MECHANIC DIESEL

COMPETENCY BASED CURRICULUM

(Duration: 2 Yrs.)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL- 5

SECTOR – AUTOMOBILE

सत्यमेव जयते

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

Directorate General of Training

Skill India
कौशल भारत-कुशल भारत

MECHANIC DIESEL

(Revised in 2018)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL - 5

Developed By

Ministry of Skill Development and Entrepreneurship
Directorate General of Training
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
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Special acknowledgement is extended by DGT to the following expert members who had contributed immensely in this curriculum.

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CONTENTS

1. BACKGROUND

1.1 Apprenticeship Training Scheme under Apprentice Act 1961

The Apprentices Act, 1961 was enacted with the objective of regulating the Programme of training of apprentices in the industry by utilizing the facilities available therein for imparting on-the-job training. The Act makes it obligatory for employers in specified industries to engage apprentices in designated trades to impart Apprenticeship Training on the job in industry to school leavers and person having National Trade Certificate(ITI pass-outs) issued by National Council for Vocational Training (NCVT) to develop skilled manpower for the industry**.** There are four categories of apprentices namely**; trade apprentice, graduate, technician and technician (vocational) apprentices.**

Qualifications and period of apprenticeship training of **trade apprentices** vary from trade to trade. The apprenticeship training for trade apprentices consists of basic training followed by practical training. At the end of the training, the apprentices are required to appear in a trade test conducted by NCVT and those successful in the trade tests are awarded the National Apprenticeship Certificate.

The period of apprenticeship training for graduate (engineers), technician (diploma holders and technician (vocational) apprentices is one year. Certificates are awarded on completion of training by the Department

1.2 Changes in Industrial Scenario

Recently we have seen huge changes in the Indian industry. The Indian Industry registered an impressive growth during the last decade and half. The number of industries in India have increased manifold in the last fifteen years especially in services and manufacturing sectors. It has been realized that India would become a prosperous and a modern state by raising skill levels, including by engaging a larger proportion of apprentices, will be critical to success; as will stronger collaboration between industry and the trainees to ensure the supply of skilled workforce and drive development through employment. Various initiatives to build up an adequate infrastructure for rapid industrialization and improve the industrial scenario in India have been taken.

1.3 Reformation

The Apprentices Act, 1961 has been amended and brought into effect from 22nd December, 2014 to make it more responsive to industry and youth. Key amendments are as given below:

- Prescription of number of apprentices to be engaged at establishment level instead of trade-wise.
- Establishment can also engage apprentices in optional trades which are not designated, with the discretion of entry level qualification and syllabus.
- Scope has been extended also to non-engineering occupations.
- Establishments have been permitted to outsource basic training in an institute of their choice.
- The burden of compliance on industry has been reduced significantly.

2. TRAINING SYSTEM

2.1 GENERAL

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

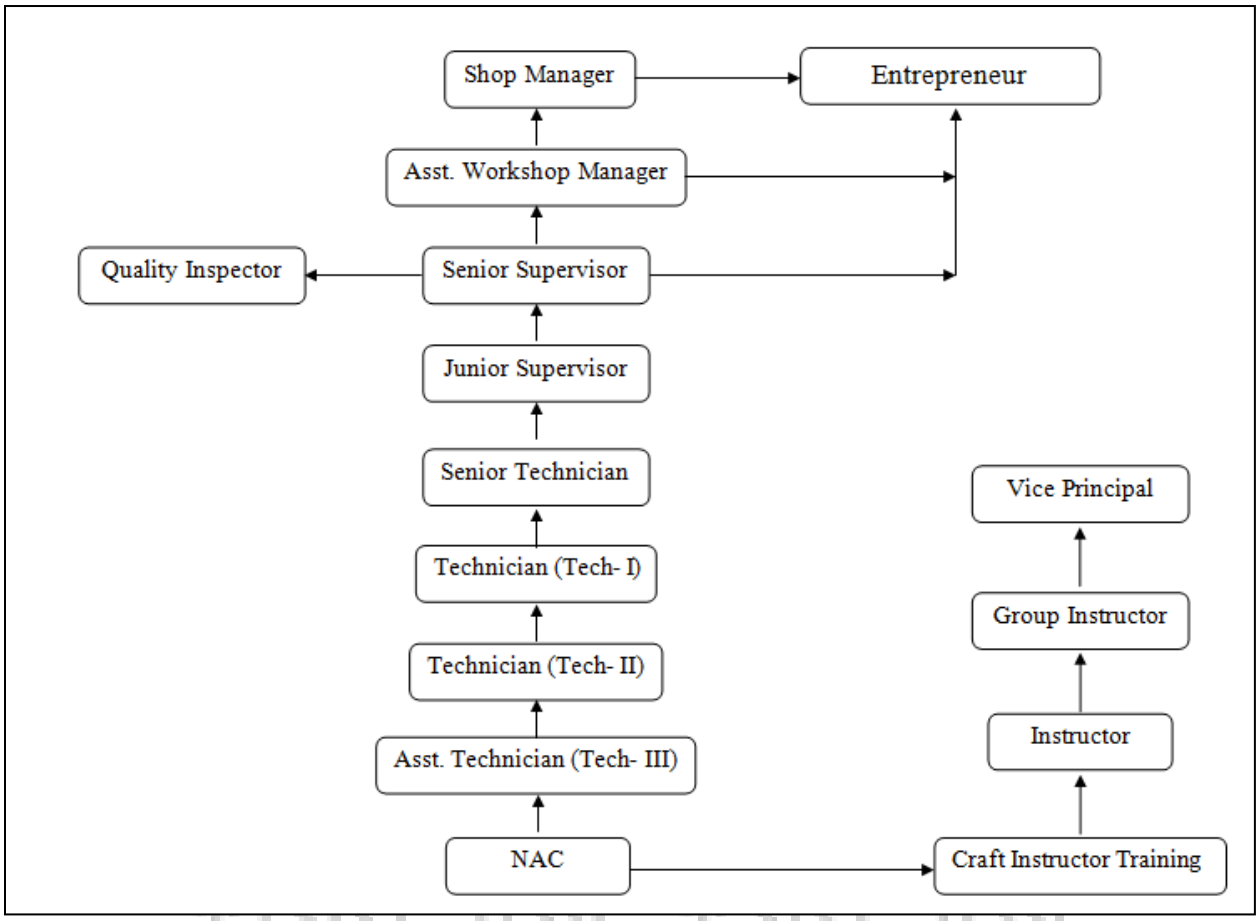
Mechanic Diesel trade under ATS is one of the most popular courses delivered nationwide through different industries. The course is of two years (02 Blocks) duration. It mainly consists of Domain area and Core area. In the Domain area Trade Theory & Practical impart professional - skills and knowledge, while Core area - Workshop Calculation and science, Engineering Drawing and Employability Skills imparts requisite core skills & knowledge and life skills. After passing out the training programme, the trainee is being awarded National Apprenticeship Certificate (NAC) by NCVT having worldwide recognition.

Broadly candidates need to demonstrate that they are able to:

- Read & interpret technical parameters/document, plan and organize work processes, identify necessary materials and tools;
- Perform task with due consideration to safety rules, accident prevention regulations and environmental protection stipulations;
- Apply professional skill, knowledge, core skills & employability skills while performing jobs and solve problem during execution.
- Perform engine vacuum test, engine compression and engine oil pressure test, interpret and conclude the results
- Document the technical parameters related to the task undertaken.
- Perform Service, Overhauling, and Repair in Various Diesel Engines and System and Parts of Diesel Engine.

2.2 CAREER PROGRESSION PATHWAYS:

- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming instructor in ITIs.
- Indicative pathways for vertical mobility.



2.3 COURSE STRUCTURE:

Table below depicts the distribution of training hours across various course elements during a period of two years (*Basic Training and On-Job Training*): -

Total training duration details: -

Time (in months)	1-3	4-12	13-15	16-24
Basic Training	**Block– I**	**-----**	**Block – II**	**------**
Practical Training (On - job training)	**----**	**Block – I**	**------**	**Block – II**

A. Basic Training

For 02 yrs. Engg. Course :-(**Total 06 months:** 03 months in 1st yr. + 03 months in 2nd yr.)

For 01 yr. Engg. course :-(**Total 03 months:** 03 months in 1st yr.)

Sl. No.	Course Element	Total Notional Training Hours	
		For 02 yrs. course	**For 01 yr. course**
1	Professional Skill (Trade Practical)	550	275
2	Professional Knowledge (Trade Theory)	240	120
3	Workshop Calculation & Science	40	20
4	Engineering Drawing	60	30
5	Employability Skills	110	55
	Total (including Internal Assessment)	**1000**	**500**

B. On-Job Training:-

For 02 yrs. Engg. Course :- (**Total 18 months:** 09 months in 1st yr. + 09 months in 2nd yr.)

Notional Training Hours for On-Job Training: 3120 Hrs.

For 01 yr. Engg. course :-(**Total 12 months**)

Notional Training Hours for On-Job Training: 2080 Hrs.

C. Total training hours:-

Duration	Basic Training	On-Job Training	Total
For 02 Engg. yrs. course	1000 hrs.	3120 hrs.	4120 hrs.
For 01 yr. Engg. course	500 hrs.	2080 hrs.	2580 hrs.

2.4 ASSESSMENT & CERTIFICATION:

The trainee will be tested for his skill, knowledge and attitude during the period of course and at the end of the training programme as notified by Govt of India from time to time. The Employability skills will be tested in first two semesters only.

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 have to maintain individual *trainee portfolio* as detailed in assessment guideline (section-2.4.2). 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 NAC will be conducted by NCVT on completion of course as per guideline of Govt 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 basis for setting question papers for final assessment. The examiner during final examination will also check** individual trainee's profile as detailed in assessment guideline (section-2.4.2) before giving marks for practical examination.

2.4.1 PASS REGULATION

The minimum pass percent for Practical is 60% & minimum pass percent for Theory subjects 40%. The candidate pass in each subject conducted under all India trade test.

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 assessment. Due consideration should be given while assessing for team work, avoidance/reduction of scrap/wastage and disposal of scarp/wastage as per procedure, behavioral attitude, sensitivity to 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 examination body. The following marking pattern to be adopted while assessing:

Mechanic Diesel

Performance Level	Evidence
(a) Weightage in the range of 60 -75% to be allotted during assessment	
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.	• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment • Below 70% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • 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	
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.	• Good skill levels in the use of hand tools, machine tools and workshop equipment • 70-80% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • 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	
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/accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • 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 Engine

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. 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. 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.

Reference NCO 2015: 7233.0400 - Mechanic, Diesel Engine

4. NSQF LEVEL COMPLIANCE

NSQF level for Mechanic Diesel trade under ATS: **Level 5**

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 trade under ATS mostly matches with the Level descriptor at Level- 5.

The NSQF level-5 descriptor is given below:

Level	Process Required	Professional Knowledge	Professional Skill	Core Skill	Responsibility
Level 5	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.

5. GENERAL INFORMATION

Name of the Trade	MECHANIC DIESEL
NCO-2004	7233.0400
NSQF Level	Level – 5
Duration of Apprenticeship Training (Basic Training + On-Job Training)	Two years (02 Blocks each of one year duration).
Duration of Basic Training	a) Block –I : 3 months b) Block – II : 3 months **Total duration of Basic Training: 6 months**
Duration of On-Job Training	a) Block–I: 9 months b) Block–II : 9 months **Total duration of Practical Training: 18 months**
Entry Qualification	10th Passed
Selection of Apprentices	The apprentices will be selected as per Apprenticeship Act amended time to time.
Instructors Qualification for Basic Training	As per ITI instructors qualifications as amended time to time for the specific trade.
Infrastructure for Basic Training	As per related trade of ITI.
Examination	The internal examination/ assessment will be held on completion of each block. Final examination for all subjects will be held at the end of course and same will be conducted by NCVT.
Rebate to Ex-ITI Trainees	01 year
CTS trades eligible for Mechanic Diesel Apprenticeship	1. Mechanic Diesel

Note:

- *Industry may impart training as per above time schedule for different block, however this is not fixed. The industry may adjust the duration of training considering the fact that all the components under the syllabus must be covered. However the flexibility should be given keeping in view that no safety aspects is compromised.*
- *For imparting Basic Training the industry to tie-up with ITIs having such specific trade and affiliated to NCVT.*

6. LEARNING OUTCOME

6.1GENERIC LEARNING OUTCOME

The following are minimum broad Common Occupational Skills/ Generic Learning Outcome after completion of the Mechanic Diesel course of 02 years duration under ATS.

Block I & II:-

1. Recognize & comply 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 –Unit, Fraction, Properties of Material, Average, Mass, Weight and Density, Percentage, Force, Speed and Velocity, Mansuration, Algebra, Work Power and Energy, Trigonometry, Friction, Heat & Temperature, Basic Electricity, Heat treatment, Graph, Transmission of Power, C0oncept of Pressure]*
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, scales, Different Projections, Machined components & different thread forms, Assembly drawing, Sectional views, Estimation of material, Electrical & electronic symbol]*
4. Select and ascertain measuring instrument 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 organize the work related to the occupation.

6.2 SPECIFIC LEARNING OUTCOME

Block – I

1. MEASURING PRACTICE – taper measurement of the given job and flatness of the given job
2. Practice on Hacksawing and filing to given dimensions.
3. Practice on Marking and Drilling clear and Blind Holes.

4. Construction of simple electrical circuits.
5. Diagnose series, parallel, series parallel circuits using Ohm's law,
6. Check electrical circuit with a test lamp.
7. Use of service manual wiring diagram for troubleshooting.
8. Observe and report the reading of Tachometer, Odometer, temp and Fuel gauge under ideal and on load condition.
9. Perform engine vacuum test, engine compression and engine oil pressure test, interpret and conclude the results.
10. Service Cooling System and Its Parts.
11. Service Lubricating System And Its Parts.
12. Perform a battery load test.
13. Perform jump start an engine with jumper cables.
14. Maintenance of Battery.
15. Inspect, test and diagnose starting system.
16. Inspect, test and diagnose charging system.
17. Test alternator in an auto electrical test bench.
18. Test starter in an auto electrical test bench.

Block – II

19. Service and Inspect an Intake system.
20. Service and Inspect an exhaust system.
21. Overhauling Of Cylinder Head Assembly.
22. Overhauling Of Cylinder Block Assembly.
23. Service Fuel Feed System.
24. Diagnose engine electronic problems with scan tool.
25. Diagnose sensor problems.
26. Inspect and test an exhaust system.
27. Test and service a catalytic converter.
28. Perform a shaft balancing test of a turbo charger.
29. Check low and high pressure fuel circuits using gauges.
30. Diagnose instrument panel board warning light problems.
31. Perform preventive maintenance of a AC generator.

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

7. LEARNING OUTCOME WITH ASSESSMENT CRITERIA

GENERIC LEARNING OUTCOME	
LEARNING OUTCOMES	**ASSESSMENT CRITERIA**
1. Recognize & comply 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 off 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 in regard 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, explain different mathematical calculation & science in the field of study including basic	2.1 Explain concept of basic science related to the field such as Material science, Mass, weight, density, speed, velocity, heat & temperature, force, motion, pressure, heat treatment, centre of gravity, friction.

electrical and	
apply in day to day work.*[[Different mathematical calculation & science –Unit, Fraction, Properties of Material, Average, Mass, Weight and Density, Percentage, Force, Speed and Velocity, Mansuration, Algebra, Work Power and Energy, Trigonometry, Friction, Heat & Temperature, Basic Electricity, Heat treatment, Graph, Transmission of Power, C0oncept of Pressure]*	2.2 Measure and Calculate dimensions of Parts or Assembly
	2.3 Use Measuring Tools to measure for Engine Parts to specification.
	2.4 Comply 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 & 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, scales, Different Projections, Machined components & different thread forms, Assembly drawing, Sectional views, Estimation of material, Electrical & electronic symbol]*	3. 1. Read & interpret the information on drawings and apply in executing practical work.
	3. 2. Read & analyse the specification to ascertain the material requirement, tools, and machining /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 ascertain measuring instrument and measure dimension of components and record data.	4.1 Select appropriate measuring instruments such as micrometers, vernier calipers, dial gauge, bevel protector and height gauge (as per tool list).
	4.2 Ascertain the functionality & correctness of the instrument.
	4.3 Measure dimension of the components & record data to analyse the with given drawing/measurement.
5. Explain the concept in productivity, quality tools, and	5.1 Explain the concept of productivity and quality tools and apply during execution of job.

labour welfare legislation and apply such in day to day work to improve productivity & quality.	5.2 Understand the basic concept of labour welfare legislation and adhere to responsibilities and remain sensitive towards such laws.
	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 familiarizes 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 organize 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. Assign roles and responsibilities of the co-trainees for execution of the task effectively and monitor the same.
SPECIFIC OUTCOME	
<u>Block-I & II (Section:10)</u>	
*Assessment Criteria i.e. the standard of performance, for each specific learning outcome mentioned under **block – I & block – II** (section: 10) must ensure that the trainee achieves well developed skill with clear choice of procedure in familiar context. Assessment criteria should broadly cover the aspect of **Planning** (Identify, ascertain, estimate etc.); **Execution** (perform, illustration, demonstration etc. by applying 1) a range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials and information 2) Knowledge of facts, principles, processes, and general concepts, in a field of work or study 3)Desired Mathematical Skills and some skill of collecting and organizing information, communication) and **Checking/ Testing** to ensure functionality during the assessment of each outcome. The assessments parameters must also ascertain that the candidate is responsible for own work and learning and some responsibility for other's work and learning.*	

8. SYLLABUS

BASIC TRAINING (Block – I)

Duration: (03) Three Months

Week No.	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
1.	ADMISSION AND ORIENTATION OF THE COURSE. 1. Admission formalities and orientation of the course. GENERAL SHOP SAFETY 2. First aid and Fire safety, Use of fire extinguishers. 3. Identify fuels, oils and chemicals used in the engines and accessories-handling of shop safety equipment-handling of safety devices-first aid- practice on hazard waste disposal.	**Admission & introduction to the trade:** Introduction to the Course duration, course content, study of the syllabus. **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 Electrical safety tips.
2.	MEASURING SYSTEMS AND MEASUREMENTS 4. Practice on measuring on the given jobs- measuring space with a feeler gauge- measuring the given jobs with precision measuring instruments- checking external and internal diameter and run outs-measure straightness on the given job.	Measuring systems and types- description of steel rule- description of feeler gauge- constructional details and working principle of precision measuring instruments like Vernier caliper, micrometer, bore gauge and dial gauge- description of surface plate and V blocks- importance of correct roundness-surface finish and its importance.
3.	BASIC HAND TOOLS 5. Practice on marking and cutting of a given job- file the job to bring required size- practice on drilling, tapping and dying-reaming practice- repair damaged threads- - sharpening the tools.	Details of various types of marking and cutting tools- punch, scriber, hammer and mallets, hack saw frame and blade, chisels etc. – marking media-description of work holding devices like vices- details of various drill bits- description and types of drilling machines- details of taps, dies and reamers- details of screw extractors- details of bench grinders- safety precautions to be observed while working with hand tools and lifting& carrying components and

		equipment.
4.	FASTENERS AND BEARINGS 6. Practice on general cleaning, checking and on loosening and tightening of various types of screwing joints using screwing tools. Removal of broken stud /bolt from blind hole. 7. Remove and replace bearings from the given jobs.	Threads- thread categorization- types of threads- types of screwed joints- types of nuts- property classes of bolts- screw locking arrangements- types and description of screwing tools- description and types different types of bearings.
5.	BASIC WELDING AND SHEET METAL 8. Practice on heating, cutting using welding torch. 9. Practice on making Rectangular Tray. Pipe bending, fitting nipples unions in pipes. Soldering and Brazing of Pipes.	Basics of gas welding, constructional and working principle of gas and acetylene welding equipment. 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. Different types of pipe fittings.
6.	BASIC HYDRAULICS AND PNEUMATICS 10. Construction of hydraulic circuits using all frequently used valves like check valves, flow control valve, pressure relief valve, actuators, directional control valves, hydraulic accumulator, etc. 11. Exercise on using impact wrenches.	Fundamentals of Hydraulics & Pneumatics. Symbols of various Hydraulics & Pneumatic elements. Application of different types of hydraulic components. Description of air compressors, impact wrenches. Description of Power tools and equipment. Safety precautions to be observed while working with Hydraulic and pneumatic equipment.
7.	BASIC ELECTRICAL AND ELECTRONICS 12. Identify and interpret electrical/electronic system concern. 13. Practice on measuring circuit voltage, ampere and resistance. 14. Practice on measuring voltage drop. 15. Practice on installing crimp connector and terminal end. 16. Practice on soldering wires. 17. Practice on testing fuses and	General principles of electrical engineering- structure of atoms- voltage- current- fuses- electrical conduction- current direction- types of current- voltage drop- resistance- PTC and NTC resistors- types of resistors- ohm's law- resistor circuits- electro magnetism- electromagnetic induction- description of multi-meter- function and types of relays- semiconductors- N type and P type semiconductors- description of diodes and transistors. safety precautions to be observed while working with

	relays- test diodes	electrical equipment.
8.	18. Identification of different type of Vehicle. 19. Demonstration of vehicle specification data; 20. Identification of vehicle information 21. Number (VIN). 22. Demonstration of Garage, Service station equipment. 23. Vehicle hoists – Two post and four post hoist, Engine hoists, Jacks**,** Stands.	Auto Industry - History, leading manufacturers, development in automobile industry, trends, new product. 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. Generator Sets – leading Manufacturers, development in the field. Brief description and uses of Vehicle hoists – Two post and four post hoist, Engine hoists, Jacks**,** Stands
9.	24. Identification of major components of diesel engine and its accessories. 25. Different types of Starting and Stopping Method of Diesel Engine.	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) & spark ignition engine(S.I)**,** 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. General Description of Motor Vehicles
10.	COOLING AND LUBRICATING SYSTEM 26. Drain, flush and refill cooling system- remove and replace drive belt and hoses- remove and replace coolant pump- remove and replace radiator and fan assembly- test thermostat. 27. Drain engine oil- change oil filter- replace new engine oil- blotting paper test- remove and replace oil pump- remove, clean and replace oil cooler.	Engine operating temperature- requirements of cooling system- types of cooling system and its description- description of pump circulating system components- radiator and its types- Oil cooler description- expansion tank- details of radiator pressure cap- coolant pump- construction and working- fan- rigid and variable drive- electrically driven fans- viscous coupling- types of thermostat and its description Functions of a lubricating system- description of different types of lubricating systems- forced feed and dry sump lubrication- list out engine lubricating components- description of different types of oil pumps- gear, rotor and crescent oil pumps- oil pressure limiting valves- types of

		oil filtering systems and its description- description of oil cooler- crank case ventilation
11-13.	BATTERY 28. Remove and connect battery terminal from a battery- clean terminals- check voltage of a battery- check cranking voltage- check charging voltage- top up distilled water up to the level- connecting two batteries in series- charging a battery – test battery- specific gravity test. LIGHTING SYSTEMS 29. Practice on tracing wiring circuit of lighting system. 30. Identification of various lights installed in vehicle. STARTING SYSTEM 31. Remove and replace starter- check starting system wiring harness- test ignition switch- remove and replace starter relay- dismantle and assemble starter. CHARGING SYSTEM 32. Checks the operation of the charging system- perform voltage drop tests- remove and replace alternator- dismantle and reassemble alternator.	Purpose of battery- types- construction and working principle of a lead acid battery- maintenance free batteries- battery ratings- battery charging methods- trouble shooting a battery. Description of Lighting system in EMM, reading Instrument panel light. Study about wiring diagram of a stating system- Principle of starter- components of a starter- construction and working of starter- starter field coil design- solenoids- types and function. Study about wiring diagram of a charging system- construction and working principle of alternator- description of voltage regulator operation.
	Internal Assessment/Examination 03days	

Note: - *More emphasis to be given on video/real-life pictures during theoretical classes. Some real-life pictures/videos of related industry operations may be shown to the trainees to give a feel of Industry and their future assignment.*

BASIC TRAINING (Block – II)
Duration: (03) Three Months

Week No.	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
1	INTAKE AND EXHAUST SYSTEMS 33. Remove, clean and replace intake system- remove and replace exhaust manifold, silencer and exhaust pipe -remove and replace catalytic converter.	Description of air induction system- description of intake and exhaust manifold- details of various types of catalytic converters- details of various types of mufflers- trouble shooting in intake and exhaust systems.
2.	CYLINDER HEAD ASSEMBLY 34. Remove accessories fitted with the diesel engine. 35. Remove and dismantle cylinder head. 36. Clean and lubricate cylinder head components viz. valve, valve guide, valve seats, valve spring, timing belt, rocker arm and cam shaft. 37. Reassemble and refit cylinder head components- set valve timing- adjust valve clearance.	Description of different types engine according to valve arrangements- cylinder head design- details of arrangement of valves in engines- valve timing diagram of a diesel engines- details of arrangement of camshaft in engines- multiple valve technology- detailed description of valve components- details of camshaft drives- valve clearance- description of hydraulic valves- description of variable engine timing technology.
3.	CYLINDER BLOCK ASSEMBLY 38. Dismantle engine block components- clean and lubricate components viz. Crank shaft, main and connecting rod bearings, piston, piston rings, connecting rods, fly wheel and vibration damper- tighten cylinder head bolts-reassemble engine block assembly.	Functions of a cylinder- cylinder types and description- types of cylinder liners- description of cylinder head gasket- functions of a piston- types and material used for piston- connecting rod- functions- material and design of connecting rod- crank shaft- functions- material and design of crank shaft- fly wheel- description of vibration damper.
4&5	DIESEL FUEL SYSTEM (INLINE AND ROTARY PUMPS) 39. Clean fuel tank- remove and replace fuel filters- check leaks in fuel system-remove and replace fuel hoses- removing and refitting	Lay out of diesel fuel systems- description of fuel tank- details of low pressure pump- importance of clean fuel- types of fuel filters and its description- construction and working of different types of fuel injection pumps- types and working of governor-

	fuel injection pump and injectors- setting injection timing- bleed fuel system CRDI SYSTEM 40. Disconnect and connect fuel supply hoses- relief fuel pressure- check fuel leakage- remove and install high pressure pipe line- remove and install fuel injector- remove and replace high pressure fuel pump- flush fuel tank- remove, test and replace fuel pump- replace fuel.	description of injectors- different types of nozzles. Common rail direct injection system – need, advantages- layout of common rail direct injection system- low pressure and high pressure circuits- components of CRDI system- working principle of common rail direct injection system.
6	ENGINE CONTROL SYSTEMS 41. Practice on tracing input sensor wiring and connectors-remove and replace sensors- remove and replace ECU.	Description of electronic control system- classification of sensors- description of various types of sensors-Function and working principle of sensors. Description of OBD.
7	EMISSION CONTROL SYSTEM 42. Test and service an exhaust gas recirculating valve- remove and replace EGR valve- clean an EGR valve and passages.	Details of air pollution and emissions- emission standards- description of smoke meter- types and description- exhaust gas recirculation system design and operation.
8.	SUPER CHARGERS AND TURBO CHARGERS 43. Remove and replace super charger- dismantle and assemble super charger- dismantle and assemble turbo chargers.	Need for super charging-effects of increasing volumetric efficiency- description of super charging systems- working principle of a super charger- description of turbo charger- components of turbo charger and its functions- boost pressure control- description of variable turbine geometry.
9.	GAUGES AND WARNING LIGHTS 44. Remove and replace gauges in the panel board- start the engine and observe the readings shown in the gauges	Description about temperature and fuel gauges- purpose and types of warning lights- their description.
10.	PRESSURE TIME FUEL SYSTEM -MARINE SYSTEM 45. Remove and replace fuel pump	Constructional details and working principle of PT injector fuel system- trouble shooting in PT fuel injection

	and fuel injector in PT fuel systems- check leakages in fuel hoses- clean fuel lines- set injection timing in PT system.	system- **Marine 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.
11	POWER GENERATION 46. Precautions to be observed while loading the generator set- test AC supply with multimeter in breaker input side- clean breaker unit- clean AC generator components with compressed low pressure dry air- check the wire for any damages- lubricate the bearings.	Basic principle of AC generator- components of AC generator- constructional details and working principle of AC generator-trouble shooting in diesel gen sets.
12	47. MAINTENANCE OF A DIESEL ENGINE AND GEN SET 48. Check and top up coolant and engine oil level- clean and replace air filter- 49. Practice on checking and adjusting drive belt tension. 50. Check oil leaks in an engine. 51. Check vacuum and fuel hoses for any damages and leaks.	Details about the coolant- description and types- importance of correct ratio of distilled water and coolant-details of engine oil- types, grade and specification- description about the various belts using in engines- importance of clean air filter- types of oil filters and air filters.
13.	52. Verifying control panel readings and indicators of Gen sets.	Importance of Maintenance schedule of Gen sets.
	Internal Assessment/Examination 03days	

Note: - *More emphasis to be given on video/real-life pictures during theoretical classes. Some real-life pictures/videos of related industry operations may be shown to the trainees to give a feel of Industry and their future assignment.*

9. SYLLABUS - CORE SKILLS

9.1 WORKSHOP CALCULATION SCIENCE & ENGINEERING DRAWING

Block – I		
Sl. No.	**Workshop Calculation and Science (Duration: - 20 hrs.)**	**Engineering Drawing (Duration : - 30 hrs.)**
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** - Viewing of engineering drawing sheets. - Method of Folding of printed Drawing Sheet as per BIS SP:46-2003
2.	**Fractions**: Fractions, Decimal fraction, Addition, Subtraction, Multiplication and Division of Fractions and Decimals, conversion of Fraction to Decimal and vice versa. Simple problems using Calculator.	**Drawing Instruments : their 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.	**Properties of Material** : 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 Alloys.	**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.	**Average :** Problems of Average. **Ratio & Proportion** : Simple calculation on related problems.	**Drawing of Geometrical Figures:** Drawing practice on: - Angle: Measurement and its types, method of bisecting. - Triangle -different types - Rectangle, Square, Rhombus, Parallelogram. - Circle and its elements.
5.	**Mass, Weight and Density**: Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density.	**Dimensioning:** - Definition, types and methods of dimensioning (functional, non-functional and auxiliary) - Types of arrowhead

		- Leader Line with text
6.		**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
7.	**Percentage**: Introduction, Simple calculation. Changing percentage to decimal and fraction and vice-versa.	**Method of presentation of Engineering Drawing** - Pictorial View - Orthogonal View - Isometric view
8.	Forces definition. - Definition and example of compressive, tensile, shear forces, axial and tangential forces. Stress, strain, ultimate strength, factor of safety for MS. **Speed and Velocity**: Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation.	**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
9.	**Menstruation:** 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. - Area of cut-out regular surfaces: circle and segment and sector of circle. - Volume of cut-out solids: hollow cylinders, frustum of cone, block section. - Volume of simple solid blocks	**Dimensioning practice:** - Position of dimensioning (unidirectional, aligned, oblique as per BIS SP:46-2003) - Symbols preceding the value of dimension and dimensional tolerance.
10.	**Algebra** : Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables). - Circular Motion: Relation between circular motion and Linear motion, Centrifugal force, Centripetal force.	**Construction of Geometrical Drawing Figures:** - Polygons and their values of included angles. - Conic Sections (Ellipse)

11.	**Work, Power and Energy**: work, unit of work, power, unit of power, Horse power, mechanical efficiency, energy, use of energy, potential and kinetic energy, examples of potential energy and kinetic energy.	**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. Drawing of Orthographic projection from isometric/3D view of blocks

Block – II		
Sl. No.	**Workshop Calculation and Science (Duration: - 20 hrs.)**	**Engineering Drawing (Duration: - 30 hrs.)**
1.	**Trigonometry:** Trigonometric ratios, Trigonometric tables. - Finding the value of unknown sides and angles of a triangle by Trigonometrically method. - Finding height and distance by trigonometry.	Machined components; concept of fillet & chamfer; surface finish symbols.
2.	**Friction** and its application in Workshop practice.	Screw thread, their standard forms as per BIS, external and internal thread, conventions on the features for drawing as per BIS.
3.	**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.	Reading & interpretation of assembly drawing and detailing.
4.	**Basic Electricity**: Introduction, use of electricity, 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. Concept of earthing.	Reading of drawing. Simple exercises related to missing lines, dimensions and views. How to make queries.
5.	**Heat treatment** – Necessity, different common types of Heat treatment.	- Simple exercises related to trade related symbols. - Solution of NCVT test papers.
6.	**Graph:** - Read images, graphs, diagrams bar chart, pie chart. - Graphs: abscissa and ordinates, graphs of straight line, related to two sets of varying quantities.	
7.	**Transmission of power:** By belt, pulleys & gear drive.	
8.	**Concept of pressure** – units of pressure, atmospheric pressure, gauge pressure –	

	gauges used for measuring pressure. **Introduction to pneumatics & hydraulics systems.** Solution of NCVT test papers	

9.2 EMPLOYABILITY SKILLS

(DURATION: - 110 HRS.)

Block – I **(Duration – 55 hrs.)**	
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 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	Duration : 20 Hrs. Marks : 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	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
Block – II **Duration – 55 hrs.**	
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. Different Between Small Scale & Large Scale Business, Market Survey, Method of marketing, Publicity and advertisement, Marketing Mix.
Institutions 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 familiarizes 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 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 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 hygienic, 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 House-keeping, Practice of good Housekeeping.
Quality Tools	Basic quality tools with a few examples.

10. DETAILS OF COMPETENCIES (ON-JOBTRAINING)

BROAD LEARNING TO BE COVERED IN INDUSTRY FOR MECHANIC DIESEL TRADE:

1. Safety and best practices /Basic Industrial Culture (5S, KAIZEN, etc.)
2. Record keeping and documentation
3. Making components observing different metal removing procedure and perform different fitting job.
4. Assembling of different components as per requirement and check functionality.
5. Carryout maintenance of different Diesel Engines and Various systems of Engines.

Note: Actual training will depend on the existing facilities available in the establishments.

The **competencies/ specific outcomes** on completion of On-Job Training are detailed below: -

BLOCK – I (09 Months)

1. MEASURING PRACTICE – taper measurement of the given job and flatness of the given job
2. Practice on Hacks awing and filing to given dimensions.
3. Practice on Marking and Drilling clear and Blind Holes
4. Construction of simple electrical circuits
5. Diagnose series, parallel, series parallel circuits using Ohm's law,
6. Check electrical circuit with a test lamp.
7. Use of service manual wiring diagram for troubleshooting.
8. Observe and report the reading of Tachometer, Odometer, temp and Fuel gauge under ideal and on load condition.
9. Perform engine vacuum test, engine compression and engine oil pressure test, interpret and conclude the results
10. SERVICE COOLING SYSTEM-
    a. perform cooling system pressure tests, inspect and test radiator, pressure cap, coolant recovery tank, and hoses; determine necessary action
    b. inspect, replace and adjust drive belts, tensioners, and pulleys; check pulley and belt alignment

c. inspect, test, and replace thermostat

d. inspect and test fan (electrical)

11. SERVICE LUBRICATING SYSTEM- change engine oil and filter, flush lubricating system, ervice oil pump
12. Perform a battery load test
13. Perform jump start an engine with jumper cables
14. Maintenance of Battery
15. Inspect, test and diagnose starting system
16. Inspect, test and diagnose charging system
17. Test alternator in an auto electrical test bench
18. Test starter in an auto electrical test bench

B. BLOCK – II (09 Months)

19. Service and Inspect an Intake system
20. Service and Inspect an exhaust system
21. OVERHAULING OF CYLINDER HEAD ASSEMBLY

    Dismantle engine head assembly, visual inspection of components for cracks, check gasket surface areas for warpage and surface finish, inspect and measure valves, valve seats and valve spring, replace valve seats and valves, valve lapping, replace valve guide, check valve stem- to- guide clearance, reaming valve guide for correct clearance, inspect and measure rocker assembly, determine necessary action, Inspect and measure cam shaft run out, journal and cam lobe wear, Inspect valve lifters, Inspect and replace drive belt/chain, reassemble engine head assembly

22. OVERHAULING OF CYLINDER BLOCK ASSEMBLY

    Dismantle engine block assembly, Inspect engine block for visible cracks and surface warpage, Inspect and measure cylinder walls/sleeves for damage, wear and ridges, Inspect and measure crank shaft for journal wear, Inspect and measure main and connecting rod bearings for wear, Determine piston to bore clearance, Inspect, measure and install piston rings, Service oil pump, measure oil pump components, Reassemble engine block components, Adjust valve clearance

23. SERVICE FUEL FEED SYSTEM
    Clean fuel tank, service low pressure pump, service fuel filter, phasing and calibration of fuel injection pump, service and test injectors, Check low and high pressure fuel circuits using gauges, Calibrating a CRDI pump

24. Diagnose engine electronic problems with scan tool
25. Diagnose sensor problems
26. Inspect and test an exhaust system
27. Test and service a catalytic converter
28. Perform a shaft balancing test of a turbo charger
29. Check low and high pressure fuel circuits using gauges
30. Diagnose instrument panel board warning light problems
31. Perform preventive maintenance of a AC generator.

Note:

1. Industry must ensure that above mentioned competencies are achieved by the trainees during their on job training.
2. In addition to above competencies/ outcomes industry may impart additional training relevant to the specific industry.

ANNEXURE – I

INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

DIESEL MECHANIC			
LIST OF TOOLS AND EQUIPMENT for Basic Training (For 20 Apprentices)			
A. TRAINEES TOOL KIT (For each additional unit trainees tool kit Sl. 1-18 is required additionally)			
Sl. no.	**Name of the Tool &Equipments**	**Specification**	**Quantity**
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 with handle	0.5 kg	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	(6mm to 32mm	6
16	Spanners socket with speed handle, T-bar, ratchet and universal upto 32 mm set of 28 pieces with box	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” inch	6
B : INSTRUMENTS & GENERAL SHOP OUTFIT			
20.	Adjustable spanner	pipe wrench 350 mm	2
21.	Air blow gun with standard accessories		1
22.	Air impact wrench with standard accessories		4

23.	Air ratchet with standard accessories		4
24.	Allen Key set	12 pieces (2mm to 14mm)	4
25.	Alternator assembly		2
26.	Ammeter	300A/ 60A DC with external shunt	4
27.	Auto Electrical test bench		1
28.	Battery –charger		2
29.	Belt Tensioner gauge		1
30.	Caliper inside	15 cm Spring	4
31.	Calipers outside	15 cm spring	4
32.	Car Jet washer with standard accessories		1
33.	Chisel	10 cm flat	4
34.	Chisels cross cut	200 mm X 6mm	4
35.	Circlip pliers Expanding and contracting type	15cm and 20cm each	4
36.	Clamps C	100mm	2
37.	Clamps C	150mm	2
38.	Clamps C	200mm	2
39.	Cleaning tray	45x30 cm.	4
40.	Compression testing gauge suitable for diesel Engine with standard accessories		2
41.	Connecting rod alignment fixture		1
42.	Cylinder bore gauge capacity	20 to 160 mm	4
43.	Cylinder liner- Dry & wet liner, press fit & slidefit liner		1 each
44.	DC Ohmmeter	0 to 300 Ohms, mid scales at 20 Ohms	2
45.	Depth micrometer	0-25mm	4
46.	Dial gauge type 1 Gr. A (complete with clamping devices and with magnetic stand)		4
47.	Different type of Engine Bearing model		1 set
48.	Different type of piston model		1each
49.	Dividers	15 cm Spring	4
50.	Drift Punch Copper	15 Cm	4
51.	Drill twist by 0.5 mm	1.5 mm to 15 mm (various sizes)	4
52.	Electric Soldering Iron	230 V 60 watts 230 V 25 watts	2 each
53.	Electric tester		4
54.	Engineer's square	15 cm. Blade	4

55.	Engineers stethoscope		1
56.	Executive Auto Electrical tool kit		1
57.	Feeler gauge	20 blades (metric)	4
58.	File flat	20 cm bastard	4
59.	File, half round	20 cm second cut	4
60.	File, Square	20 cm second cut	4
61.	File, Square	30 cm round	4
62.	File, triangular	15 cm second cut	4
63.	Files assorted sizes and types including safe edge file		2 set
64.	Flat File	25 cm second cut	4
65.	Flat File	35 cm bastard	4
66.	Fuel feed pump for diesel		1
67.	Fuel injection pump (Diesel) inline		1
68.	Fuel injection pump dismantling tool kit /Universal Vice		1
69.	Fuel injection pump, VE pump / Distributor fuel rotary pump (DPC) pumps / along with special tools and accessories.		1 each
70.	Functional/experiment model of different type of sensors.		1 set
71.	Gloves for Welding (Leather and Asbestos)		5 sets
72.	Glow plug tester		2
73.	Granite surface plate	1600 x 1000 with stand and cover	1
74.	Growler		2
75.	Hacksaw frame	adjustable 20-30 cm	10
76.	Hammer Ball Peen	0.75 Kg	4
77.	Hammer Chipping	0.25 Kg	5
78.	Hammer copper	1 Kg with handle	4
79.	Hammer Mallet		4
80.	Hammer Plastic		4
81.	Hand operated crimping tool (i) for crimping up to 4mm and (ii) for crimping up to	10mm	2
82.	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	1 sets
83.	Hand vice –	37 mm	2

84.	Hollow Punch set of seven pieces	6mm to 15mm	2 sets each
85.	Impact screw driver		2
86.	Injector – Multi hole type, Pintle type		4 each
87.	Injector cleaning unit		1
88.	Injector tester (Hand tester)		1
89.	Insulated Screw driver	20 cm x 9mm blade	4
90.	Insulated Screw driver	30 cm x 9mm blade	4
91.	Magnifying glass	75mm	2
92.	Marking out table	90X60X90 cm.	1
93.	Multimeter digital		5
94.	Oil can	0.5/0.25 liter capacity	4
95.	Oil pump for dismantling and assembling.		2
96.	Outside micrometer	0 to 25 mm	4
97.	Outside micrometer	25 to 50 mm	4
98.	Outside micrometer	50 to 75 mm	1
99.	Outside micrometer	75 to 100 mm ,100 to 125 mm, 125 to 150 mm	1
100.	Philips Screw Driver set of 5 pieces	100 mm to 300 mm	2
101.	Piston ring compressor		2
102.	Piston Ring expander and remover.		2
103.	Piston Ring groove cleaner.		2
104.	Pliers combination	20 cm.	2
105.	Pliers flat nose	15 cm	2
106.	Pliers round nose	15 cm	2
107.	Pliers side cutting	15 cm	2
108.	Portable electric drill Machine		1
109.	Prick Punch	15 cm	4
110.	Punch Letter	4mm (Number)	2 set
111.	Radiator cut section-down flow		1
112.	Radiator pressure cap		2
113.	Scraper flat	25 cm	2
114.	Scriber	15 cm	2
115.	Scriber with scribing black universal		2
116.	Spanner D.E. set of 12 pieces	6mm to 32mm	4
117.	Spanner, adjustable 15cm.		2
118.	Spanner,	ring set of 12 metric sizes 6 to 32 mm.	4

119.	Spanners socket with speed handle, T-bar, ratchet and universal upto	32 mm set of 28 pieces with box	2
120.	Starter motor axial type, pre-engagement type & Co-axial type		1each
121.	Steel measuring tape	10 meter in a case	4
122.	Steel rule	15 cm inch and metric	4
123.	Steel rule	30 cm inch and metric	4
124.	Straight edge gauge	2 ft.	2
125.	Straight edge gauge	4 ft.	2
126.	Stud extractor set of	3	2 sets
127.	Stud remover with socket handle		1
128.	Surface gauge	with dial test indicator plunger type i.e. 0.01 mm	4
129.	Tachometer	Counting type	1
130.	Taps and Dies complete sets BSF		1 set
131.	Taps and wrenches	metric	2 sets
132.	Telescope gauge		4
133.	Thermostat		2
134.	Thread pitch gauge metric, BSW		2
135.	Torque wrenches	5-35 Nm, 12-68 Nm & 50-225 Nm	1 each
136.	Turbocharger cut sectional view		1
137.	Universal puller for removing pulleys, bearings		1
138.	V' Block	75 x 38 mm pair with Clamps	2
139.	Vacuum gauge to read	0 to 760 mm of Hg.	2
140.	Valve spring compressor universal.		1
141.	vernier caliper	0-300 mm with least count 0.02mm	4
142.	Vice grip pliers		2
143.	Wire Gauge (metric)		2
144.	Work bench	250 x 120 x 60 cm with 4 vices 12cm Jaw	4
145.	4 Point relays		2
146.	5 Point relays		2
147.	Vacuum pump gauge		1
148.	Glow plug wrench		1
149.	Oil seal remover		1
150.	Oil seal installer		1

151.	Valve guide remover		1
152.	Forceps		1
153.	Fly wheel holder		1
154.	Bearing puller		1
155.	Bearing installer		1
156.	Injection pump pulley remover		1
157.	Cam shaft pulley holder		1
158.	Cam shaft locking tool		1
159.	Oil filter wrench socket		1
160.	Oil pressure gauge		1
161.	Radiator pressure tester		1
162.	Fuel pressure gauge with adopters		1
C : GENERAL MACHINERY INSTALLATIONS			
163.	Diesel Engine – CRDI - 4 stroke for Dismantling and assembling with swiveling stand	4 Stroke Multi Cylinder Diesel Engine Mounted on swivelling stand with all accessories.	2 Nos.
164.	Diesel engine (Running condition) Stationary type with generator set 4 Cyl.	Actual Working Condition Stationary Diesel Engine Mounted on Caster wheel trolley	1 no.
165.	Bench grinder	Pedestal Type	2 nos.
166.	Drilling machine (general purpose)	Drilling machine (general purpose)	1 no.
167.	Hand operated Hydraulic press	Hand operated Hydraulic press	1set
168.	Multi Scan Tool with oscilloscope	Multi Scan Tool with oscilloscope	1set
169.	Working Condition of Diesel Engine – CRDI - 4 stroke Engine Assembly with fault simulation board (vehicular model)	Working Condition of Diesel Engine – CRDI - 4 stroke Engine Assembly with fault simulation board (vehicular model)	1 set

INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

TRADE: DIESEL MECHANIC

LIST OF TOOLS& EQUIPMENTS FOR -20APPRENTICES

1) Space Norms : 45 Sq. m.(For Engineering Drawing)

2) Infrastructure:

A : TRAINEES TOOL KIT:-			
Sl. No.	**Name of the items**	**Specification**	**Quantity**
1.	Draughtsman drawing instrument box		16
2.	Set square celluloid	45^o (250 X 1.5 mm)	16
3.	Set square celluloid	30^o-60^o (250 X 1.5 mm)	16
4.	Mini drafter		16
5.	Drawing board	(700mm x500 mm) IS: 1444	16
B : Furniture Required			
Sl. No.	**Name of the items**	**Specification**	**Quantity**
1	Drawing Board		16
2	Models : Solid & cut section		as required
3	Drawing Table for trainees		as required
4	Stool for trainees		as required
5	Cupboard (big)		01
6	White Board	size: 8ft. x 4ft	01
7	Trainer's Table		01
8	Trainer's Chair		01

TOOLS & EQUIPMENTS FOR EMPLOYABILITY SKILLS		
Sl. 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.		

TOOLS & EQUIPMENT FOR ON-JOB TRAINING

General Machinery Installations –

Sl. No.	Name & Description of Machines	Quantity
1	Diesel engine (Running condition) Stationary type with generator set 4 Cyl.	1
2	Multi Scan Tool with oscilloscope	1
3	Working Condition of Diesel Engine – CRDI - 4 stroke Engine Assembly with fault simulation board (vehicular model)	1
4	Drilling machine (general purpose)	1
5	Fuel Injection pump Test bench (in-line and Rotary pumps)	1
6	Fuel Injection pump Test bench (CRDI)	1

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:			

Sl. No	**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														