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

**COMPETENCY BASED CURRICULUM**

# MECHANIC TRACTOR

**(Duration: One Year)**

## CRAFTSMEN TRAINING SCHEME (CTS)

## NSQF LEVEL- 4

## SECTOR – AUTOMOTIVE

# MECHANIC TRACTOR

## (Engineering Trade)

**(Revised in 2015)**

**Version: 1.1**

## CRAFTSMEN TRAINING SCHEME (CTS)

## NSQF LEVEL- 4



Developed By

Ministry of Skill Development and Entrepreneurship
Directorate General of Training
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# ACKNOWLEDGEMENT

The DGT sincerely acknowledges contributions of the Industries, State Directorates, Trade Experts, Domain Experts and all others who contributed in revising the curriculum. Special acknowledgement is extended by DGT to the following expert members who had contributed immensely in this curriculum.

| **List of Expert members participated for finalizing the course curriculum of Mechanic Tractor Trade** | | | |
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## CONTENTS

# 1. COURSE INFORMATION

During the one-year duration a candidate is trained on subjects Professional Skill, Professional Knowledge, Engineering Drawing, Workshop Calculation Science and Employability Skills. In addition to this a candidate is entrusted to make/do project work and extra-curricular activities to build up confidence. The practical skills are imparted in simple to complex manner & simultaneously theory subject is taught in the same fashion to apply cognitive knowledge while executing task. The broad components covered in this course are as below:-

The learner is trained on various skills like, make choices to carry out marking of the components for basic fitting operations in the work shop; perform precision measurements on the components and compare parameters with specifications used in automotive work shop practices; use different types of tools and work shop equipment in the work shop; use different types of fastening and locking devices in a vehicle; perform basic fitting operations used in the work shop practices and inspection of dimensions etc. The trainee will learn to produce sheet metal components using various sheet metal operations; inspect the auto component using Non destructive testing methods; manufacture components with different types of welding processes in the given job; identify the hydraulic and pneumatic components in a vehicle; construct electrical circuits and test its parameters by using electrical measuring instruments and perform basic electrical testing in a vehicle.

The learner also learns to demonstrate Major Assemblies of Tractor; overhaul Diesel Engine of Tractor; perform servicing of Cooling and Lubrication system of Tractor; service Intake and Exhaust System of Tractor; service Fuel Feed System of Tractor; overhaul Clutch and Gearbox of Tractor in a workshop; overhaul Differential and PTO Unit of Tractor in the workshop; overhaul Steering System of Tractor in the workshop. He/she will practice repair works of Wheels and Tyres of Tractor in the Workshop; overhauling of Brake system of Tractor in the workshop; overhauling of Major Assemblies of Power Tiller; overhauling of Implements of Tractor; overhauling of Charging and Starting System of Tractor and carryout Field Operation.

# 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 Tractor trade under CTS is delivered nationwide through network of ITIs. The course is of one year duration. It mainly consists of Domain area and Core area. The Domain area (Trade Theory & Practical) imparts professional skills and knowledge, while Core area (Workshop Calculation science, Engineering Drawing and Employability Skills) impart requisite core skills, knowledge and life skills. After passing out the training program, the trainee is awarded National Trade Certificate (NTC) by NCVT which is recognized worldwide.

### Candidates need broadly 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.
- Check the job/assembly as per drawing for functioning, identify and rectify errors in job/assembly.
- 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 a National Apprenticeship certificate (NAC).
- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming instructor in ITIs.
- Can join various industries of the relevant field.
- Can become an Entrepreneur.

## 2.3 COURSE STRUCTURE

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

| S No. | Course Element | Notional Training Hours |
|---|---|---|
| 1 | Professional Skill (Trade Practical) | 1050 |
| 2 | Professional Knowledge (Trade Theory) | 252 |
| 3 | Workshop Calculation & Science | 84 |
| 4 | Engineering Drawing | 126 |
| 5 | Employability Skills | 110 |
| 6 | Library & Extracurricular activities | 58 |
| 7 | Project work | 160 |
| 8 | Revision & Examination | 240 |
| | **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 year 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 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

For the purposes of determining the overall result, weightage of 100% is applied for six months and one year duration courses and 50% weightage is applied to each examination for two years

courses. The minimum pass percent for Practical is 60% & minimum pass percent for Theory subjects is 33%.

## 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 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.<br>• 60-70% accuracy achieved while undertaking different work with those demanded by the component/job.<br>• A fairly good level of neatness and consistency in the finish.<br>• 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.<br>• 70-80% accuracy achieved while undertaking different work with those demanded by the component/job.<br>• A good level of neatness and consistency in the finish.<br>• 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.<br>• Above 80% accuracy achieved while undertaking different work with those demanded by the component/job.<br>• A high level of neatness and consistency in the finish.<br>• Minimal or no support in completing the project. |

# 3. JOB ROLE

**Brief description of job roles:**

**Tractor Mechanic**; repairs and overhauls tractors by various mechanical processes for agriculture, constructional and other heavy duties. Examines and drives vehicle on road or runs engine in stationary position to diagnose troubles and defects. Dismantles part or complete engine or unit according to nature of defects. Repairs or replaces defective parts, reassembles them with prescribed settings, clearances, timings and adjustments by further tooling as necessary and ensures accuracy of fit. Installs assembled or repaired engine securely in position on vehicle chassis and connects oil and fuel lines, controls and other accessories. Starts engine and observes performance for any unusual noise and knocks. Adjusts carburettor, fuel pump (Carburettor for petrol engine and fuel pump for diesel engine), sets clearance between tappets and valves, tunes engine, adjusts brakes, makes electrical connections and performs other tasks to ensure stipulated performance. May repair and overhaul electric motors, fuel pump, carburettor etc. of engine. May weld, braze or solder parts. May repair other agricultural machinery for ploughing, levelling, harvesting etc. and be designated as Mechanic, Agricultural Machines.

**Reference NCO-2015:** 7231.0300 - Tractor Mechanic

## 4. GENERAL INFORMATION

| | |
|---|---|
| **Name of the Trade** | **Mechanic Tractor** |
| **NCO - 2015** | 7231.0300 |
| **NSQF Level** | Level – 4 |
| **Duration of Craftsmen Training** | One year |
| **Entry Qualification** | Passed 10th class examination with Mathematics and Science |
| **Unit Strength (No. Of Student)** | 20 |
| **Space norms** | 210 Sq. m (Including Parking room) |
| **Power norms** | 4.8 KW |
| **Instructors Qualification for:** | |
| **1. Mechanic Tractor Trade** | Degree in Agriculture Engineering / Automobile/ Mechanical Engg. (with specialization in Automobile) from recognized university with one year experience in Tractor industry and should possess valid LMV driving license.<br>OR<br>Diploma in Agriculture Engineering / Automobile/ Mechanical Engg. (with specialization in (Automobile) from a recognized board of Technical education with two year in Tractor industry and should possess valid LMV driving license.<br>OR<br>NTC/NAC passed in the Trade of "Mechanic Tractor /Mechanic Agricultural Machinery)" with 3 years' post qualification experience in the relevant field and should possess valid LMV driving license.<br><br>**Essential Qualification:**<br>Craft Instructor Certificate in relevant trade under NCVT.<br><br>**Note:** 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** | Degree in Engineering with one year experience.<br>OR<br>Diploma in Engineering with two years experience. |

| | |
|---|---|
| | **<u>Essential Qualification</u>:**<br>**Craft Instructor Certificate in RoD& A course under NCVT.** |
| **3. Engineering Drawing** | Degree in Engineering with one year experience.<br>OR<br>Diploma in Engineering with two years experience.<br>OR<br>NTC/ NAC passed in the Draughtsman (Civil) with three years experience.<br><br>**<u>Essential Qualification</u>:**<br>Craft Instructor Certificate in RoD& A course under NCVT. |
| **4. Employability Skill** | MBA OR BBA with two years experience OR Graduate in Sociology/ Social Welfare/ Economics with Two years experience OR Graduate/ Diploma with Two years experience and trained in Employability Skills from DGT institutes.<br>AND<br>Must have studied English/ Communication Skills and Basic Computer at 12$^{th}$ / Diploma level and above.<br>OR<br>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 | Work shop 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 Tractor** 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 **Mechanic Tractor** 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 | Work in familiar, predictable, routine, situation of clear choice | Factual knowledge of field of knowledge or study | Recall and demonstrate practical skill, routine and repetitive in narrow range of application, using appropriate rule and tool, using quality concepts | Language to communicate written or oral, with required clarity, skill to basic Arithmetic and algebraic principles, basic understanding of social political and natural environment | Responsibility for own work and learning. |

# 6. LEARNING 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 LEARNING OUTCOME

1. Apply safe working practices in an automotive work shop.
2. Select and measure dimension of components and record data.
3. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day-to-day work to improve productivity & quality.
4. Explain energy conservation, global warming and pollution and contribute in day-to-day work by optimally using available resources.
5. Explain personnel finance, entrepreneurship and manage/organize related task in day-to-day work for personal & societal growth.
6. Plan and execute the work related to the occupation.

## 6.2 SPECIFIC LEARNING OUTCOME

7. Make choices to carry out marking of the components for basic fitting operations in the work shop.
8. Perform precision measurements on the components and compare parameters with specifications used in automotive work shop practices.
9. Use different types of fastening and locking devices in a vehicle.
10. Use cutting tools in the work shop, following safety precautions while grinding.
11. Use different types of tools and work shop equipment in the work shop.
12. Perform basic fitting operations used in the work shop practices and inspection of dimensions.
13. Produce sheet metal components using various sheet metal operations.
14. Construct electrical circuits and test its parameters by using electrical measuring instruments.
15. Perform basic electrical testing in a vehicle.
16. Perform battery testing and charging operations.
17. Construct basic electronic circuits and testing.
18. Manufacture components with different types of welding processes in the given job.
19. Inspect the auto component using Non destructive testing methods.
20. Identify the hydraulic and pneumatic components in a vehicle.
21. Demonstrate Major Assemblies of Tractor.
22. Overhaul Diesel Engine of Tractor.
23. Perform servicing of Cooling and Lubrication system of Tractor in a workshop.

24. Service Intake and Exhaust System of Tractor in a workshop.
25. Service Fuel Feed System of Tractor in a workshop.
26. Overhaul Clutch and Gearbox of Tractor in a workshop.
27. Overhaul Differential and PTO Unit of Tractor in the workshop.
28. Overhaul Steering System of Tractor in the workshop.
29. Carryout Repair of Wheels and Tyres of Tractor in the Workshop.
30. Overhaul Brake system of Tractor in the workshop.
31. Overhaul Major Assemblies of Power Tiller and carryout Field Operation.
32. Overhaul Implements of Tractor.
33. Overhaul Charging and Starting System of Tractor.

# 7. LEARNING OUTCOME WITH ASSESSMENT CRITERIA

| GENERIC LEARNING OUTCOME | |
|---|---|
| **LEARNING OUTCOME** | **ASSESSMENT CRITERIA** |
| 1. Apply safe working practices in an automotive work shop. | 1.1 Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements. |
| | 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 with 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 Protective Equipment (PPE) and use the same as per related working environment. |
| | 1.10 Identify basic first aid and use them under different circumstances. |
| | 1.11 Identify different fire extinguisher and use the same as per requirement. |
| | |
| 2. Select and measure dimension of components and record data. | 2.1 Select appropriate measuring scale/tape/gauges. |
| | 2.2 Measure dimension of the components/assembly & compare with given drawing/measurement. |
| | |

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| 3. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day-to-day work to improve productivity & quality. | 3.1 Explain the concept of productivity and quality tools and apply during execution of job. |
| | 3.2 Understand the basic concept of labour welfare legislation and adhere to responsibilities and remain sensitive towards such laws. |
| | 3.3 Knows benefits guaranteed under various acts. |
| | |
| 4. Explain energy conservation, global warming and pollution and contribute in day-to-day work by optimally using available resources. | 4.1 Explain the concept of energy conservation, global warming, pollution and utilize the available recourses optimally & remain sensitive to avoid environment pollution. |
| | 4.2 Dispose waste following standard procedure. |
| | |
| 5. Explain personnel finance, entrepreneurship and manage/organize related task in day-to-day work for personal & societal growth. | 5.1 Explain personnel finance and entrepreneurship. |
| | 5.2 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. |
| | 5.3 Prepare Project report to become an entrepreneur for submission to financial institutions. |
| | |
| 6. Plan and execute the work related to the occupation. | 6.1 Use documents, drawings and recognize hazards in the work site. |
| | 6.2 Plan workplace/ assembly location with due consideration to operational stipulation. |
| | 6.3 Communicate effectively with others and plan project tasks. |
| | 6.4 Execute the task effectively. |
| | |

| SPECIFIC LEARNING OUTCOME | |
|---|---|
| **LEARNING OUTCOME** | **ASSESSMENT CRITERIA** |
| 7. Make choices to carry out marking of the components for basic fitting operations in the work shop. | 7.1 Mark according to drawings by using marking tools on the work pieces. |
| | 7.2 Chip the job in accordance with standard specifications and tolerances. |
| | 7.3 Measure all dimensions in accordance with standard specifications and tolerances. |
| | |
| 8. Perform precision measurements on the components and compare parameters with specifications used in automotive work shop practices. | 8.1 Measure all dimensions in accordance with standard specifications and tolerances by using precision measuring instruments. |
| | 8.2 Measure the parameters related with the vehicle components for its effective operation by matching with manufacturer's specification using different gauges. |
| | |
| 9. Use of different types of fastening and locking devices in a vehicle. | 9.1 Identify the different type of fasteners and locking devices used in the vehicle. |
| | 9.2 Use different types of locking devices correctly. |
| | 9.3 Specify the bolt and nut threads. |
| | 9.4 Practice on removing the damaged studs and bolts. |
| | |
| 10. Use cutting tools in the work shop, following safety precautions while grinding. | 10.1 Identify cutting tool materials and their application. |
| | 10.2 Plan and grind cutting and marking tools. |
| | 10.3 Measure the tool angles with gauges. |
| | |
| 11. Use different types of tools and work shop equipment in the work shop. | 11.1 Identify the different types of hand and power tools used in the automotive work shop. |
| | 11.2 Operate various tools and work shop equipment. |
| | |
| 12. Perform basic fitting operations used in the work shop practices and inspection of dimensions. | 12.1 Mark according to drawing by using marking tools on flat surfaces. |
| | 12.2 Hack saw and file the job using different methods and perform in accordance with the standard specifications |

| | |
|---|---|
| | and tolerances. |
| | 12.3 Drilling and reaming on flat surfaces. |
| | 12.4 Identify and use hand tools for internal and external threading with taps and dies. |
| | 12.5 Measure all dimensions in accordance with standard specification and tolerances. |
| | |
| 13. Produce sheet metal components using various sheet metal operations. | 13.1 Ascertain and select tools and materials for the job and make this available for use in a timely manner. |
| | 13.2 Plan and organize the work for different types of sheet metal operations. |
| | 13.3 Mark according to drawing by using marking tools on flat surfaces. |
| | 13.4 Produce components as per the drawing. |
| | |
| 14. Construct electrical circuits and test its parameters by using electrical measuring instruments. | 14.1 Plan and organize the work for basic electrical operations. |
| | 14.2 Select the tools, instruments and materials required to do the job. |
| | 14.3 Comply with safety rules when performing the basic electrical operations. |
| | 14.4 Perform electrical wire joints, form electrical circuits and test basic electrical parameters as per the circuit drawings and operating procedures. |
| | |
| 15. Perform basic electrical testing in a vehicle. | 15.1 Plan and organize the work for auto electrical component testing. |
| | 15.2 Tracing the auto electrical components in a vehicle. |
| | 15.3 Test continuity and voltage drop in the electrical circuits. |
| | 15.4 Operate the electrical components in a vehicle and test lamps. |
| | |
| 16. Perform battery testing and charging operations. | 16.1 Ascertain and select tools and materials for the job. |
| | 16.2 Comply with safety rules when performing the following operations. |
| | 16.3 Plan and select different methods for charging the battery. |
| | 16.4 Perform battery testing as per the operating procedure. |
| | |

| | |
|---|---|
| 17. Construct basic electronic circuits and testing. | 17.1 Plan and select different types of basic electronic components and measuring instruments. |
| | 17.2 Construct and test the basic electronic gate circuits and its components as per the standard procedure. |
| | |
| 18. Manufacture components with different types of welding processes in the given job. | 18.1 Plan and select appropriate method to produce components with welding process. |
| | 18.2 Comply with safety rules when performing the above operations. |
| | 18.3 Mark according to the drawing using marking tools on the job. |
| | 18.4 Select appropriate tools and equipment to perform the above operations. |
| | 18.5 Set up and produce component as per standard operating procedure. |
| | |
| 19. Inspect the auto component using Non destructive testing methods. | 19.1 Classify different vehicle components by its manufacturing processes |
| | 19.2 Ascertain and select tools and equipment to do NDT test the given job. |
| | 19.3 Plan and organize the work for nondestructive testing. |
| | 19.4 Perform different types of nondestructive tests using appropriate testing equipment. |
| | 19.5 Observe safety/precaution during testing the job. |
| | |
| 20. Identify the hydraulic and pneumatic components in a vehicle. | 20.1 Comply with safety rules when performing the following operations. |
| | 20.2 Locate and identify the hydraulic components in a vehicle. |
| | 20.3 Locate and identify the pneumatic components in a vehicle. |
| | |
| 21. Demonstrate Major Assemblies of Tractor. | 21.1 Ascertain and select tools and materials for the job and make this available for use in a timely manner. |
| | 21.2 Identify different gauges fitted on the dashboard and check for proper functioning |
| | 21.3 Perform daily checks before starting the engine. |
| | 21.4 Start the engine and allow it to warm up. |

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| | 21.5 Identify the problem in functionality of particular Gauge fitted on dashboard and record the reading and compare it with standard reading. |
| | 21.6 Repair / Replace the defective gauges as per standard operating practice. |
| | 21.7 Check for proper functionality. |
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| 22. Overhaul Diesel Engine of Tractor. | 22.1 Ascertain and select tools and materials for the job and make this available for use in a timely manner. |
| | 22.2 Plan work in compliance with standard safety norms. |
| | 22.3 Demonstrate possible solutions and agree tasks within the team. |
| | 22.4 Drain coolant and lubricants from the engine and Remove Accessories of engine. |
| | 22.5 Service cylinder head assembly. |
| | 22.6 Service Oil Sump and Oil Pump. |
| | 22.7 Service Piston and connecting Rod Assembly. |
| | 22.8 Service Flywheel, Crank shaft, camshaft and its Bearings and gear. |
| | 22.9 Service cylinder block. |
| | 22.10 Check and adjust valve clearances as per procedure and recommended specification. |
| | 22.11 Refit all the accessories. |
| | 22.12 Refill all the required coolant and lubricants as per standard specification. |
| | 22.13 Start the engine and observe reading of dashboard gauges and record Engine Performance. |
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| 23. Perform servicing of Cooling and Lubrication system of Tractor in a workshop. | 23.1 Check Engine Coolant and Reverse flush the cooling system using flushing solution. |
| | 23.2 Service Radiator and radiator cap |
| | 23.3 Check Radiator hoses for crack and replace if necessary. |
| | 23.4 Test Thermostat valve for proper functioning as per manufacturer specification and replace if necessary. |
| | 23.5 Check water pump for serviceability and replace if faulty. |
| | 23.6 Check Fan/Alternator Belt for proper tension. |
| | 23.7 Check & Replace Engine Oil |
| | 23.8 Replace Oil Filter & oil pump |

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| | 23.9 Service Oil Cooler and pressure relief valve |
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| 24. Service Intake and Exhaust System of Tractor in a workshop. | 24.1 Service/Replace Air Cleaner |
| | 24.2 Overhaul Air Compressor |
| | 24.3 Overhaul Exhauster Assembly |
| | 24.4 Service Turbocharger/Supercharger as per manufacturer specification. |
| | 24.5 Service Intercooler. |
| | 24.6 Check Exhaust Leakages and Rubber Mounting of Exhaust System. |
| | 24.7 Service Exhaust manifold. |
| | 24.8 Check and Replace Catalytic Converter. |
| | 24.9 Check and Replace Resonator/Muffler. |
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| 25. Service Fuel Feed System of Tractor in a workshop. | 25.1 Tune up Petrol Engine Tractor as per manufacturer specification |
| | 25.2 Check leakages in Diesel/Petrol fuel line. |
| | 25.3 Service Fuel Tank and fuel filter |
| | 25.4 Service Fuel Feed Pump/Petrol Fuel Pump |
| | 25.5 Set Diesel Fuel Injection Pump Timing as per manufacturer specification |
| | 25.6 Bleed the Fuel System to vent out any air trapped. |
| | 25.7 Start the Engine and check for proper functioning as per standard guidelines specified by manufacturer. |
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| 26. Overhaul Clutch and Gearbox of Tractor in a workshop. | 26.1 Ascertain and select tools and equipment for the job and make this available for use in a timely manner. |
| | 26.2 Plan work in compliance with standard safety norms. |
| | 26.3 Adjust clutch pedal free play and check its performance. |
| | 26.4 Monitor performance of Clutch and Gearbox by operating vehicle. |
| | 26.5 Service Clutch, Gearbox and Driveline of tractor. |
| | 26.6 Refit Clutch, Gearbox and Auxiliary Gearbox to the Tractor and check performance as per standard guidelines. |
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| 27. Overhaul Differential and PTO Unit of Tractor in the | 27.1 Ascertain and select tools and equipment for the job and make this available for use in a timely manner. |

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| workshop. | 27.2 Plan work in compliance with standard safety norms. |
| | 27.3 Service Differential unit of the tractor |
| | 27.4 Service PTO unit of the tractor. |
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| 28. Overhauling Steering System of Tractor in the workshop. | 28.1 Inspect steering linkages for excessive play. |
| | 28.2 Service Steering Gear Box of the Tractor. |
| | 28.3 Remove front Axle assembly from the Tractor. |
| | 28.4 Repair Front Axle Assembly as per guidelines laid down by manufacturer |
| | 28.5 Refit Front Axle Assembly and check for proper functioning as per manufacturer's guidelines. |
| | 28.6 Check front and rear suspension for proper functioning and abnormal noise. |
| | 28.7 Service front and rear suspension system. |
| | 28.8 Refit the front and rear suspension to the tractor and check for proper functioning as per manufacturer's specification. |
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| 29. Carryout Repair of Wheels and Tyres of Tractor in the Workshop. | 29.1 Check and service Rim, tires and tube and perform repair/replace if necessary. |
| | 29.2 Inflate tires as per manufacturer recommended inflation pressure. |
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| 30. Overhaul Brake system of Tractor in the workshop. | 30.1 Test the brake of tractor for effectiveness. |
| | 30.2 Service Brake. |
| | 30.3 Remove Hydraulic Brake cylinder. |
| | 30.4 Service Hydraulic brake cylinder. |
| | 30.5 Bleed the brake system. |
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| 31. Overhaul Major Assemblies of Power Tiller and carryout Field Operation. | 31.1 Remove major assemblies of Power tiller. |
| | 31.2 Dismantle Transmission, clutch and brake |
| | 31.3 Clean and Replace/Repair components of Transmission, clutch and brake. |
| | 31.4 Assemble Transmission, clutch and brake components. |
| | 31.5 Refit the Transmission, clutch and brake to the Power Tiller. |
| | 31.6 Carryout field operation of Power tiller without implements. |

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| 32. Overhaul Implements of Tractor. | 32.1 Check Plough, Harrows, cultivator, seed drill and tractor trailer for proper functioning. |
| | 32.2 Carryout Service of Plough, Harrows, cultivator, seed drill and tractor trailer. |
| | 32.3 Perform hitching practice ( Single & Three Point). |
| | 32.4 Adjust agricultural implements for correct functioning during field operations. |
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| 33. Overhaul Charging and Starting System of Tractor. | 33.1 Check Charging system for proper functioning as per manufacturer guidelines. |
| | 33.2 Service alternator. |
| | 33.3 Refit Alternator to the tractor and check for functioning. |
| | 33.4 Check starting system for proper functioning as per manufacturer guidelines. |
| | 33.5 Service starter. |
| | 33.6 Refit starter to the tractor and check for functioning. |
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## 8. SYLLABUS

| SYLLABUS – MECHANIC TRACTOR | | | |
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| **Duration: One Year** | | | |
| **Week No.** | **Reference Learning Outcome** | **Professional Skills (Trade Practical) With Indicative Hours** | **Professional Knowledge (Trade Theory)** |
| 1 | Apply safe working practices in an automotive work shop. | 1. Familiarization with institute, Job opportunities in the automobile sector, Machinery used in Trade. (12 hrs)<br>2. Types of work done by the students in the shop floor. (13 hrs) | **Admission & introduction to the trade:** Introduction to the Course duration, course content, study of the syllabus. General rule pertaining to the Institute, facilities available-Hostel, Recreation, Medical and Library working hours and time table |
| 2 | -do- | 3. Practical related to Safety and Health, Importance of maintenance and cleanliness of Workshop. (5 hrs)<br>4. Interaction with health centre and fire service station to provide demo on First aid and Fire safety, Use of fire extinguishers. (5 hrs)<br>5. Demonstration on safe handling and Periodic testing of lifting equipment, and Safety disposal of used engine oil. (10 hrs)<br>6. Energy saving Tips of ITI electricity usage. (5 hrs) | **Occupational Safety & Health** Importance of Safety and general Precautions to be observed in the shop. Basic first aid, safety signs - for Danger, Warning, caution & personal safety message. Safe handling of Fuel Spillage, Fire extinguishers used for different types of fire. Safe disposal of toxic dust, safe handling and Periodic testing of lifting equipment, Authorization of Moving & road testing vehicles. **Energy conservation**- Definition, Energy Conservation Opportunities (ECOs)-Minor ECos and Medium ECOs, Major ECOs), Safety disposal of Used engine oil, Electrical safety tips. |
| 3-4 | Make choices to carry | 7. Practice using all marking aids, | **Hand & Power Tools:-** |

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| | out marking of the components for basic fitting operations in the work shop. | like steel rule with spring calipers, dividers, scriber, punches, Chisel etc. (10 hrs)<br>8. Layout a work piece- for line, circle, arcs and circles. (10 hrs)<br>9. Practice to measure a wheel base of a vehicle with measuring tape. (10 hrs)<br>10. Practice to measure valve spring tension using spring tension tester Practice to remove wheel lug nuts with use of an air impact wrench Practice on General workshop tools & power tools. (20 hrs) | Marking scheme, **Marking material**-chalk, Prussian blue. Cleaning tools- Scraper, wire brush, Emery paper, Description, care and use of Surface plates, steel rule, measuring tape, try square. Calipers-inside and outside. Dividers, surface gauges, scriber, punches-prick punch, center punch, pin punch, hollow punch, number and letter punch. Chisel-flat, cross-cut. Hammer-ball pein, lump, mallet. Screw drivers-blade screwdriver, Phillips screw driver, Ratchet screwdriver. Allen key, bench vice & C-clamps, Spanners- ring spanner, open end spanner & the combination spanner, universal adjustable open end spanner. Sockets & accessories, Pliers -Combination pliers, multi grip, long nose, flat-nose, Nippers or pincer pliers, Side cutters, Tin snips, Circlip pliers, external circlips pliers. Air impact wrench, air ratchet, wrenches-Torque wrenches, pipe wrenches, car jet washers Pipe flaring & cutting tool, pullers-Gear and bearing. |
| 5-7 | Perform precision measurements on the components and compare parameters with specifications used in automotive work shop practices. | 11. Measuring practice on Cam height, Camshaft Journal dia, crankshaft journal dia, Valve stem dia, piston diameter, and piston pin dia with outside Micrometers. (8 hrs)<br>12. Measuring practice on the | **Systems of measurement,** Description, care & use of -Micrometers- Outside and depth micrometer, Micrometer adjustments, Vernier calipers, Telescope gauges, Dial bore gauges, Dial indicators, |

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| | | height of the rotor of an oil pump from the surface of the housing or any other auto component measurement with depth micrometer. (7 hrs)<br>13. Measuring practice on valve spring free length. (7 hrs)<br>14. Measuring practice on cylinder bore, Connecting rod bore, inside diameter (ID) of a camshaft bearing with Telescope gauges. (7 hrs)<br>15. Measuring practice on cylinder bore for taper and out-of-round with Dial bore gauges. (7 hrs)<br>16. Measuring practice to measure wear on crankshaft end play, crankshaft run out, and valve guide with dial indicator. (8 hrs)<br>17. Measuring practice to check the flatness of the cylinder head is warped or twisted with straightedge is used with a feeler gauge. (8 hrs)<br>18. Measuring practice to check the end gap of a piston ring, piston-to-cylinder wall clearance with feeler gauge. (8hrs)<br>19. Practice to check engine manifold vacuum with vacuum gauge. (8 hrs)<br>20. Practice to check the air pressure inside the vehicle tires is maintained at the recommended setting. (7 hrs) | straightedge, feeler gauge, thread pitch gauge, vacuum gauge, tire pressure gauge. |

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| 8 | Use different types of fastening and locking devices in a vehicle. | 21. Practice on General cleaning, checking and use of nut, bolts, & studs etc. (15 hrs)<br>22. Removal of stud/bolt from blind hole. (10 hrs) | **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 secure these fasteners. Function of **Gaskets,** Selection of materials for gaskets and packing, oil seals. |
| 9 | Use cutting tools in the work shop, following safety precautions while grinding. | 23. Practice on cutting tools like Hacksaw, file, chisel, Sharpening of Chisels, center punch, safety precautions while grinding. (15 hrs)<br>24. Practice on Hacksawing and filing to given dimensions. (10 hrs) | **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. |
| 10 | Use different types of tools and work shop equipment in the work shop. | 25. Practice on Marking and Drilling clear and Blind Holes, Sharpening of Twist Drills Safety precautions to be observed while using a drilling machine. (25 hrs) | **Limits, Fits & Tolerances** :- Definition of limits, fits & tolerances with examples used in auto components.<br>**Drilling machine** - Description and study of Bench type Drilling machine, Portable electrical Drilling machine, drill holding devices, Work Holding devices, Drill bits.. |
| 11 | Perform basic fitting operations used in the work shop practices and inspection of dimensions. | 26. Practice on Tapping a Clear and Blind Hole, Selection of tape drill Size, use of Lubrication, Use of stud extractor. (10 hrs)<br>27. Cutting Threads on a Bolt/ Stud. (5 hrs)<br>28. Adjustment of two piece | **Taps and Dies:** Hand Taps and wrenches, Calculation of Tap drill sizes for metric and inch taps. Different type of Die and Die stock. Screw extractors. **Hand Reamers** - Different Type of hand reamers, Drill size for reaming, Lapping, Lapping abrasives, type |

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| | | Die, Reaming a hole/ Bush to suit the given pin/ shaft, scraping a given machined surface. (10 hrs) | of Laps |
| 12 | Produce sheet metal components using various sheet metal operations. | 29. Practice on making Rectangular Tray. (5 hrs)<br>30. Pipe bending, fitting nipples unions in pipes. (10 hrs)<br>31. Soldering and Brazing of Pipes. (10 hrs) | **Sheet metal** - State the various common metal Sheets used in Sheet Metal shop Sheet metal operations - Shearing, bending, Drawing, Squeezing<br>Sheet metal joints - Hem & Seam Joints Fastening Methods - Riveting, soldering, Brazing. fluxes used on common joints. Sheet and wire-gauges. The blow lamp- its uses and pipe fittings. |
| 13 | Construct electrical circuits and test its parameters by using electrical measuring instruments. | 32. Practice in joining wires using soldering Iron, Construction of simple electrical circuits, measuring of current, voltage and resistance using digital multimeter, practice continuity test for fuses, jumper wires, fusible links, circuit breakers. (25 hrs) | **Basic electricity,** Electricity principles, Ground connections, Ohm's law, Voltage, Current, Resistance, Power, Energy. Voltmeter, ammeter, Ohmmeter Mulitmeter, Conductors & insulators, Wires, Shielding, Length vs. resistance, Resistor ratings |
| 14 | Perform basic electrical testing in a vehicle. | 33. Diagnose series, parallel, series-parallel circuits using Ohm's law, Check electrical circuit with a test lamp, perform voltage drop test in circuits using multimeter, measure current flow using multimeter/ammeter, use of service manual wiring diagram for troubleshooting. (25 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. |
| 15 | Perform battery testing and charging operations. | 34. Cleaning and topping up of a lead acid battery, Testing battery with hydrometer, | Description of Chemical effects, Batteries & cells, Lead acid batteries & Stay Maintenance |

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| | | Connecting battery to a charger for battery charging, Inspecting & testing a battery after charging, Measure and Diagnose the cause(s) of excessive Key-off battery drain (parasitic draw) and do corrective action. (15 hrs)<br>35. Testing of relay and solenoids and its circuit. (10 hrs) | Free (SMF) batteries, Magnetic effects, Heating effects, Thermo-electric energy, Thermisters, Thermo couples, Electrochemical energy, Photovoltaic energy, Piezo-electric energy, Electromagnetic induction, Relays, Solenoids, Primary & Secondary windings, Transformers, stator and rotor coils. |
| 16 | Construct basic electronic circuits and testing. | 36. Identify and test power and signal connectors for continuity, Identify and test different type of Diodes, NPN & PNP Transistors for its functionality, Construct and test simple logic circuits OR, AND & NOT and Logic gates using switches. (25 hrs) | **Basic electronics:** Description of Semi conductors, Solid state devices- Diodes, Transistors, Thyristors, Uni Junction Transistors ( UJT), Metal Oxide Field Effect Transistors ( MOSFETs), Logic gates-OR, AND & NOT and Logic gates using switches. |
| 17-18 | Manufacture components with different types of welding processes in the given job. | 37. Practice to make straight beads and Butt, Lap & T joints Manual Metal Arc Welding. (25 hrs)<br>38. Setting of Gas welding flames, practice to make a straight beads and joints Oxy-Acetylene welding Film on Heat treatment process. (25 hrs) | **Introduction to welding and Heat Treatment**<br>**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;.<br>Heat Treatment Process- Introduction, Definition of heat treatment, Definition of Annealing, Normalizing, |

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| | | | Hardening and tempering. Case hardening, Nitriding, Induction hardening and Flame Hardening process used in auto components with examples. |
| 19 | Inspect the auto components using Non Destructive testing methods. | 39. Practice on Liquid penetrant testing method and Magnetic particle testing method. (25 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 |
| 20 | Identify the hydraulic and pneumatic components in a vehicle. | 40. Identification of Hydraulic and pneumatic components used in vehicle. (10 hrs)<br>41. Tracing of hydraulic circuit on hydraulic jack, hydraulic power steering, and Brake circuit. (10 hrs).<br>42. Identification of components in Air brake systems. (5 hrs) | **Introduction to Hydraulics & Pneumatics: -** Definition of Pascal law, pressure, Force, viscosity. Description, symbols and application in automobile of Gear pump-Internal & External, single acting, double acting & Double ended cylinder; Directional control valves-2/2, 3/2, 4/2, 4/3 way valve, Pressure relief valve, Non return valve, Flow control valve used in automobile. Pneumatic Symbols, Description and function of air Reciprocating Compressor. Function of Air service unit (FRL-Filter, Regulator & Lubricator). |
| 21 | -do- | 43. Identification of different type of Vehicle. (5 hrs)<br>44. Demonstration of vehicle specification data; Identification of vehicle information Number (VIN). (10 hrs)<br>45. Demonstration of Garage, | 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 |

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| | | Service station equipments.- Vehicle hoists - Two post and four post hoist, Engine hoists, Jacks, Stands. (10 hrs) | R&D Infrastructure Project (NATRIP), & Automobile Association.<br>Definition: - Classification of vehicles on the basis of load as per central motor vehicle rule, wheels, final drive, and fuel used, axles, position of engine and steering transmission, body and load. Brief description and uses of Vehicle hoists - Two post and four post hoist, Engine hoists, Jacks, Stands. |
| 22-23 | **In-plant training/ Project work** | | |
| 24-26 | **Revision** | | |
| 27 | Demonstrate Major Assemblies of different types of Tractor. | 46. Demonstration of tractor specification data. (5 hrs)<br>47. Identification of different major assemblies of tractor and cleaning of tractors, oil greasing and lubricating all moving parts of tractor. (10 hrs)<br>48. Practice on starting and stopping of tractor engine. (10 hrs) | Tractor Industry in India - leading manufacturers, development in Tractor industry, trends, new product.<br>Study of tractors, dozers & their major assemblies, and different make (indigenous). Constructional differences between tractor and dozers and their merits.<br>Different type of Tractor starting method and stopping. |
| 28 | -do- | 49. Dismantling of tractor engine as per procedure & Inspection of components for dimension and wear. (25 hrs) | **Engine Basics:**<br>Classification of engines, **Principle & working of 2&4-stroke diesel engine (Compression ignition Engine (C.I) ),** Principle of Spark Ignition Engine(SI), differentiate between 2-stroke and 4 stroke, C.I engine and S.I Engine, Direct injection and Indirect injection,.<br>Brief on common rail diesel |

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| | | | injection engine. **Engine output, compression pressure,** Compression ratio. |
| 29 | Overhaul Diesel Engine of Tractor. | 50. Remove cylinder head from engine. (5 hrs)<br>51. Overhauling of cylinder head assembly with use of service manual for clearance and other parameters. (10 hrs)<br>52. Practice on removing rocker arm assembly manifolds, fitting of valve guide. (10 hrs) | **Engine Components -** working principle & construction of cylinder heads, types of combustion chambers. Function of Engine Valves, different types, materials, Type of valve operating mechanism. Importance of Valve seats & inserts, importance of Valve movement, Valve stem, oil seals, Valve-timing diagram and concept of Variable valve timing. |
| 30 | -do- | 53. Cylinder block overhaul. (5 hrs)<br>54. Measurement of cylinder liner & crankshaft for ovality and taperness. (5 hrs)<br>55. Overhauling piston and connecting rod assembly with use of service manual for clearance and other parameters. (10 hrs)<br>56. Practice on removing oil sump and oil pump - clean the sump. (5 hrs) | **Description of Cylinder block, Cylinder block construction,** types of cylinder blocks & cylinder liners. Description & functions of different types of pistons, piston rings and piston pins and materials. Used recommended clearances for the rings and its necessity precautions while fitting rings, common troubles and remedy. |
| 31 | -do- | 57. Practice on removing the big end bearing, connecting rod with the piston. (5 hrs)<br>58. Practice on removing the piston rings, Dismantle the piston and connecting rod. (10 hrs)<br>59. Check the side clearance of piston rings in the piston groove & lands for wear. (5 | 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. Recommended clearances for the cylinder liners & rings. Bearing failure & its causes-care & maintenance. |

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| | | hrs)<br>60. Check piston skirt and crown for damage and scuffing, clean oil holes. Measure -the piston ring close gap in the cylinder, clearance between the piston and the liner, clearance between crank pin and the connecting rod big end bearing. (5 hrs) | |
| 32 | -do- | 61. Check connecting rod for bend and twist. (5 hrs)<br>62. Setting of Connecting rod big end & main bearing. (5 hrs)<br>63. Assembling crank shaft, main bearings, connecting rods and piston assembly in the engine, fitting cylinder head. (10 hrs)<br>64. Setting valve timing. (5 hrs) | Description of crankshaft & Camshafts. Types of their drives. Description of Overhead camshaft, importance of Cam lobes. Crankcase ventilation (PCV). Camshaft, Crank-shaft balancing, Firing order of the engine.<br>Description and function of the fly wheel and vibration damper. Timing mark. |
| 33 | Perform servicing of Cooling and Lubrication system of Tractor in a workshop. | 65. Checking cooling system for overheating / under-cooling. (5 hrs)<br>66. Dismantling, cleaning, assembling & testing of water pumps, reverse flushing the system. (10 hrs)<br>67. Checking of thermostat valve, pressure cap. (5 hrs)<br>68. Adjusting the fan belt tension. (5 hrs) | **Cooling systems:-** Purpose, types, Heat transfer method, effect of boiling point & pressure, coolant properties, preparation and recommended change of interval, use of antifreezer.<br>**Cooling system components,** water pump, function of thermostat, pressure cap, Recovery system & Thermo-switch. Function & types of Radiator. |
| 34 | -do- | 69. Identification of lubrication oil flow circuit in an engine.(5 hrs)<br>70. Overhauling oil pump, servicing of oil cooler & | **Lubrication system:** - purposes & characteristics of oil, type of lubricants, grade as per SAE, & their application, oil additives, |

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| | | centrifugal oil filter. (10 hrs)<br>71. Testing oil pressure. (10 hrs) | type of lubrication system.<br>Lubrication system components- different type of Oil pump, Oil filters & oil cooler. Probable reasons for low / high oil pressure, high oil consumption and their remedies. |
| 35 | Service Intake and Exhaust System of Tractor in a workshop. | 72. Servicing of air cleaner (Oil bath) Checking & changing an air filter. (5 hrs)<br>73. Dismantling & assembling of turbocharger, check for axial clearance as per service manual. (5 hrs)<br>74. Checking of Exhaust Gas Recirculation. (5 hrs)<br>75. Check Exhaust system for rubber mounting for damage, deterioration and out of position; for leakage, loose connection, dent and damage; Practice on Exhaust manifold removal and installation. (5 hrs)<br>76. Practice on Catalytic converter removal and installation. (5 hrs) | **Intake & exhaust systems** - Description of Diesel induction & Exhaust systems. Description & function of air compressor, exhauster, Super charger, Intercoolers, turbo charger, variable turbo charger mechanism.<br>**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, Mufflers- Reactive, absorptive, Combination, Electronic mufflers, Catalytic converters, Backpressure, Diesel particulate filter, Exhaust Gas Recirculation(EGR). |
| 36-37. | Service Fuel Feed System of Tractor in a workshop. | 77. Repair to a tractor carburetors -adjusting float level and slow speed adjustments - studying the fuel flow circuit in carburetor. (6 hrs)<br>78. Practice in engine tune up in a vehicle -testing vacuum and compression of engine, | **Carburetor operation- Carburation, Carburetor system components, Carburetor systems, Metering jets, Accelerating, Carburetor barrels Diesel Fuel Systems-**<br>Diesel fuel characteristics, concept of Quiet diesel technology & Clean diesel |

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| | | adjusting tappets setting ignition timing and adjusting carburetor For slow speeds. (6 hrs)<br>79. Tracing of different parts of fuel system. (5 hrs)<br>80. Repairing fuel leaks in pipe line and unions, Servicing and testing of fuel feed pump. Servicing of fuel filters. Servicing of fuel Injection Pump. (6 hrs)<br>81. Servicing of pressure pump of (C.R.D.I.). (5 hrs)<br>82. Regulator's and Elect/ Electronic injectors, checking operation of C.R.D.I. system. Overhauling & testing of injectors. (6 hrs)<br>83. Setting injection timing. Bleeding fuel lines for Air locks. (6 hrs)<br>84. Testing cylinder compression, checking idle speed, Obtaining & interpreting scan tool data. (5 hrs)<br>85. Fault finding & remedy, care & maintenance. (5 hrs) | technology, Fuel feed system used in Tractor's description and layout. Diesel fuel system components, Description and function of Diesel fuel injection system, types of fuel injection pumps, type of drive, injectors-types and function. Governor and their types.<br>Distributor-type injection pump, Glow plugs,<br>Cummins & Detroit Diesel injection. Diesel electronic control- Diesel electronic control systems (DEC), Common rail diesel injection system.<br>Method of bleeding fuel supply system |
| 38 | Overhaul Clutch and Gearbox of Tractor in a workshop. | 86. Dismantle clutch assembly. (3 hrs)<br>87. Inspect the parts of clutch. (3 hrs)<br>88. Relining of clutch plate & assemble. (3 hrs)<br>89. Coupling the clutch with flywheel & join the engine with gear box. (5 hrs)<br>90. Adjust clutch pedal free play. | **Clutch**:-types, construction and function. Components of clutch -driver & driven plates, torsion spring, cushion springs, operating fingers, clutch shaft, Slave cylinder & oil seal. Clutch release bearing & linkages.<br>**Manual transmissions-**<br>Function, description, types and their application. Gearbox layout. |

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| | | Dismantle gear box of a tractor & inspect the parts. (3 hrs)<br>91. Assemble the gear box. (4 hrs)<br>92. Overhauling Transfer case and auxiliary gear box. (4 hrs) | Components of tractor gear box. Principle of epicyclical gear box. Necessity of torque convertor, need of 4 x 4 wheel drive / Front wheel drive, Low & high gear ratio, universal joint and propeller shaft. |
| 39 | Overhaul Differential and PTO Unit of Tractor in the workshop. | 93. Overhauling of differential. (5 hrs)<br>94. Servicing of reduction gear, rear axle wheel hub. (10 hrs)<br>95. Servicing of PTO (Power Take Off). Measure rpm of PTO shaft & speed of belt pulley. (10 hrs) | **Final Drive & Drive Shafts**<br>Differential carriers double reduction gearing, differential lock, crown wheel and pinion adjustments, function and types of power take off (PTO) mechanism. Types of front & rear axles. Common trouble and their remedies, care and maintenance. |
| 40-41 | Overhaul Steering System of Tractor in the workshop. | 96. Checking, Layout of Mechanical steering system. Checking/ Inspection of Steering linkage and necessary repair. (5 hrs)<br>97. Remove steering wheel. Overhauling of steering gear box of tractor. (5 hrs)<br>98. Remove front axle and spindle hub and steering linkage. (5 hrs)<br>99. Reassembling steering assembly and Test for correct function. (5 hrs)<br>100. Checking, inspect layout of different parts of Hydraulic steering system. (10 hrs)<br>101. Practice on visual Inspection of chassis frame for crack, bent and twists. (5 hrs)<br>102. Overhauling and Inspection of | **Steering & Suspension Systems-**<br>Function and types of steering system. Description, construction and function of mechanical steering system steering wheel, steering gear box, tie-rod, arms link, ball and socket joints etc. their movement and adjustment. Description and mechanism of foot steerage pedal as incorporated in tractors. Description, working and principle of hydraulic steering system. Different parts such as pump, distributor valves, pipe line and hoses etc Development of mechanical framing. Use of Power tiller, Tractor & Bulldozer, Chassis frame of tractor. |

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| | | shackle, front & rear suspension. (10 hrs)<br>103. Lubricating a suspension system. (5 hrs) | |
| 42 | Carryout Repair of Wheels and Tyres of Tractor in the Workshop. | 104. Remove wheels from tractor. (4 hrs)<br>105. Dismantle wheel for checking rims, tyres for wear and tubes for leaks. (5 hrs)<br>106. Repairing, derusting, painting. (4 hrs)<br>107. Fitting of tyres and tubes on rim & inflate to correct pressure. (4 hrs)<br>108. Balancing of Tractor wheels. Practice of tyre rotation. Fitting wheels on tractors. Tightening of wheel in correct sequence. (4 hrs)<br>109. Checking & adjusting tire pressure by use of air or by Nitrogen. (4 hrs) | **Wheels & Tyres-** Description, construction and function of Wheel. Rim sizes. Types & sizes of tyres. Solid, pneumatic & Radial. Ply rating. Tyre materials, Hysteresis & designations, Tyre information, Tyre tread designs, Tyre ratings for temperature & traction. Importance of in-Flatting tyres to correct pressure. Repair and maintenance of tyres and tubes. Storage of tyres. Descriptions Tirewear Patterns and causes Nitrogen vs atmospheric air in tyres |
| 43-44 | Overhaul Brake system of Tractor in the workshop. | 110. Overhauling brakes including cleaning and inspection of all components, relining shoes, setting and actuating shoe clearance. (8 hrs)<br>111. Inspection spring of both shoe and lever. (7 hrs)<br>112. Inspecting and setting parking brakes. (7 hrs)<br>113. Inspecting and setting hydraulic main brake including replacement of washer and oil seals. (8 hrs)<br>114. Overhauling serve mechanism (as applicable) inspecting piston and valves. | **Braking Systems -** Braking fundamentals Principles of braking, Drum & disc brakes, Lever/mechanical advantage, Hydraulic pressure & force, Brake fade.<br>**Braking systems** - Brake type used on tractor -principles, Air brakes,<br>**Braking system components**- Park brake system, Brake pedal, Brake lines, Brake fluid, Bleeding, Master cylinder, Divided systems, Tandem master cylinder, Power booster or brake unit, Hydraulic brake booster, |

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| | | (5 hrs)<br>115. Bleeding and adjustment of brakes. (5 hrs)<br>116. Fault tracing and remedy. (5 hrs)<br>117. Skimming of brake drum and disc plate. (5 hrs) | Applying brakes, Brake force, Brake light switch<br>**Drum brakes & components** - Drum brake system, Drum brake operation, Brake linings & shoes, Backing plate, Wheel cylinders<br>**Disc brakes & components** -Disc brake system, Disc brake operation, Disc brake rotors, Disc brake pads, Disc brake calipers, Proportioning valves, Proportioning valve operation, Brake friction materials. |
| 45 | Overhaul Major Assemblies of Power Tiller and carryout Field Operation. | 118. Overhauling power tiller transmission system includes main clutches, steering clutch/ brakes mechanism-gear box and wheel hub testing for field operation without implements and with implements. (15 hrs)<br>119. Driving practice with trolley/ trailer. (10 hrs) | Description, working principle & use of **power tiller** (two wheel tractor) power unit. Method of power transmission to wheel from engine. Main clutch assembling working procedure steering Clutch/brakes mechanism method of power transmission to implement (Rotation), irrigation pump, thresher. Hitching of M.B. Plough, trailer disc harrow. |
| 46 | Overhaul Implements of Tractor. | 120. Checking implements such as ploughs, harrows, cultivators, seed drills, tractor trailer, & P.T.O. units etc. for serviceability before use. (5 hrs)<br>121. Lubricate them as required. Hitching practice (single & three point). (5 hrs)<br>122. Exercise in driving a tractor with different implements. (5 hrs)<br>123. Adjusting agriculture | **Tractor equipment:-** Description, function of harrows, cultivators, seed drills & tractor trailer. Hitching of equipment. Danger in overloading & incorrect field operation. Average life of Agriculture implements. Description and function of tractor accessories such as Draw bar, top link & Belly Pulley. Setting of draw bar to correct height. Use of Hydraulic lift. Maintenance of tractor |

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| | | implements for correct functioning during field operation. (5 hrs) | accessories. |
| 47 | Overhaul Charging and Starting System of Tractor. | 124. Practice on removing alternator from vehicle dismantling, cleaning checking for defects, assembling and testing for motoring action of alternator & fitting to vehicles. (10 hrs)<br>125. Practice on removing starter motor vehicle and overhauling the starter motor, testing of starter motor. (10 hrs)<br>126. Servicing storage batteries, tracing lighting circuit fault rectification. (5 hrs) | **Tractor Electrical Maintenance:** Lighting arrangement in tractors (As applicable). Description of charging circuit. Operation of alternator, regulator unit ignition warning lamp troubles and remedy in charging system. Fault finding in electrical system. Description of **starter motor circuit,** common troubles and remedy in starter circuit. Description of lighting circuit. Charging & discharging of lead acid battery. |
| 48-49 | **In plant Training/Project Work** | | |
| 50-52 | **Revision/Examination** | | |

***Note: -***

1. *The instructor may design their own project and also inputs from local industry may be taken in designing such new project.*
2. *The project should broadly cover 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 to a group (Group of at least 4 trainees). The group should demonstrate Planning, Execution, Contribution and Application of Learning. They need to submit a project report.*
3. *If the instructor feels that for execution of specific project more time is required then he may plan accordingly in appropriate time during the execution of normal trade practical.*

# 9. SYLLABUS - CORE SKILLS

## 9.1 WORKSHOP CALCULATION SCIENCE & ENGINEERING DRAWING

| 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<br>- Relationship to other technical drawing types<br>- Conventions<br>- Viewing of engineering drawing sheets.<br>- 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<br>- Drawing board, T-Square, Drafter (Drafting M/c), Set Squares, Protractor, Drawing Instrument Box (Compass, Dividers, Scale, Diagonal Scales etc.), Pencils of different Grades, Drawing pins / Clips. |
| 3. | **Square Root** : Square and Square Root, method of finding out square roots, Simple problem using calculator. | Lines :<br>- Definition, types and applications in Drawing as per BIS SP:46-2003<br>- Classification of lines (Hidden, centre, construction, Extension, Dimension, Section)<br>- Drawing lines of given length (Straight, curved)<br>- Drawing of parallel lines, perpendicular line<br>- Methods of Division of line segment |
| 4. | **Ratio & Proportion**: Simple calculation on related problems. | Drawing of Geometrical Figures: Definition, nomenclature and practice of<br>- Angle: Measurement and its types, method of bisecting.<br>- Triangle -different types<br>- Rectangle, Square, Rhombus, Parallelogram. |

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

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| | | - Bars and profile sections<br>- Weld, brazed and soldered joints.<br>- Electrical and electronics element<br>- Piping joints and fittings |
| 11. | **Algebra** : Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables). | Construction of Scales and diagonal scale |
| 12. | **Mensuration :** Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle,<br>Volume of solids - cube, cuboids, cylinder and Sphere.<br>Surface area of solids - cube, cuboids, cylinder and Sphere. | Practice of Lettering and Title Block |
| 13. | **Trigonometry:** Trigonometrical ratios, measurement of angles.<br>Trigonometric tables | Dimensioning practice:<br>- Position of dimensioning (unidirectional, aligned, oblique as per BIS SP:46-2003)<br>- Symbols preceding the value of dimension and dimensional tolerance.<br>- Text of dimension of repeated features, equidistance elements, circumferential objects. |
| 14. | **Heat & Temperature:** Heat and temperature, their units, difference between heat and temperature, boiling point, melting point, scale of temperature, relation between different scale of temperature, Thermometer, pyrometer, transmission of heat, conduction, convection, radiation. | Construction of Geometrical Drawing Figures:<br>- Different Polygons and their values of included angles. Inscribed and Circumscribed polygons.<br>- Conic Sections (Ellipse& Parabola) |
| 15. | **Basic Electricity:** Introduction, use of electricity, how electricity is produced, Types of current_ AC, DC, their comparison, voltage, resistance, their units. Conductor, insulator, Types of connections - series, parallel, electric power, Horse power, energy, unit of | Drawing of Solid figures (Cube, Cuboids, Cone, Prism, Pyramid, Frustum of Cone and Pyramid.) with dimensions. |

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| | electrical energy. | |
| 16. | **Levers and Simple Machines:** levers and its types.<br>Simple Machines, Effort and Load, Mechanical Advantage, Velocity Ratio, Efficiency of machine, Relationship between Efficiency, velocity ratio and Mechanical Advantage. | Free Hand sketch of hand tools and measuring tools used in respective trades. |
| 17. | ---------- | Projections:<br>- Concept of axes plane and quadrant.<br>- Orthographic projections<br>- Method of first angle and third angle projections (definition and difference)<br>- Symbol of 1st angle and 3rd angle projection as per IS specification. |
| 18. | ---------- | Drawing of Orthographic projection from isometric/3D view of blocks |
| 19. | ---------- | Orthographic Drawing of simple fastener (Rivet, Bolts, Nuts & Screw) |
| 20. | ---------- | Drawing details of two simple mating blocks and assembled view. |

## 9.2 CORE SKILL – EMPLOYABILITY SKILL

| **Duration: 110 Hrs.** | |
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| **1. English Literacy** | **Duration : 20 Hrs.**<br>**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.**<br>**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.<br>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),<br>Meaning of World Wide Web (WWW), Web Browser, Web Site, Web page and Search Engines. Accessing the Internet using Web Browser, |

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| | Downloading and Printing Web Pages, Opening an email account and use of email. Social media sites and its implication.<br>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.**<br>**Marks : 07** |
| **Introduction to Communication Skills** | Communication and its importance<br>Principles of Effective communication<br>Types of communication - verbal, non verbal, written, email, talking on phone.<br>non verbal communication -characteristics, components-Para-language Body language<br>Barriers to communication and dealing with barriers.<br>Handling nervousness/ discomfort. |
| **Listening Skills** | Listening-hearing and listening, effective listening, barriers to effective listening guidelines for effective listening.<br>Triple- A Listening - Attitude, Attention & Adjustment.<br>Active Listening Skills. |
| **Motivational Training** | Characteristics Essential to Achieving Success.<br>The Power of Positive Attitude.<br>Self awareness<br>Importance of Commitment<br>Ethics and Values<br>Ways to Motivate Oneself<br>Personal Goal setting and Employability Planning. |
| **Facing Interviews** | Manners, Etiquettes, Dress code for an interview<br>Do's & Don'ts for an interview. |
| **Behavioral Skills** | Problem Solving<br>Confidence Building<br>Attitude |
| **4. Entrepreneurship Skills** | **Duration : 15 Hrs.**<br>**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 &** | Qualities of a good Entrepreneur, SWOT and Risk Analysis. Concept & |

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| **Marketing analysis** | 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.**<br>**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.**<br>**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.<br>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.<br>safety, health, welfare under legislative of India. |
| **Ecosystem** | Introduction to Environment. Relationship between Society and Environment, Ecosystem and Factors causing imbalance. |

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| **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.**<br>**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.**<br>**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. |

## ANNEXURE-I

| LIST OF TOOLS AND EQUIPMENT | | | |
|---|---|---|---|
| **Mechanic Tractor (For batch of 20 candidates)** | | | |
| **S. No.** | **Name of the Tools & Equipment** | **Specification** | **Quantity** |
| **A. TRAINEES TOOL KIT** | | | |
| 1. | Allen Key set of 12 pieces | 2mm to 14mm | (5+1) nos. |
| 2. | Caliper inside | 15 cm Spring | 6 nos. |
| 3. | Calipers outside | 15 cm spring | 6 nos. |
| 4. | Center Punch | 10 mm. Dia. x 100 mm. | 6 nos. |
| 5. | Dividers | 15 cm Spring | 6 nos. |
| 6. | Electrician Screw Driver | 250mm | 6 nos. |
| 7. | Hammer ball peen | 0.5 kg with handle | 6 nos. |
| 8. | Hands file | 20 cm. Second cut flat | 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 | 20cm.X 9mm. Blade | 6 nos. |
| 12. | Screw driver | 30 cm. X 9 mm. Blade | 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 metric sizes | 6 to 32 mm. | 6 nos. |
| 16. | Spanners socket with speed handle, T-bar, ratchet and universal upto 32 mm set of 28 pieces with box | | 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. TOOLS, INSTRUMENTS AND GENERAL SHOP OUTFIT** | | | |
| 25. | AC alternator slip ring puller | | 1 no. |
| 26. | Adjustable spanner | pipe wrench 350 mm | 2 nos. |
| 27. | Air blow gun with standard accessories | | 1 no. |
| 28. | Air impact wrench with standard accessories | | 4 nos. |
| 29. | Air ratchet with standard accessories | | 4 nos. |

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| 30. | Allen Key set of 12 pieces | 2mm to 14mm | 2 nos. |
| 31. | Alternator for tractor - different type | | 2 nos. |
| 32. | Ammeter | 300A/ 60A DC with external shunt | 4 nos. |
| 33. | Angle plate adjustable | 250x150x175 | 1 no. |
| 34. | Angle plate | size 200x100x200mm | 2 nos. |
| 35. | Anvil 50 Kgs with Stand | | 1 no. |
| 36. | Arbor press hand operated | 2 ton capacity | 1 no. |
| 37. | Auto Electrical test bench | | 1 no. |
| 38. | Battery -charger | | 2 nos. |
| 39. | Belt Tensioner gauge | | 1 no. |
| 40. | Blow Lamp | 1 litre | 2 nos. |
| 41. | Caliper inside | 15 cm Spring | 4 nos. |
| 42. | Calipers outside | 15 cm spring | 4 nos. |
| 43. | Car Jet washer with standard accessories | | 1 no. |
| 44. | Carburetor repair tool kit | | 1 no. |
| 45. | Chain Pulley Block-3 ton capacity with tripod stand | | 1 no. |
| 46. | Chaser hard W/V 9 to 40 T.P.I. set of 11 external. | | 1 set |
| 47. | Chaser, hand W/W 9 to 40 T.P.I.set of 11 internal | | 1 set |
| 48. | Chisel | 10 cm flat | 4 nos. |
| 49. | Chisels cross cut | 200 mm X 6mm 4 | 4 nos. |
| 50. | Circlip pliers Expanding and contracting type | 15cm and 20cm each | 4 nos. |
| 51. | Clamps C | 100mm | 2 nos. |
| 52. | Clamps C | 150mm | 2 nos. |
| 53. | Clamps C | 200mm | 2 nos. |
| 54. | Cleaning tray | 45x30 cm. 4 | 4 nos. |
| 55. | Clutches, different types such as cone type, disc type | | 1 each |
| 56. | Compression testing gauge suitable for diesel Engine | | 2 nos. |
| 57. | Connecting rod alignment fixture 1 | | 1 no. |
| 58. | Copper bit soldering iron | 0.25 Kg | 4 nos. |
| 59. | Cut section model of fuel filter | | 1 no. |
| 60. | Cylinder bore gauge capacity | 20 to 160 mm | 4 nos. |
| 61. | Cylinder liner- Dry & wet liner, press fit & slidefit liner | | 1 each |

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| 62. | DC Ohmmeter | 0 to 300 Ohms, mid scales at 20 Ohms | 2 nos. |
| 63. | Depth micrometer | 0-25mm | 4 nos. |
| 64. | Dial gauge type 1 Gr. A (complete with clamping devices and stand) | | 4 nos. |
| 65. | Different type of Engine Bearing model | | 1 set |
| 66. | Different type of piston model | | 1 each |
| 67. | Dividers | 15 cm Spring | 4 nos. |
| 68. | Drift Punch Copper | 15 Cm | 4 nos. |
| 69. | Drift, copper | 10 x 15 1/2 mm | 2 nos. |
| 70. | Drill point angle gauge | | 1 no. |
| 71. | Drill twist | 1.5 mm to 15 mm (various sizes) by 0.5 mm 4 | 4 nos. |
| 72. | Electric Soldering | Iron 230 V 60 watts 230 V 25 watts | 2 each |
| 73. | Electric testing screw driver | | 4 nos. |
| 74. | Engineer's square | 15 cm. Blade | 4 nos. |
| 75. | Engineers stethoscope | | 1 no. |
| 76. | Equipment puncture, in box, | | 1 no. |
| 77. | Feeler gauge | 20 blades (metric) | 2 nos. |
| 78. | File flat | 20 cm bastard | 4 nos. |
| 79. | File, half round | 20 cm second cut | 4 nos. |
| 80. | File, Square | 20 cm second cut | 4 nos. |
| 81. | File, Square | 30 cm round | 4 nos. |
| 82. | File, triangular | 15 cm second cut | 4 nos. |
| 83. | Files assorted sizes and types including safe edge file (20 Nos) | | 2 set |
| 84. | Flat File | 25 cm second cut | 4 nos. |
| 85. | Flat File | 35 cm bastard | 4 nos. |
| 86. | Fuel feed pump for Diesel | | 1 no. |
| 87. | Fuel injection pump (Diesel) inline | | 1 no. |
| 88. | Glow plug tester | | 2 nos. |
| 89. | Granite surface plate | 1600 x 1000 with stand and cover | 1 no. |
| 90. | Grease Gun | | 2 nos. |
| 91. | Grover - | 3, 4, 6mm. | 1 Each |
| 92. | Growler | | 2 nos. |
| 93. | Hacksaw frame adjustable | 20-30 cm | 10 |
| 94. | Hammer Ball Peen | 0.75 Kg | 4 nos. |
| 95. | Hammer Chipping | 0.25 Kg | 4 nos. |
| 96. | Hammer copper | 1 Kg with handle | 4 nos. |
| 97. | Hammer Mallet | | 4 nos. |
| 98. | Hammer Plastic | | 2 nos. |

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| 99. | Hand operated crimping tool (i) for crimping up to 4mm and (ii) for crimping up to 10mm | | 2 nos. |
| 100. | Hand reamers adjustable | 10.5 to 11.25 mm, 11.25 to 12.75 mm, 12.75 to 14.25 mm and 14.25 to 15.75 mm | 2sets |
| 101. | Hand Shear Universal | 250mm | 2 nos. |
| 102. | Hand vice | 37 mm | 2 nos. |
| 103. | High rate discharge tester (cell tester) | | 1 no. |
| 104. | Hollow Punch set of seven pieces | 6mm to 15mm | 2 sets each |
| 105. | Hydraulic jack HI-LIFT type - | 3 ton capacity | 1 no. |
| 106. | Injector - Multi hole type, Pintle type | | 4 each |
| 107. | Injector cleaning unit | | 1 no. |
| 108. | Injector testing set (Hand tester) | | 1 no. |
| 109. | Insulated Screw driver | 20 cm x 9mm blade | *10 nos. |
| 110. | Insulated Screw driver | 30 cm x 9mm blade | *10 nos. |
| 111. | Left cut snips | 250mm | 4 nos. |
| 112. | Lifting jack screw type | 3 ton capacity | 4 nos. |
| 113. | Magneto spanner set with | 8 spanners | 1 set |
| 114. | Magnifying glass | 75mm | 2 nos. |
| 115. | Marking out table | 90X60X90 cm. | 1 no. |
| 116. | Multi Scan Tool | | 1 no. |
| 117. | Multimeter digital | | 5 nos. |
| 118. | Oil can | 0.5/0.25 liter capacity | 2 nos. |
| 119. | Oil pump for dismantling and assembling. | | 2 nos. |
| 120. | Oil Stone | 15 cm x 5 cm x 2.5 cm | 1 no. |
| 121. | Oscilloscope | 20MHz | 1 no. |
| 122. | Outside micrometer | 0 to 25 mm | 4 nos. |
| 123. | Outside micrometer | 25 to 50 mm | 4 nos. |
| 124. | Outside micrometer | 50 to 75 mm | 1 no. |
| 125. | Outside micrometer | 75 to 100 mm | 1 no. |
| 126. | Pat melting | | 2 nos. |
| 127. | Philips Screw Driver set of 5 pieces | 100 mm to 300 mm | 2 sets |
| 128. | Pipe cutting tool | | 2 nos. |
| 129. | Pipe flaring tool | | 2 nos. |
| 130. | Piston ring compressor | | 2 nos. |
| 131. | Piston Ring expander and remover. | | 2 nos. |
| 132. | Piston Ring groove cleaner. | | 1 no. |
| 133. | Pliers combination | 20 cm. | 2 nos. |
| 134. | Pliers flat nose | 15 cm | 2 nos. |
| 135. | Pliers round nose | 15 cm | 2 nos. |
| 136. | Pliers side cutting | 15 cm | 2 nos. |
| 137. | Poker | | 2 nos. |

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| 138. | Portable electric drill Machine | | 1 no. |
| 139. | Portable oil monitoring Indicator | | 1 no. |
| 140. | Power Supply | 0-12 v, lamp | 1 no. |
| 141. | Prick Punch | 15 cm | 4 nos. |
| 142. | Punch Letter | 4mm | 2 set |
| 143. | Radiator cut section-cross flow | | 1 no. |
| 144. | Radiator cut section-down flow | | 1 no. |
| 145. | Radiator pressure cap | | 2 nos. |
| 146. | Rake | | 1 no. |
| 147. | Rear axle assembly-gear box steering box assembly of the diesel engine | | 2 set |
| 148. | Ridger. | | 2 nos. |
| 149. | Right cut snips | 250mm | 4 nos. |
| 150. | Rivet sets snap and Dolly combined | 3mm, 4mm, 6mm | 4 nos. |
| 151. | Scraper flat | 25 cm | 2 nos. |
| 152. | Scraper half round | 25 cm | 2 nos. |
| 153. | Scraper Triangular | 25 cm | 2 nos. |
| 154. | Scriber | 15 cm | 2 nos. |
| 155. | Scriber with scribing black universal | | 2 nos. |
| 156. | Set of stock and dies - UNC, UNF and metric | | 2 sets |
| 157. | Shear Tin Man's | 450 mm x 600mm | 4 nos. |
| 158. | Sheet Metal Gauge | | 2 nos. |
| 159. | Sher Tinmans | 300mm | 4 nos. |
| 160. | Shovel | | 2 nos. |
| 161. | Soldering Copper Hatchet type | 500gms | 4 nos. |
| 162. | Solid Parallels in pairs (Different size) in Metric | | 2 nos. |
| 163. | Spanner Clyburn | 15 cm | 1 no. |
| 164. | Spanner D.E. set of 12 pieces | 6mm to 32mm | 4 nos. |
| 165. | Spanner T. flocks for screwing up and up-screwing inaccessible positions | | 2 nos. |
| 166. | Spanner, adjustable | 15cm. | 2 nos. |
| 167. | Spanner, ring set of 12 metric sizes | 6 to 32 mm. | 2 nos. |
| 168. | Spanners socket with speed handle, T-bar, ratchet and universal upto 32 mm set of 28 pieces with box | | 2 nos. |
| 169. | Spark lighter | | 2 nos. |
| 170. | Spark plug spanner | 14mm x 18mm x Size | 2 nos. |
| 171. | Spirit level | 2 V 250, 05 metre | 2 nos. |
| 172. | Spring tension tester | | 1 no. |
| 173. | Stake grooving. | | 2 nos. |
| 174. | Stake, hatchet. | | 2 nos. |

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| 175. | Starter motor for tractor -different type | | 1 each |
| 176. | Steel measuring tape 10 meter in a case | | 4 nos. |
| 177. | Steel rule | 15 cm inch and metric | 4 nos. |
| 178. | Steel rule | 30 cm inch and metric | 4 nos. |
| 179. | Steel wire Brush | 50mmx150mm | 4 nos. |
| 180. | Stone, carborandum | 15 x 5 x 4 cm smooth and rough. | 1each |
| 181. | Straight edge gauge | 2 ft. | 2 nos. |
| 182. | Straight edge gauge | 4 ft. | 2 nos. |
| 183. | Stud extractor set of 3 | | 2 sets |
| 184. | Stud remover with socket handle | | 1 no. |
| 185. | Surface gauge with dial test indicator plunger type | i.e. 0.01 mm | 2 nos. |
| 186. | Tachometer (Counting type) | | 1 no. |
| 187. | Taps and Dies complete sets (5 types) | | 1 set |
| 188. | Taps and wrenches - Metric | | 2 sets |
| 189. | Telescope gauge | | 4 nos. |
| 190. | Temperature gauge | 0-100 deg c | 2 nos. |
| 191. | Thermostat | | 2 nos. |
| 192. | Thread pitch gauge metric, BSW | | 1 no. |
| 193. | Timing lighter | | 1 no. |
| 194. | Torque wrenches | 5-35 Nm, 12-68 Nm & 50-225 Nm | 1 each |
| 195. | Trammel 30 cm | | 2 nos. |
| 196. | Turbocharger cut sectional view | | 1 no. |
| 197. | Tyre pressure gauge with holding nipple | | 2 nos. |
| 198. | Universal puller for removing pulleys, bearings | | 1 no. |
| 199. | V' Block | 75 x 38 mm pair with Clamps | 2 nos. |
| 200. | Vacuum gauge to read | 0 to 760 mm of Hg. | 2 nos. |
| 201. | Valve Lifter | | 1 no. |
| 202. | Valve spring compressor universal. | | 1 no. |
| 203. | Vernier calliper | 0-300 mm with least count 0.02mm | *5 nos. |
| 204. | Vice grip pliers | | 2 nos. |
| 205. | Voltmeter | 50V/DC | 4 nos. |
| 206. | Water pump for dismantling and assembling | | 2 nos. |
| 207. | Wing compass | 25 cm | 2 nos. |
| 208. | Wire Gauge (metric) | | *5 nos. |
| 209. | Work bench | 250 x 120 x 60 cm with 4 vices 12cm Jaw | *5 nos. |

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| **C. GENERAL INSTALLATION/ MACHINERIES** | | | |
| 210. | 3 furrow disc plough with scrapersyk | | 1 no. |
| 211. | 9 tine cultivator-spring loaded mounted type | | 1 no. |
| 212. | Arbor press hand operated | 2 ton capacity | 1 no. |
| 213. | Automotive exhaust 5 gas analyzer (petrol & Diesel) or Diesel Smoke meter | | 1 no. |
| 214. | Bench lever shears | 250mm Blade x 3mm Capacity | 1 no. |
| 215. | Discrete Component Trainer / Basic Electronics Trainer | | 1 no. |
| 216. | Drilling machine bench to drill up to 12mm dia along with accessories | | 1 no. |
| 217. | Dual Magnetization Yoke : | AC / HWDC, 230 VAC, 50Hz | 1 set |
| 218. | Gas Welding Table | 1220mm x760mm | 2 nos. |
| 219. | Grinding machine (general purpose) D.E. pedestal with 300 mm dia wheels rough and smooth | | 1 no. |
| 220. | Liquid penetrant Inspection kit | | 1 set |
| 221. | Multi Scan Tool | | 1 no. |
| 222. | P.T.O. operated rotary lawn mower | | 1 no. |
| 223. | Pipe Bending Machine (Hydraulic type) | 12mm to 30mm | 1 no. |
| 224. | Pneumatic rivet gun | | |
| 225. | Spring tension tester | | 1 no. |
| 226. | Tin smiths bench folder | 600 x 1.6mm | 1 no. |
| 227. | Tractor Diesel Engine 4 stroke for Dismantling and assembling with | | 2 nos. |
| 228. | Trolley type portable air compressor single cylinder with 45 liters capacity Air tank, | | 1 no. |
| 229. | Welding plant Oxy-Acetylene complete ( high pressure) | | 1 no. |
| 230. | Welding Transformer | 150-300 Amps | 1 no. |
| 231. | Wheel type tractor fitted with diesel engine with standard accessories | | 2 nos. |
| **D. LIST OF CONSUMABLE:** | | | |
| 232. | Automatic Transmission oils | | As required |
| 233. | Battery- SMF | | As required |
| 234. | Brake fluids | | As required |
| 235. | Chalk, Prussian blue. | | As required |
| 236. | Chemical compound for fasteners | | As required |
| 237. | Diesel | | As required |

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| 238. | Different type gasket material | | As required |
| 239. | Different type of oil seal | | As required |
| 240. | Drill Twist (assorted) | | As required |
| 241. | Emery paper - | 36-60 grit , 80-120 | As required |
| 242. | Engine coolant | | As required |
| 243. | Engine oil | | As required |
| 244. | Gear oils | | As required |
| 245. | Hacksaw blade (consumable) | | As required |
| 246. | Hand rubber gloves tested for 5000 V | | 5 pair |
| 247. | Holders, lamp teakwood boards, plug sockets, solders, flux wires and cables batteries round consumable blocks and other consumables as required | | As required |
| 248. | Hydrometer | | 8 nos. |
| 249. | Lapping abrasives | | As required |
| 250. | Leather Apron | | 5 nos. |
| 251. | Petrol | | As required |
| 252. | Power steering oil | | As required |
| 253. | Radiator Coolants | | As required |
| 254. | Safety glasses | | As required |
| 255. | Steel wire Brush 50mmx150mm | | 5 nos. |
| 256. | Engine Spare Parts | | As per req. |
| 257. | Gloves for Welding (Leather and Asbestos) | | 5 sets |
| **E. WORKSHOP FURNITURE** | | | |
| 258. | Book shelf (glass panel) 6% „ x 3' x 1%' | | As required |
| 259. | Computer Chair | | 1+1 |
| 260. | Computer Table | | 1+1 |
| 261. | Desktop computer and related MS office software | | 1+1 |
| 262. | Discussion Table 8' x 4' x 2% „ | | 2 nos. |
| 263. | Fire Extinguishers, first- aid box | | As required |
| 264. | Instructional Material - NIMI Books/Ref. books | | As required |
| 265. | Internet connection with all accessories | | As required |
| 266. | Laser printer | | 1 no. |
| 267. | LCD projector/ LED /LCD TV (42") | | 1 no. |
| 268. | Multimedia DVD for Automotive application/subjects | | As required |
| 269. | Online UPS 2KVA | | 1 no. |
| 270. | Stools | | 21 nos. |
| 271. | Storage Rack 6% „ x 3' x 1%' | | As required |

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| 272. | Storage shelf 6% „ x 3' x 1%' | | As required. |
| 273. | Suitable class room furniture | | As required |
| 274. | Suitable Work Tables with vices | | As required |
| 275. | Tool Cabinet - 6% „ x 3' x 1%' | | 2 nos. |
| 276. | Trainees locker 6% „ x 3' x 1%' | | 2 Nos. to accommodate 20 Lockers |

***Note: -***

1. *All the tools and equipment are to be procured as per BIS specification.*
2. *Quantity marked with * has been increased as per the batch size.*
3. *Internet facility is desired to be provided in the class room.*

| Tools & Equipment 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 & Equipment 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:** | **Examination:** | | **Duration of the Trade/course:** |
| **Learning Outcome:** | | | |

| **S No.** | **Candidate Name** | **Father's/Mother's Name** | Safety Consciousness (15) | Workplace Hygiene & Economical use of materials (5) | Attendance/ Punctuality (10) | Ability to follow Manuals/ Written instructions (5) | Application of Knowledge (10) | Skills to Handle Tools/ Equipment/ Instruments/ Devices (10) | Economical use of Materials (5) | Working Strategy (10) | Quality in Workmanship/ Performance (15) | VIVA (15) | **Total Internal Assessment Marks** | **Result (Y/N)** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | | | | | | | | | | | | | | |
| **2** | | | | | | | | | | | | | | |