Isometric view
9.	------	Symbolic Representation used in the related trade (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 **Duration: Six Months**		
S No.	**Workshop Calculation and Science**	**Engineering Drawing**
1.	**Basic Algebra**: Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	**Dimensioning practice:** - Position of dimensioning (unidirectional, aligned, as per BIS SP:46-2003) - Types of arrowhead - Leader Line with text - Symbols preceding the value of dimension and dimensional tolerance.
2.	**Mensuration:** Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi-circle, Volume of solids – cube, cuboid, cylinder and Sphere. Surface area of solids – cube, cuboid, cylinder and Sphere.	Drawing of Solid figures (Cube, Cuboids, Cone, Prism, Pyramid, Frustum of Cone and Pyramid) with dimensions.
3.	**Trigonometry:** Trigonometrical ratios, measurement of angles. Trigonometric tables	Free hand Drawing of Solid figures (Prism, Pyramid, Frustum of Cone and Pyramid) with dimensions.
4.	**Elasticity:** Elastic & Plastic material. Stress & strain and their units. Young's modules. Ultimate stress and breaking stress.	Free Hand sketch of hand tools and measuring tools used in respective trades.
5.	**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.	**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.
6.	**Basic Electricity**: Introduction, use of electricity, how electricity is produced,	Drawing of Orthographic projection in 3rd angle.

	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. - Electrical insulating materials. - Basic concept of earthing.	
7.	- Area of irregular surfaces. - Application related to shop problems.	Free hand Drawing of simple fastener (Rivet, Bolts, Nuts & Screw)
8.	- Material weight and cost problems related to trade.	Free hand sketching of simple objects related to trade.
9.	- Temperature measuring instruments. Specific heats of solids & liquids.	- Riveted joints-Butt & Lap (Drawing one for each type).
10.	- Thermal Conductivity, Heat loss and heat gain.	- Reading of drawing. Simple exercises related to missing lines, dimensions. How to make queries.
11.	- Heat treatment and advantages.	- Simple exercises relating missing symbols. - Missing views
12.	----------	- Concept of preparation of assembly drawing and detailing. Preparation of simple assemblies & their details of trade related job/exercises with the dimensions from the given sample or models.
13.	----------	Reading of fabricated engineering drawing

9.2 EMPLOYABILITY SKILLS

First Semester	
1. English Literacy	**Duration : 20 hrs** **Marks : 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 known people, 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 on messages and filling in message forms, Greeting and introductions, office hospitality, Resumes or curriculum vita essential parts, letters of application reference to previous communication.
2. IT Literacy	**Duration : 20 hrs** **Marks : 09**
Basics of Computer	Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of the 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, WebsSite, 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	**Duration : 15 hrs** **Marks : 07**
Introduction to Communication Skills	Communication and its importance Principles of effective communication Types of communication - verbal, non-verbal, written, email, talking on phone. Non-verbal 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
Second Semester	
4. Entrepreneurship Skills	**Duration : 15 hrs** **Marks : 06**
Concept of Entrepreneurship	Entrepreneur - Entrepreneurship - Enterprises: Conceptual issue Entrepreneurship vs. management, Entrepreneurial motivation. Performance &record, Role &function of entrepreneurs in relation to the enterprise & relation to the economy, Source of business ideas, Entrepreneurial opportunities, The process of setting up a business.
Project Preparation & Marketing Analysis	Qualities of a good entrepreneur, SWOT and risk analysis. Concept &Application of PLC, Sales &Distribution management. Difference between small scale &large scale business, Market survey, Method of marketing, Publicity and advertisement, Marketing mix.
Institution's Support	Preparation of project. Role of various schemes and institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non-financing support agencies to familiarize with the policies / programmes, procedure & the available scheme.
Investment Procurement	Project formation, Feasibility, Legal formalities i.e., Shop act, Estimation &costing, Investment procedure - Loan procurement - Banking processes.
5. Productivity	**Duration : 10 hrs** **Marks : 05**
Benefits	Personal/ Workman - Incentive, Production linked Bonus, Improvement in living standard.
Affecting Factors	Skills, Working aids, Automation, Environment, Motivation - How it improves or slows down productivity.
Comparison with Developed Countries	Comparative productivity in developed countries (viz. Germany, Japan and Australia) in select 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 and Environment Education	**Duration : 15 hrs**

		Marks : 06
Safety & Health	Introduction to occupational safety and health Importance of safety and health at workplace.	
Occupational Hazards	Basic hazards, chemical hazards, vibroacoustic hazards, mechanical hazards, electrical hazards, thermal hazards. occupational health, occupational hygiene, occupational diseases/ disorders & its prevention.	
Accident &Safety	Basic principles for protective equipment. 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 provision legislation of India. Safety, health, welfare under legislative of India.	
Ecosystem	Introduction to environment. Relationship between society and environment, ecosystem and factors causing imbalance.	
Pollution	Pollution and pollutants including liquid, gaseous, solid and hazardous waste.	
Energy Conservation	Conservation of energy, re-use and recycle.	
Global Warming	Global warming, climate change and ozone layer depletion.	
Ground Water	Hydrological cycle, ground and surface water, Conservation and harvesting of water.	
Environment	Right attitude towards environment, Maintenance of in-house environment.	
7. Labour Welfare Legislation		**Duration : 05 hrs** **Marks : 03**
Welfare Acts	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		**Duration : 10 hrs** **Marks : 05**
Quality Consciousness	Meaning of quality, Quality characteristic.	

Quality Circles	Definition, Advantage of small group activity, objectives of quality circle, Roles and function of quality circles in organization, 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.
Quality Tools	Basic quality tools with a few examples.

ANNEXURE-I

MECHANIC DIESEL			
LIST OF TOOLS AND EQUIPMENT			
A. TRAINEES TOOL KIT per 4 Trainees (FOR 20 TRAINEES + 1 ISTRUCTOR)			
	Name of the Tool &Equipments	**Specification**	**Quantity**
1.	Allen Key set of 12 pieces	2mm to 14mm	5+1
2.	Calliper inside with spring	15 cm	6 nos.
3.	Callipers outside with spring	15 cm	6 nos.
4.	Center Punch.	10 mm. Dia. x 100 mm	6 nos.
5.	Dividers with spring	15 cm	6 nos.
6.	Electrician Screw Driver	250mm	6 nos.
7.	Hammer ball peen with handle	0.5 kg	6 nos.
8.	Hands file for Second cut flat	20 cm.	6 nos.
9.	Philips Screw Driver set of 5 pieces	100 mm to 300 mm	6 nos.
10.	Pliers combination	20 cm.	6 nos.
11.	Screw driver Blade	20cm.X 9mm.	6 nos.
12.	Screw driver Blade	30 cm. X 9 mm.	6 nos.
13.	Scriber	15 cm	6 nos.
14.	Spanner D.E. set of 12 pieces	6mm to 32mm	6 nos.
15.	Spanner, ring set of 12	6 to 32 mm. (metric)	6 nos.
16.	Spanners socket with speed handle, T-bar, ratchet and universal set of 28 pieces with box	up to 32 mm	6 nos.
17.	Steel rule	30 cm inch and metric	6 nos.
18.	Steel tool box with lock and key (folding type)	400x200x150 mm	6 nos.
19.	Wire cutter and stripper		6 nos.
B. INSTRUMENTS AND GENERAL SHOP OUTFIT - For 2 (1+1) units no additional items are required			
TOOLS & EQUIPMENT			
20.	Adjustable spanner (pipe wrench)	350 mm	2
21.	Air blow gun with standard accessories		1

22.	Allen Key set of 12 pieces	2mm to 14mm	4
23.	Ammeter DC with external shunt	300A/ 60A	4
24.	Air ratchet with standard accessories		4
25.	Air impact wrench with standard accessories		4
26.	Angle plate adjustable	250x150x175mm	1.
27.	Angle plate size	200x100x200mm	2
28.	Anvil with Stand	50 Kgs	1
29.	Auto Electrical test bench		1
30.	Battery –charger	5 meters flexible in case	2
31.	Blow Lamp	1 litre	2
32.	Belt Tensioner gauge		1
33.	Caliper inside with Spring	15 cm	4
34.	Calipers outside with spring	15 cm	4
35.	Car Jet washer with standard accessories		1
36.	Chain Pulley Block capacity with tripod stand	3 ton	1
37.	Chisel flat	10 cm	4
38.	Chisels cross cut	200 mm X 6mm	4
39.	Circlip pliers Expanding and contracting	15cm and 20cm	4 each
40.	Clamps C	100mm	2
41.	Clamps C	150mm	2
42.	Clamps C	200mm	2
43.	Cleaning tray	45x30 cm.	4
44.	Compression testing gauge suitable for diesel Engine with standard accessories		2
45.	Connecting rod alignment fixture		1
46.	Copper bit soldering iron	0.25 Kg	4
47.	Cylinder bore gauge capacity	20 to 160 mm	4
48.	Cylinder liner- Dry & wet liner, press fit & slidefit liner		1 each
49.	DC Ohmmeter	0 to 300 Ohms	2
50.	Depth micrometer	0-25mm	4

51.	Dial gauge type 1 Gr. A (complete with clamping devices and with magnetic stand)		4
52.	Different type of Engine Bearing model		1 set
53.	Different type of piston model		1 set
54.	Dividers with Spring	15 cm	4
55.	Drift Punch Copper	15 Cm	4
56.	Drill point angle gauge		1
57.	Drill twist (various sizes)	1.5 mm to 15 mm by 0.5mm	4
58.	Electric Soldering Iron	230 V 60 watts 230 V 25 watts	2 each
59.	Electric testing screw driver		4
60.	Engineer's square	Blade size 15 cm	4
61.	Engineers stethoscope		1
62.	Feeler gauge 20 blades (metric)		4
63.	File flat , bastard	20 cm	4
64.	File, half round ,second cut	20 cm	4
65.	File, Square second cut	20 cm	4
66.	File, Square round	30 cm	4
67.	File, triangular , second cut	15 cm	4
68.	Files assorted sizes and types including safe edge file (20 No's)		2each
69.	Flat File , second cut	25 cm	4
70.	Flat File , bastard	35 cm	4
71.	Fuel feed pump for Diesel		1
72.	Fuel injection pump (Diesel) inline		1
73.	Fuel injection pump dismantling tool kit /Universal Vice		1
74.	Fuel injection pump VE pump / Distributor fuel rotary pump (DPC) pumps / along with special tools and accessories		1 each
75.	Gloves for Welding	(Leather and Asbestos)	5 sets
76.	Glow plug tester		2
77.	Granite surface plate with stand and cover	1600 x 1000mm	1

78.	Grease Gun		2
79.	Grease Gun heavy duty trolley type	10 kg capacity	1
80.	Growler		2
81.	Hacksaw frame	adjustable 20-30 cm	10
82.	Hammer Ball Peen	0.75 Kg	4
83.	Hammer Chipping	0.25 Kg	5
84.	Hammer copper with handle	1 Kg	4
85.	Hammer Mallet		4
86.	Hammer Plastic		4
87.	Hand operated crimping tool	(i) up to 4mm (ii) up to 10mm	2 each
88.	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	2 set
89.	Hand Shear Universal	250mm	2
90.	Hand vice	Up to 37 mm	2
91.	Hollow Punch set of seven pieces	6mm to 15mm	2set
92.	Injector – Multi hole type, Pintle type		4 each
93.	Injector cleaning unit		1
94.	Injector testing set (Hand tester)		1
95.	Insulated Screw driver	20 cm x 9mm blade	4
96.	Insulated Screw driver	30 cm x 9mm blade	4
97.	Left cut snips	250mm	4
98.	Lifting jack screw	3 ton, 5ton & 20 Ton	1 each
99.	Magneto spanner set with 8 spanners		1set
100.	Magnifying glass	75mm	2
101.	Marking out table	90X60X90 cm.	1
102.	Multimeter digital		5
103.	Oil can	0.5/0.25 liter capacity	4
104.	Oil pump for dismantling and assembling.		2
105.	Oil Stone	15 cm x 5 cm x 2.5 cm	1
106.	Oscilloscope	20MHz	2

107.	Outside micrometer	0 to 25 mm	2
108.	Outside micrometer	25 to 50 mm	2
109.	Outside micrometer	50 to 75 mm	1
110.	Outside micrometer	75 to 100 mm	1
111.	Philips Screw Driver set of 5 pieces	100 mm to 300 mm	2
112.	Pipe cutting tool		2
113.	Pipe flaring tool		2
114.	Piston ring compressor		2
115.	Piston Ring expander and remover.		2
116.	Piston Ring groove cleaner.		1
117.	Pliers combination	20 cm.	2
118.	Pliers flat nose	15 cm	2
119.	Pliers round nose	15 cm	2
120.	Pliers side cutting	15 cm	2
121.	Portable electric drill Machine		1
122.	Prick Punch	15 cm	4
123.	Punch Letter 4mm (Number)		2 sets
124.	Radiator cut section-cross flow		1
125.	Radiator cut section-down flow		1
126.	Radiator pressure cap		2
127.	Right cut snips	250mm	2
128.	Rivet sets snap and Dolly combined	3mm, 4mm, 6mm	2
129.	Scraper flat	25 cm	2
130.	Scraper half round	25 cm	2
131.	Scraper Triangular	25 cm	2
132.	Scriber	15 cm	2
133.	Scriber with scribing black universal		2
134.	Set of stock and dies -Metric		2sets
135.	Tinnman's Shear	450 mm x 600mm	2
136.	Sheet Metal Gauge		2
137.	Tinnman'sShear	300mm	4
138.	Soldering Copper	Hatchet type 500gms	2

139.	Solid Parallels in pairs (Different size) in Metric		2
140.	Spanner Clyburn	15 cm	1
141.	Spanner D.E. set of 12 pieces	6mm to 32mm	4
142.	Spanner T. flocks for screwing up and up-screwing inaccessible		2
143.	Spanner, adjustable	15cm	2
144.	Spanner, ring set of 12 metric sizes	6 to 32 mm.	4
145.	Spanners socket with speed handle, T-bar, ratchet and universal		2
146.	Spark lighter		2
147.	Spark plug spanner 14mm x 18mm x Size		2
148.	Starter motor axial type, pre-engagement type & Co-axial type		1each
149.	Steel measuring tape in a case	10 meter	4
150.	Steel rule 15 cm inch and metric		4
151.	Steel rule 30 cm inch and metric		4
152.	Straight edge gauge 2 ft.		2
153.	Straight edge gauge 4 ft.		2
154.	Stud extractor set of 3		2sets
155.	Stud remover with socket handle		1
156.	Surface gauge with dial test indicator plunger type	0.01 mm	4
157.	Tachometer (Counting type)		1
158.	Tandem master cylinder with booster		4
159.	Taps and Dies complete sets (5 types)		1set
160.	Taps and wrenches - Metric		2sets
161.	Telescope gauge		4
162.	Temperature gauge with sensor	0-100 ^{0}C	2
163.	Thermostat		2
164.	Thread pitch gauge Metric		2
165.	Timing lighter		2
166.	Torque wrenches	5-35 Nm, 12-68 Nm & 50-225 Nm	1each

167.	Trammel	30 cm	2
168.	Turbocharger cut sectional view		1
169.	Tyre pressure gauge with holding nipple		2
170.	Universal puller for removing pulleys, bearings		1
171.	V' Block 75 x 38 mm pair with Clamps		2
172.	Vacuum gauge	0 to 760 mm of Hg.	2
173.	Valve Lifter		1
174.	Valve spring compressor universal		1
175.	Vernier calliper	0-300 mm with least count 0.02mm	4
176.	Vice grip pliers		2
177.	Water pump for dismantling and assembling		4
178.	Wire Gauge (metric)		2
179.	Work bench	250 x 120 x 60 cm with 4 vices 12cm Jaw	4
GENERAL SHOP OUTFIT			
180.	Air conditioned CRDI Vehicle in running condition -LMV		1
181.	Arbor press hand operated 2 ton capacity		1
182.	Automotive exhaust 5 gas analyser (petrol & Diesel) or Diesel Smokemeter		1
183.	Bench lever shears	250mm Blade x 3mm	1
184.	Diesel Engine – CRDI - 4 stroke	Dismantling and assembling with Swivelling stand	1
185.	Diesel engine (Running condition) Stationary type		1
186.	Discrete Component Trainer / Basic Electronics Trainer		1
187.	Drilling machine bench to drill up to 12mm dia along with accessories		1
188.	Dual Magnetization Yoke	AC / HWDC, 230 VAC, 50Hz	01 set

189.	Gas Welding Table	1220mm x760mm	2
190.	Grinding machine (general purpose) D.E. pedestal with 300 mm dia. wheels rough and smooth		1
191.	Heavy Commercial vehicle type (without body on frame)		1
192.	Hydraulic jack HI-LIFT type -3 ton capacity, and 5 Ton capacity		1each
193.	Liquid penetrate Inspection kit		1set
194.	Multi Scan Tool with oscilloscope		1
195.	Pipe Bending Machine (Hydraulic type)	12mm to 30mm	1
196.	Pneumatic rivet gun with standard accessories		2
197.	Spring tension tester		1
198.	Tin smiths bench folder	600 x 1.6mm	1
199.	Trolley type portable air	compressor single cylinder with 45 litres capacity Air tank, along with accessories & with working pressure 6.5 kg/sq. cm	1
200.	Welding plant Oxy-Acetylene complete (high pressure)		1
201.	Welding Transformer	150-300 Amps	1
202.	Working Condition of Diesel Engine – CRDI - 4 stroke Engine, Assembly with fault simulation board		1
203.	Cut section of 4/6 cylinder diesel engine with moving condition to show momentum of internal parts		1
204.	Fuel injection test bench for calibration of fuel pump		1
205.	Electrical test bench		1
206.	Diesel Engine six Cylinder in running condition		1
CONSUMABLE			

207.	Battery- SMF		As required
208.	Brake fluids		As required
209.	Chalk, Prussian blue		As required
210.	Chemical compound for fasteners		As required
211.	Diesel		As required
212.	Different type gasket material		As required
213.	Different type of oil seal		As required
214.	Drill Twist (assorted)		As required
215.	Emery paper - 36–60 grit , 80–120		As required
216.	Engine oil & Engine coolant		As required
217.	Gear oils		As required
218.	Gloves for Welding (Leather and Asbestos)		As required
219.	Hacksaw blade (consumable)		As required
220.	Hand rubber gloves tested for 5000 V		5 pairs
221.	Holders, lamp teakwood boards, plug sockets,		As required
222.	Hydrometer		8
223.	Lapping abrasives		As required
224.	Leather apron		5
225.	Petrol		As required
226.	Power steering oil		As required
227.	Radiator Coolants		As required
228.	Safety glasses		As required
229.	Steel wire Brush 50mmx150mm		5
CLASS ROOM FURNITURE FOR TRADE THEORY			
230.	Instructor's table and Chair (Steel)		1 set

231.	Students chairs with writing pads		20
232.	White board size 1200mm X 900 mm		1
233.	Instructors lap top with latest(vista & above) configuration pre-loaded with operating system. and MS Office package.		1
234.	LCD projector with screen.		1
235.	Trainees locker	6½ ‘ x 3’ x 1½’	1 set each (optional)
TOOLS & EQUIPMENTS FOR ENGINEERING DRAWING HALL			
236.	Drawing board	(700mm x500 mm) IS: 1444	20+1
237.	Mini drafter		20+1
238.	Set square	celluloid 45^{o} (250 X 1.5 mm)	20+1
239.	Stool for trainees		20+1
240.	Cupboard (big)		01
241.	White Board	8ft. x 4ft.	01
242.	Trainer’s Table		01
243.	Trainer’s Chair		01
244.	Draughtsman drawing instrument box		20+1
245.	Draughtsman table		20

NOTE:

1. No additional items are required to be provided for unit or batch working in the Second shift except the items under trainee's tool kit and steel lockers.

TOOLS &EQUIPMENTS FOR EMPLOYABILITY SKILLS		
S No.	**Name of the Equipment**	**Quantity**
1.	Computer (PC) with latest configurations and Internet connection with standard operating system and standard word processor and worksheet software	10 nos.
2.	UPS - 500Va	10 nos.
3.	Scanner cum Printer	1 no.
4.	Computer Tables	10 nos.
5.	Computer Chairs	20 nos.
6.	LCD Projector	1 no.
7.	White Board 1200mm x 900mm	1 no.
Note: Above Tools &Equipments not required, if Computer LAB is available in the institute.		

ANNEXURE-II

FORMAT FOR INTERNAL ASSESSMENT

Name & Address of the Assessor:			**Year of Enrollment:**
Name & Address of ITI (Govt./Pvt.):			**Date of Assessment:**
Name & Address of the Industry:			**Assessment location: Industry / ITI**
Trade Name:	**Semester:**		**Duration of the Trade/course:**
Learning Outcome:			

SNo	**Candidate Name**	**Father's/Mother's Name**	Safety Consciousness (15)	Workplace Hygiene (5)	Attendance/ Punctuality (10)	Ability to Follow Manuals/ Written Instructions (5)	Application of Knowledge (10)	Skills to Handle tools &Equipment (10)	Economical Use of Materials (5)	Speed in Doing Work (10)	Quality in Workmanship (15)	VIVA (15)	**Total Internal Assessment Marks**	**Result (Y/N)**
Maximum Marks (Total 100 Marks)			**15**	**5**	**10**	**5**	**10**	**10**	**5**	**10**	**15**	**15**		
1														
2														