CURRICULUM

FOR THE TRADE OF

MATERIAL HANDLING EQUIPMENT MECHANIC – CUM – OPERATOR

UNDER

APPRENTICESHIP TRAINING SCHEME

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

CONTENTS

1. ACKNOWLEDGEMENT

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1. TATA Steel, Jamshedpur.

Special acknowledgement is extended by DGT to the following expert members who had contributed immensely in this curriculum.

Co-ordinator for the course: Sh. Nirmalya Nath., ADT

Sl. No.	Name & Designation Sh./Mr./Ms.	Organization	Remarks
1.	M. K. Verma, Sr. Manager	SNTI, TATA Steel Ltd.	Expert
2.	Gaurav Sharma, Sr. Manager	SNTI, TATA Steel Ltd.	Expert
3.	Anand Kumar Singh, Manager	SNTI, TATA Steel Ltd.	Expert
4.	N. Nath, ADT	CSTARI, Kolkata	Expert

2. BACKGROUND

2. 1. Apprenticeship Training Scheme under Apprentice Act 1961

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

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

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

2. 2. Changes in Industrial Scenario

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

2. 3. Reformation

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

- Prescription of number of apprentices to be engaged at establishment level instead of trade-wise.

- Establishment can also engage apprentices in optional trades which are not designated, with the discretion of entry level qualification and syllabus.

- Scope has been extended also to non-engineering occupations.

- Establishments have been permitted to outsource basic training in an institute of their choice.

- The burden of compliance on industry has been reduced significantly.

3. RATIONALE

(Need for Apprenticeship in **Material Handling Equipment Mechanic – Cum – Operator** trade)

1. It will enhance the ability to read blueprints, verify dimensions, alignments, and clearances of finished parts and making of simple parts by using hand / machine tools for defined accuracy.
2. It will enhance the ability to join and fasten devices by using soldering, brazing, gas & electric welding and flame cutting.
3. It will enhance the ability to check and repair/replacement of broken/worn-out gears, shafts, pulleys, clutches, flanges, glands, seals and sealant pump etc.
4. It will enhance the ability to observe and prepare various reports of LMV/HMV under ideal and on load conditions.
5. It will help the trainees to familiarize with components of LMV/HMV, different terminologies used in their operation/maintenance and various safeties to be followed.
6. It will enhance the ability to carry out maintenance and overhaul diesel engine with its accessories and check their performance.
7. It will enhance the ability to understand and carry out basic maintenance on various circuits pertaining to LMV/HMV.
8. It will enhance the ability to comprehend electrical components used in LMV/HMV and maintenance of battery.

4. JOB ROLES: REFERENCE NCO

Brief description of Job roles:

Loaders and Unloaders load and unload cargo and freight in ships, railway wagons, boats, aircraft, motor transport, conveyers, cranes and other animal or hand drawn vehicles, performing such operation as shifting, stacking, counting loads or bundles, and may be designated according to type of freight handled or nature of transport in which engaged such as:- LOADER AIRCRAFT; LOADER FRAGILE AND EXPLOSIVE MATERIALS, LOADER, BULK MATERIALS, LOADER, HEAVY MACHINERY, LOADER, RAILWAY WAGONS, LOADER, SHIP LOADER, INLAND WATERCRAFT, LOADER, ROAD TRANSPORT, LOADER, ANIMAL OR HAND DRAWN VEHICLES, etc.

Plan and organize assigned work and detect & resolve issues during execution. Demonstrate possible solutions and agree tasks within the team. Communicate with required clarity and understand technical English. Sensitive to environment, self-learning and productivity.

Perform TPM (Total Production Management), TQM (Total Quality Management) and record keeping system.

Reference NCO:

i) **NCO-2004: 9333.10**

5. GENERAL INFORMATION

1. **Name of the Trade** : **MATERIAL HANDLING EQUIPMENT MECHANIC – CUM – OPERATOR**

2. **N.C.O. Code No.** : **NCO-2004: 9333.10**

3. **Duration of Apprenticeship Training (Basic Training + Practical Training):** 2years

3.1 **For Freshers: -** Duration of Basic Training: -

a) Block –I : 3 months

b) Block – II : 3 months

Total duration of Basic Training: **6 months**

Duration of Practical Training (On -job Training): -

a) Block–I: 9 months

b) Block–II : 9 months

Total duration of Practical Training: **18 months**

3.2 **For ITI Passed: -** Duration of Basic Training: - **NIL**

Duration of Practical Training (On -job Training): **12 months**

4. **Entry Qualification** : Passed 10th Class Exam under 10+2 System.

5. **Selection of Apprentices:** The apprentices will be selected as per Apprentices Act amended time to time.

6. **Rebate for ITI passed trainees** : i) **One year** in the trade of **Mechanic Machine Tool Maintenance (MMTM)**

Note: Industry may impart training as per above time schedule for different block, however this is not fixed. The industry may adjust the duration of training considering the fact that all the components under the syllabus must be covered. However the flexibility should be given keeping in view that no safety aspects is compromised.

6. COURSE STRUCTURE

Training duration details: -

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

Components of Training	Duration of Training in Months →																							
↓	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Basic Training Block - I																								
Practical Training Block - I																								
Basic Training Block - II																								
Practical Training Block - II																								

7. SYLLABUS

7.1 BASIC TRAINING
(BLOCK – I & II)
DURATION: 06 MONTHS

GENERAL INFORMATION

1) **Name of the Trade** : **MATERIAL HANDLING EQUIPMENT MECHANIC – CUM – OPERATOR**

2) **Hours of Instruction** : 1000 Hrs. (500 hrs. in each block)

3) **Batch size** : 20

4) **Power Norms** : 17 KW for Workshop

5) **Space Norms** : 192 Sq. m.

6) **Examination** : The internal assessment will be held on completion of each Block.

7) **Instructor Qualification** :

i) Degree/Diploma in **Mechanical** Engg. from recognized university/Board with one/two year post qualification experience respectively in the relevant field.

OR

ii) NTC/NAC in the trade of **Material Handling Equipment Mechanic-cum-operator/MMTM** with three year post qualification experience in the relevant field.

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

8) **Tools, Equipments & Machinery required**: - As per Annexure – I

7.1.1 DETAIL SYLLABUS OF CORE SKILL

A. Block– I
Basic Training

Topic No.	a) Engineering Drawing	Duration (in hours)	b) Workshop Science & Calculation	Duration (in hours)
1.	Engineering Drawing: Introduction and its importance Different types of standards used in engineering drawing. Drawing Instruments: their uses Drawing board, T-Square, Drafter (Drafting M/c), Set Squares, Protractor, Drawing Instrument Box (Compass, Dividers, Scale, Diagonal Scales etc.), Pencils of different Grades, Drawing pins / Clips.	**30**	**Units & Measurements-** FPS, CGS, MKS/SI unit, unit of length, Mass and time. Fundamentals and derived units Conversion of units and applied problems.	**20**
2.	Lines : types and applications in Drawing as per BIS SP:46-2003 Drawing geometrical object using all types of lines. **Drawing of Geometrical Figures:** Angle, Triangle, Square, Rectangle and Circle. **Letters: -** Lettering styles, Single stroke letters and numbers as per IS standard. Lettering practice		**Material Science** : properties - Physical & Mechanical, Types - Ferrous & Non-Ferrous, difference between Ferrous and Non-Ferrous metals	
3.	**Dimensioning-** Types of dimension, elements of dimensions, Methods of indicating Values, Arrangement, Alignment and indication of dimensions. **Scales**:-Types use and construction. Representative factor of scale.		**Mass .Weight and Density** : Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density,	
4.	Method of presentation of Engineering Drawing - Pictorial View - Orthogonal View - Isometric view		**Speed and Velocity:** Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation. Average Velocity, Acceleration & Retardation. Related problems. Circular Motion: Relation between circular motion and Linear motion, Centrifugal	

			force, Centripetal force	
5.	**Constructions: -** Draw proportionate free hand sketches of plane figures. Sketch horizontal, vertical and inclined line by free hand, Draw circles by free hand using square and radial line method, Draw arcs and ellipse by free hand		**Ratio & Proportion** : Simple calculation on related problems. **Percentage:** Introduction, Simple calculation.	
6.	Projections: Concept of axes plane and quadrant. Orthographic projections Method of first angle and third angle projections (definition and difference) Symbol of 1^{st} angle and 3^{rd} angle projection as per IS specification. Free hand Drawing of Orthographic projection from isometric/3D view of geometrical blocks		**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. Meaning of H.P., I.H.P., B.H.P., and F.H.P. and CC and Torque.	

B. Block- II
Basic Training

Topic No.	a) Engineering Drawing	Duration (in hours)	b) Workshop Science & Calculation	Duration (in hours)
1.	**Screw :-** Its Types and Sizes, Screw thread, their standard forms as per BIS, external and internal thread.	**30**	**Algebra:** Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	**20**
2.	**Rivets and Joints:-** Prepare a drawing sheet on rivets nomenclature and Joints.		**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.	
3.	Free hand Sketches for simple pipe line with general fittings.		**Mensuration:** Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle, Volume of solids - cube, cuboid, cylinder and Sphere. Surface area of solids -cube, cuboid, cylinder and Sphere. Volume of cut-out solids: hollow cylinders, frustum of cone, block section. Volume of simple solid blocks.	
4.	Reading of drawing. Simple exercises related to missing lines, dimensions. How to make queries.		**Basic Electricity:** Introduction, use of electricity, how electricity is produced, Types of current_ AC, DC, their comparison, voltage, resistance, their units. Conductor, insulator, Types of connections - series, parallel, electric power, Horse power, energy, unit of electrical energy. Concept of earthling.	
5.	Simple exercises related to trade related symbols. Basic electrical and electronic symbols		**Simple machines** **Transmission of power:** - Transmission of power by belt, pulleys & gear drive. **Heat treatment process:** - Heat treatment and advantages.	

			Annealing, Normalizing, Hardening, Tempering.	
6.	Free hand sketch of trade related components / parts /cutting tool indicating angles.		**Trigonometry:** Trigonometrical ratios, measurement of angles. Trigonometric tables. Finding the value of unknown sides and angles of a triangle by Trigonometrical method. Finding height and distance by trigonometry. Application of trigonometry in shop problems. (viz. taper angle calculation). Calculate the area of triangle by using trigonometry and application of Pythagoras theorem.	
7.			**Concept of pressure** - **Definition**:-Force, Pressure, and their units, atmospheric pressure, gauges used for measuring pressure, problems. Introduction to pneumatics & hydraulics systems.	
8.	**Simple exercises related to trade related Test Papers. Solution of NCVT test papers.**			

7.1.2 DETAIL SYLLABUS OF PROFESSIONAL SKILLS & PROFESSIONAL KNOWLEDGE

A. Block –I

Basic Training

Week No.	Professional Skills	Professional Knowledge
1.	Safety: - its importance, classification, personal, general, workshop and job safety. Occupational health and safety. Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message. Preventive measures for electrical accidents & steps to be taken in such accidents. Importance of housekeeping & good shop floor practices. Disposal procedure of waste materials like cotton waste, metal chips/burrs etc. Fire& safety: Use of Fire extinguishers.	Importance of safety and general precautions observed in the in the industry/shop floor. All necessary guidance to be provided to the new comers to become familiar with the working of Institute system including stores procedures. Introduction of First aid. Safety attitude development of the trainee by educating him to use Personal Protective Equipment (PPE). Response to emergencies eg; power failure, fire, and system failure. Accidents- Definition types and causes. First-Aid, nature and causes of injury and utilization of first-aid. Introduction to 5S concept & its application. Fire: - Types, causes and prevention methods. Fire Extinguisher, its types. Global warming its causes and remedies. Industrial Waste its types, sources and waste Management.
2-5.	**Basic Bench Working Skills:** Hacksawing metal pieces, pre-files, different length with hacksaw frame in horizontal and vertical positions. Rough and smooth filling to accurate dimensions of flat and round surfaces. Measuring of lengths, angles etc and checking of curves and surface finish, with the help of checking tools and instruments including precision instruments. Marking for transfer of dimensions from Blue Prints to the jobs having flat and curved surfaces. Centre punching on marked lines, punching with number and letter punches.	**Fitters hand tools, their uses and maintenance.** Construction, use functions and types of marking , measuring, testing and cutting tools and appliances used for bench working such as calipers, hammers, V- blocks, engineers square, vices, hacksaws, chisels , files, angles plates, clamps, centre punches, scrapers, reamers, dies, taps, etc. Type, uses and working principles of precision measuring instruments like micrometers, vernier calipers depth gauges, dial indicator, bevel protractor etc. Gauges of inspection: purpose of gauges – thread gauges tool gauges, plug and ring gauges, square and radious gauges.

6-7.	Chipping with flat chisel and grooving with cross-cut chisel. Cutting of sheet metal by chisel. Use of hand and power operated shear machines. Simple sheet metal work. Use of hand drilling and bench drilling machines, counter sinking, counter boring and spot facing with bench drilling machine Hand Grinding of different types of tools, e.g. chisel, drill etc. Reaming with hand reamers. Threading by hand using taps and dies. Cold riveting of two components with different type of rivets. Pipe cutting, pipe threading, pipe fitting etc. Punching of holes hollow punches on leather gaskets and other packing materials Scraping flat and curved surface with different types of scrapers including power scrapers.	1. Safety and precaution as application to the trade. 2. Introduction, History and principles of Material Handling. 3. Horizontal and vertical movement of materials. 4. Overhead movement of materials. 5. Shipping containers for product protection. 6. Packaging methods and materials. 7. Material Handling system and integration of equipment. 8. Information needed for safe – loading material handling equipment (study of load- chart).
8.	**Gas & Electric welding & Flame Cutting:** Simple gas welding and flame cutting Simple arc welding Safety, Care and use of welding equipment Metal depositions technique **Soldering and Brazing:** Use of hard and soft solders Soldering of ferrous and non – ferrous metals. Brazing of ferrous and non- ferrous metals	**Jointing and fastening devices :** Permanent, semi-permanent and temporary fastening devices. Fasteners of different types and their functions like bolt washers, rivets, studs, pins, cutters, keys etc. Rivets and riveting – types, sizes, riveting tools etc Rivets and pipe fitting – tools, fixtures, threads etc Screws and screwing – different types of threads, functions etc. Tapers and tapering – devices with the use of tapers.

9.	**Advanced Bench Working Skills:** Making of different types of keys, keyways on pulleys gears etc. by hand. Practice on exercises involving of simple machine parts which have certain functional relationship to other parts. Removal of broken taps. Use of maintenance hand tools e.g. extractors, pullers, drift, master flat etc. Hand lapping practice. Making of simple parts by the use of hand tools and machine tools. Fitting of male and female parts to an accuracy of 0.05 mm Assembling of different parts with belts, nuts, keys, screws, pins and dewels etc.	**Limits, fits and Tolerances:** Different system of limit, fits and tolerance – Newell, ISI, British, DIN, ISO. Details of ISI System. Inter changeability and standardization. Use of templates, jigs and fixture, gauges for manufacturing of interchangeable parts.
10-12.	Skill involving in repairing of machine elements: Removing of broken studs from machine parts Removing of mounting of pulleys, gears in the shaft Replacement of repairing of bolts. Removal and mounting of antifriction bearings. Practice of scraping on machine slides, machine beds, plain bearing etc Checking and repairing of broken and worn-out gears, shafts, pulleys, clutches, flanges etc Replacement of damaged glands and seals Repairing of sealant pump	<u>Mechanical handling of machines/equipments:</u> Different types of appliances and tackle for shifting, loading and un-loading of machines and equipments. Screw jacks – their use and working principles. Chain pulley blocks – their use and working principles. Crane and hoists for lifting purposes – working principles and main constructional features. Working principles and use of other tackles like crabs and winches, slings, rollers and bars, levers, lashings and packing Mechanical advantages and velocity Use of inclined planes. Special precaution in the handling of heavy equipments, removal and replacement of heavy parts.
13.	**Revision & Internal Assessment**	

B. Block –II
Basic Training

Week No.	Professional Skills	Professional Knowledge
1.	Identification of different type of Vehicle. Demonstration of vehicle specification data; Identification of vehicle information Number (VIN). Identification of parts in a diesel engine of LMV/ HMV Practice on starting and stopping of diesel engines. Observe and report the reading of Tachometer, Odometer, temp and Fuel gauge under ideal and on load condition.	Auto Industry - History, leading manufacturers, development in automobile industry, trends, new product. Brief about Ministry of Road transport & Highways, 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.
2.	Identifying different components of HMV and its usage. Familiarize with different terminologies used related to the vehicle operation & safety aspect.	Introduction to Engine: Description of internal & external combustion engines, Classification of IC engines, Principle & working of 2&4-stroke diesel engine (Compression ignition Engine (C.I)), Principle of Spark Ignition Engine(SI), differentiate between 2-stroke and 4 stroke, C.I engine and S.I Engine, Direct injection and Indirect injection, Technical terms used in engine, Engine specification. Study of various gauges/instrument on a dash board of a vehicle - Speedometer, Tachometer, Odometer and Fuel gauge, and Indicators such as gearshift position, Seat belt warning light, Parking-brake-engagement warning light and an Engine-malfunction light. Different type of starting and stopping method of Diesel Engine. Procedure for dismantling of diesel engine from a vehicle.
3-4.	Overhauling of cylinder head assembly, Use of service manual for clearance and other parameters, Practice on removing rocker arm assembly manifolds. Practice on removing the valves and its parts from the cylinder head, cleaning. Inspection of cylinder head and manifold surfaces for warping, cracks and flatness. Checking valve seats & valve guide - Replacing the valve if necessary. Testing leaks of valve seats for leakage -Dismantle rocker	Diesel Engine Components: Description and Constructional feature of Cylinder head, Type of Diesel combustion chambers, Effect on size of Intake & exhaust passages, Head gaskets. Importance of Turbulence Valves & Valve Trains- Description and Function of Engine Valves, different types, materials, Type of valve operating mechanism, Importance of Valve seats, Valve seats inserts in cylinder heads, importance of Valve rotation,

	shaft assembly -clean & check rocker shaft-and levers, for wear and cracks and reassemble. Check valve springs, tappets, push rods, tappet screws and valve stem cap. Reassembling valve parts in sequence, refit cylinder head and manifold & rocker arm assembly, adjustable valve clearances, starting engine after adjustments.	Valve stem oil seals, size of Intake valves, Valve trains, Valve- timing diagram, concept of Variable valve timing. Description of Camshafts & drives , Description of Overhead camshaft, importance of Cam lobes, Timing belts & chains, Timing belts & tensioners.
5.	Practice on Checking & Top up coolant, Draining & refilling coolant, Checking / replacing a coolant hose, Testing cooling system pressure, Practice on Removing & replacing radiator/ thermostat. Inspect the radiator pressure cap, Testing of thermostat. Cleaning & reverse flushing. Overhauling water pump and refitting. Practice on Checking engine oil, Draining engine oil, Replacing oil filter, Refilling engine oil. Overhauling of oil pump, oil coolers, air cleaners and air filters and adjust oil pressure relief valves, repairs to oil flow pipe lines and unions if necessary.	Need for Cooling systems, Heat transfer method, Boiling point & pressure, Centrifugal force, Vehicle coolant properties and recommended change of interval, Different type of cooling systems, Basic cooling system components- Radiator, Coolant hoses, Water pump, Cooling system thermostat, Cooling fans, Temperature indicators, Radiator pressure cap, Recovery system, Thermo-switch. Need for lubrication system, Functions of oil, Viscosity and its grade as per SAE , Oil additives, Synthetic oils, The lubrication system, Splash system, Pressure system, Corrosion/noise reduction in the lubrication system. Lubrication system components -Description and function of Sump, Oil collection pan, Oil tank, Pickup tube, different type of Oil pump & Oil filters Oil pressure relief valve, Spurt holes & galleries, Oil indicators, Oil cooler.
6.	Practice on Start engine adjust idling speed and damping device in pneumatic governor and venture control unit checking Performance of engine with off load adjusting timings. Start engine- adjusting idle speed of the engine fitted with mechanical governor checking- high speed operation of the engine. Checking performance for missing cylinder by isolating defective injectors and test- dismantle and replace defective parts and reassemble and refit back to the engine	Marine & Stationary Engine:- Types, double acting engines, opposed piston engines, starting systems, cooling systems, lubricating systems, supplying fuel oil, hydraulic coupling, reduction gear drive, electromagnetic coupling, electrical drive, generators and motors, supercharging.
7.	Identification of various types of Gears & Gear boxes. Inspection of various aspects of Gears & Gear boxes such as PCD checking by Cylindrical Pin, Checking of gear tooth thickness, clearance, concentricity & wear etc.	Power transmission and machine drives; Common methods of power transmission and drives. Belts and belting – types, sizes and use of belts, belts fasteners, belt speeds, parallel and crossed belt drives.

	Gear meshing: Checking of backlash and root clearances with Feeler Gauge, Dial Test Indicator and Lead Wire. Repair of gear tooth. Shaft alignment, Pre-check: coupling fit, eccentricity, perpendicularity, with feeler, dial gauge and corrections methods.	Different kinds of shafts, rigids and flexibles. Types and use of keys and keyways – Tooth gears and gearing – types and uses of gears, conversion of rotary motion into reciprocation motion, pinions and racks etc. Chains and sprockets – types and uses, methods of fixings Couplings – types and uses, solid, flexible, friction, universal etc Care and maintenance for different types of drives Prime movers, line shafts and drive system, individual drive system, reciprocation drive, reverse drive eccentric drive, crank drive, cam drive, rotary or linear drive and vice versa. System of speed variation using stepped pulleys, gear box disc- contact etc.
8-9.	Practice to carrying out preventive maintenance work (the jobs involve inspection and lubrication of the machine as per instructions). Painting and use of surface protective coating s under preventive maintenance programme. Practice on overhauling of suspension system of HMV.	**Friction and Lubrication:** Friction – its effects, methods of reduction function, use of bearings. Coolants – different types and uses, cooling systems. Lubrication and lubricants – methods of lubrication, need and use, qualities of good lubricants, viscosity techniques of selection, types of lubricating oil and greases – their rating, commercial names and uses. <u>Bearing:</u> Different types, their application and dimensional relationship with shafts, methods of clamping and fitting lubrication of bearings, methods of mounting and dismounting, care maintenance, inspection of bearings-
10.	Identification of various types of clutches, clutch arrangements in power transmission system (machine tools), maintenance of clutch mechanism in machine tool. Dismantling & assembly of mechanical & electromagnetic assembly. Measuring shaft and coupling bore for finding	**Clutches** Function of Clutches, its types and use in power transmission system. Function of mechanical & electromagnetic system in clutch mechanism. **Couplings:** Concept of coupling and its type viz. Rigid coupling- Muff coupling, Flange

	out taper & ovality to determine the type of fit. Identification of different types of Brakes & Functioning of Braking mechanism in machine tools. Inspection of components of Brakes & braking mechanism.	coupling, Flexible coupling, Pin-bush coupling, Chain coupling, Gear coupling, Spider coupling, Tyre coupling, Grid coupling, Oldham-coupling, Fluid coupling, Universal coupling and their specific applications. **Brakes** & Braking Mechanism: Types & Functions. Inspection of brakes for safe & effective working. Brake, suspension and steering systems in the material handling equipment.
11.	**Hydraulic** circuit reading practice, pressure control circuits & regenerating circuit. Practice on basic maintenance of hydraulic system used for various equipment/HMV available.	1. Record Keeping and Reports. 2. Power and Transmission unite in different material handling equipment – Cooling & Lubrication system. 3. Hydraulic system: Introduction. Principle of hydraulics, maintenance and repair of hydraulic systems. 4. Trouble shooting and preventive maintenance.
12.	Practice in joining wires using soldering Iron, Measuring of current, voltage and resistance using digital multimeter, practice continuity test for fuses, jumper wires, fusible links, circuit breakers. Check electrical circuit with a test lamp. Cleaning and topping up of a lead acid battery, Testing battery with hydrometer, Connecting battery to a charger for battery charging, Inspecting & testing a battery after charging. Identify and test power and signal connectors for continuity, Identify and test different type of Diodes, NPN & PNP Transistors for its functionality.	**Basic electricity,** Electricity principles, Ground connections, Ohm's law, Voltage, Current, Resistance, Power, Energy. Voltmeter, ammeter, Ohmmeter Mulitmeter, Conductors & insulators, Wires, Shielding. 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. Electrical equipment, their working, repair, testing and maintenance etc. Batteries & cells, Lead acid batteries & Stay Maintenance Free (SMF) batteries. Basic electronics: Description of Semi conductors, Solid state devices- Diodes, Transistors, Thyristors, etc.
13.	**Revision & Internal Assessment**	

7.1.3 EMPLOYABILITY SKILLS

GENERAL INFORMATION

1)	**Name of the subject**	**:**	**EMPLOYABILITY SKILLS**
2)	**Applicability**	**:**	ATS- Mandatory for fresher only
3)	**Hours of Instruction**	**:**	**110 Hrs. (55 hrs. in each block)**
4)	**Examination**	**:**	The examination will be held at the end of two years Training by NCVT.
5)	**Instructor Qualification**	**:**	

i) MBA/BBA with two years experience or graduate in sociology/social welfare/Economics with two years experience and trained in Employability skill from DGET Institute.

And

Must have studied in English/Communication Skill and Basic Computer at 12th /diploma level

OR

ii) Existing Social Study Instructor duly trained in Employability Skill from DGET Institute.

7.1.3.1 SYLLABUS OF EMPLOYABILITY SKILLS

A. Block – I
Basic Training

Topic No.	Topic	Duration (in hours)
	English Literacy	**15**
1	**Pronunciation :** Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech)	
2	**Functional Grammar** Transformation of sentences, Voice change, Change of tense, Spellings.	
3	**Reading** Reading and understanding simple sentences about self, work and environment	
4	**Writing** Construction of simple sentences Writing simple English	
5	**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.	
	I.T. Literacy	**15**
1	**Basics of Computer** Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer.	
2	**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.	
3	**Word processing and Worksheet** Basic operating of Word Processing, Creating, opening and closing Documents, use of shortcuts, Creating and Editing of Text, Formatting the Text, Insertion & creation of Tables. Printing document. Basics of Excel worksheet, understanding basic commands, creating simple worksheets, understanding sample worksheets, use of simple formulas and functions, Printing of simple excel sheets	
4.	**Computer Networking and INTERNET** Basic of computer Networks (using real life examples), Definitions of Local Area Network (LAN), Wide Area Network (WAN), Internet, Concept of Internet (Network of Networks), Meaning of World Wide Web (WWW), Web Browser, Web Site, Web page	

	and Search Engines. Accessing the Internet using Web Browser, Downloading and Printing Web Pages, Opening an email account and use of email. Social media sites and its implication. Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT - ACT, types of cyber crimes.	
	Communication Skill	**25**
1	**Introduction to Communication Skills** Communication and its importance Principles of Effective communication Types of communication - verbal, non verbal, written, email, talking on phone. Non verbal communication -characteristics, components-Para-language Body - language Barriers to communication and dealing with barriers. Handling nervousness/ discomfort. Case study/Exercise	
2	**Listening Skills** Listening-hearing and listening, effective listening, barriers to effective listening guidelines for effective listening. Triple- A Listening - Attitude, Attention & Adjustment. Active Listening Skills.	
3	**Motivational Training** Characteristics Essential to Achieving Success The Power of Positive Attitude Self awareness Importance of Commitment Ethics and Values Ways to Motivate Oneself Personal Goal setting and Employability Planning. Case study/Exercise	
4	**Facing Interviews** Manners, Etiquettes, Dress code for an interview Do's & Don'ts for an interview	
5	**Behavioral Skills** **Organizational Behavior** Problem Solving Confidence Building Attitude Decision making Case study/Exercise	

B. Block– II
Basic Training

Topic No.	Topic	Duration (in hours)
	Entrepreneurship skill	**15**
1	**Concept of Entrepreneurship** **Entrepreneurship**- 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.	
2	**Project Preparation & Marketing analysis** Qualities of a good Entrepreneur, SWOT and Risk Analysis. Concept & application of Product Life Cycle (PLC), Sales & distribution Management. Different Between Small Scale & Large Scale Business, Market Survey, Method of marketing, Publicity and advertisement, Marketing Mix.	
3	**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.	
4	**Investment Procurement** Project formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment procedure - Loan procurement - Banking Processes.	
	Productivity	**10**
1	**Productivity** Definition, Necessity, Meaning of GDP.	
2	**Affecting Factors** Skills, Working Aids, Automation, Environment, Motivation How improves or slows down.	
3	**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.	
4	**Personal Finance Management** Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and Insurance.	
	Occupational Safety, Health & Environment Education	**15**
1	**Safety & Health** Introduction to Occupational Safety and Health importance of safety and health at workplace.	

2	**Occupational Hazards** Basic Hazards, Chemical Hazards, Vibro-acoustic Hazards, Mechanical Hazards, Electrical Hazards, Thermal Hazards. Occupational health, Occupational hygienic, Occupational Diseases/ Disorders & its prevention.	
3	**Accident & safety** Basic principles for protective equipment. Accident Prevention techniques - control of accidents and safety measures.	
4	**First Aid** Care of injured & Sick at the workplaces, First-Aid & Transportation of sick person	
5	**Basic Provisions** Idea of basic provision of safety, health, welfare under legislation of India.	
6	**Ecosystem** Introduction to Environment. Relationship between Society and Environment, Ecosystem and Factors causing imbalance.	
7	**Pollution** Pollution and pollutants including liquid, gaseous, solid and hazardous waste.	
8	**Energy Conservation** Conservation of Energy, re-use and recycle.	
9	**Global warming** Global warming, climate change and Ozone layer depletion.	
10	**Ground Water** Hydrological cycle, ground and surface water, Conservation and Harvesting of water	
11	**Environment** Right attitude towards environment, Maintenance of in -house environment	
	Labour Welfare Legislation	**5**
1	**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.	
	Quality Tools	**10**
1	**Quality Consciousness :** Meaning of quality, Quality Characteristic	
2	**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.	
3	**Quality Management System :** Idea of ISO 9000 and BIS systems and its importance in maintaining qualities.	
4	**House Keeping :** Purpose of Housekeeping, Practice of good Housekeeping.	
5	**Quality Tools** Basic quality tools with a few examples	

7.2 PRACTICAL TRAINING (ON-JOB TRAINING)
(BLOCK – I & II)
DURATION: 18 MONTHS (9 months in each block)

GENERAL INFORMATION

1) **Name of the Trade** : **MATERIAL HANDLING EQUIPMENT MECHANIC – CUM – OPERATOR**

2) **Batch size** : a) Apprentice selection as per Apprenticeship guidelines.
b) Maximum 20 candidates in a group.

3) **Examination** : i) The internal assessment will be held on completion of each block
ii) NCVT exam will be conducted at the end of 2nd year.

4) **Instructor Qualification** :

i) Degree/Diploma in **Mechanical** Engg. from recognized university/Board With one/two year post qualification experience in the relevant field.

OR

ii) NTC/NAC in the trade of Material **Handling Equipment Mechanic-cum-Operator** with three year post qualification experience in the relevant field.

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

5) **Infrastructure for On-Job Training** : - As per Annexure – II

7.2.1 BROAD SKILL COMPONENT TO BE COVERED DURING ON-JOB TRAINING

A. BLOCK – I (09 months)

1. Safety and best practices/Basic Industrial Culture (5S, KAIZEN, etc.), introduction to first aid & PPEs, safety while working at height, system power isolation procedure.
2. Prepare different types of documentation as per industrial need by different methods of recording information like standard operating procedures, daily management inspection, check list etc.
3. Introduction to Safety precautions on the Shop Floor unguarded defective condition, unsafe design or construction, unsafe illumination and unsaved confined space, and also unsafe acts of person like unsafe speed, unsafe loading, failure to use protective devices etc. Awareness of safety from hazard like hit, cut, press, slip, trip, fall.
4. Mechanical handling of machine leveling and testing of machines, practices on different types of knots with manila rope, correct use of slings. Use of lifting tackles (screw jack, puller, chain pulley blocks, hoist, crane etc), Leveling of machine by spirit/ master levels, and use of metal wedges, Testing of machines for any faults in alignment and proper functioning of various parts.
5. Breakdown maintenance, preventive maintenance, predictive maintenance/ condition based maintenance and overhauling of machine, Break – down maintenance of general machine tools (lathe, drilling machine or any available machine) & spares planning for reoccurring type of breakdown.

6. Detect faults and undertake repair of the machines, inspect, align and test machines for their accurate functioning, assemble and dismantle machines and their parts and adjust them as per requirement, handle loads of various types for transportation purpose, erect and install machines, various NDT methods etc.

7. Operation of different types of conveyors, Pneumatic conveyor, Wire conveyor, Slat Conveyor, Bucket Elevator, Gravity Roller Conveyor, Powered Roller Conveyor, Wheel Conveyor, V-type Bucket Conveyor, Vibrative screen & feeder, Screw Conveyor, Chain Conveyor, pipe conveyor etc. and Pneumatic Nozzle Traction
   (A) Conveyor.
   (B) Elevator.

   Conveyor system safety devices- pull cord, Zero Speed Switches (ZSS), belt sway, magnetic separator.
8. Operation of different types of cranes like Jib Cranes, Gantry Cranes, Traveling Bridge Craning and Mobile Cranes (Type Mounted & Crawler Mounted) Level Luffing Warf Cranes, Derrick.
9. Operation of cable ways, drag scrapers, Rope-ways-Mono cables, Bi-cables, Double track, shuttle Jig Back systems.
10. Operation of other material handling equipments like excavators, Chute, Fork-lifter, hoist, mobile elevators pallet, dumper, stacker cum reclaimer.

11. **Maintenance**

i) Application of Welding for maintenance.
ii) Application of hand tools for mechanical maintenance.
iii) Basics of surface damage detection and repair techniques.
iv) Cooling and lubrication system.
v) Overhauling of pumps cooler, radiation in cooling and lubricating.

B. BLOCK – II (09 months)

1. **Diesel Engine**

i) Removal of heads, adjustment of tappet setting.
ii) Pump installation and installation of fuel lines and Air bleeding from fuel system.
iii) Diesel Engine: - Fuel system, Lubrication system, cooling system and air system of diesel Engine

2. **Hydraulic System:** Maintenance of hydraulic system used for material handling equipment like hydraulic lift for machine hydraulic table, Hydraulic hand lift truck, hydraulic adjustable loading dock, Fork lift, Container handler, Reese stacker etc.

3. Hydrostatic drive, closed loop hydraulic system, hydraulic pump, valves and actuators, basic steering hydraulic circuit, hydraulic brakes, forklift and pay loader circuits.
4. **Transmission system**

i) Inspection overhauling and maintenance of gear box, transfer cases.
ii) Inspection overhauling and maintenance of various couplings. Fitting and maintenance of propeller shaft universal joints.
iii) Inspection overhaul and adjustment of differential assembly.

5. Braking system and steering

i) Inspection, Repair and adjustment of brake system and steering system.
ii) Torque converter.
iii) Fitting of brake lining.
iv) Brake shoe fitting and adjustment and bleeding.
v) Maintenance of steering system.
vi) Checking of caster, camber, Toe-in & Toe-out and King-Pin inclination.

6. **Suspension system:** Service and adjustment of shock absorbers, springs etc.

7. **Under Carriages**

i) Storage and maintenance of tyres and tubes.
ii) Maintenance of tyres record charge.
iii) Fitting of tyres and tubes.

8. **Electrical system**

i) Checking of wiring lighting circuits, warning circuits and minor repair of instrument panel.
ii) Different kinds of running electrical repairs.
iii) Repairing and overhauling of Starter motor, Dynamo, Alternator, and Voltage Regulator.
iv) Use of instruments of trouble shooting in electrical equipment like Motor, Generator etc.

9. **Trouble Shooting**

i) Fault Diagnosis.
ii) Use of operational manual and parts catalog productive/ preventive maintenance.
iii) Maintenance during storage.
iv) Safe Towing practices.

Note: It is a must that throughout the period of training the apprentice should learn good working habits and correct sequence of operations for each job, e.g. the correct sequence of tightening cylinder head nuts. This is particularly important for trouble shooting in which the approach must be systematic if it is to be successful and time saving.

8. ASSESSMENT STANDARD

8.1 Assessment Guideline:

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

The following marking pattern to be adopted while assessing:

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

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

In this work there is evidence of:

- good skill levels in the use of hand tools, machine tools and workshop equipment
- many tolerances while undertaking different work are in line with those demanded by the component/job.
- a fairly good level of neatness and consistency in the finish
- occasional support in completing the project/job.

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

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

In this work there is evidence of:

- good skill levels in the use of hand tools, machine tools and workshop equipment
- the majority of tolerances while undertaking different work are in line with those demanded by the component/job.
- a good level of neatness and consistency in the finish
- little support in completing the project/job

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

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

In this work there is evidence of:

- high skill levels in the use of hand tools, machine tools and workshop equipment
- tolerances while undertaking different work being substantially in line with those demanded by the component/job.
- a high level of neatness and consistency in the finish.
- minimal or no support in completing the project

8.2 FINAL ASSESSMENT- ALL INDIA TRADE TEST

(SUMMATIVE ASSESSMENT FOR TWO YEARS TRADE)

SUBJECTS	Marks	Sessional Marks	Full Marks	Pass Marks	Duration of Exam.
Practical	300	100	400	240	**08 hrs.**
Trade Theory	100	20	120	48	3 hrs.
Workshop Cal. & Sc.	50	10	60	24	3 hrs.
Engineering Drawing	50	20	70	28	4 hrs.
Employability Skill	50		50	17	2 hrs.
Grand Total	**550**	**150**	**700**	**-**	

Note: - The candidate pass in each subject conducted under all India trade test.

9. FURTHER LEARNING PATHWAYS

- On successful completion of the course trainees can opt for Diploma course (Lateral entry). [Applicable for candidates only who undergone ATS after CTS]
- On successful completion of the course trainees can opt for CITS course.

Employment opportunities:

On successful completion of this course, the candidates may be gainfully employed in the following industries:

1. Production & Manufacturing industries like steel plant.
2. Power plant industries or other related industries.
3. Mines & other such related industries.

ANNEXURE – I

TOOLS & EQUIPMENT FOR BASIC TRAINING

INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

TRADE: MATERIAL HANDLING EQUIPMENT MECHANIC-CUM-OPERATOR

LIST OF TOOLS & EQUIPMENTS FOR 20 APPRENTICES

A : TRAINEES TOOL KIT:-

SL. NO	NAME OF TOOL & EQUIPMENTS	QUANTITY
1.	Steel Rule 15 cm both side Graduated in Metric & English.	20 Nos
2.	Inside Spring Caliper 150 mm	20 Nos
3.	Outside Spring Caliper 150 mm	20 Nos
4.	Spring Divider 150 mm	20 Nos
5.	Engineers Square 150 mm	20 Nos
6.	Hacksaw Frame AB 250, 300	20 Nos
7.	Engineer Ball Peen Hammer 200 complete with handle	20 Nos
8.	Engineer Ball Peen Hammer 400 complete with handle	20 Nos
9.	Flat Chisel 20 x 200 H	20 Nos
10.	Cross cut Chisel 10 x 150	20 Nos
11.	Half round Chisel 10 x 250	20 Nos
12.	Diamond Point Chisel 9.5 mm	20 Nos
13.	Centre Punch 5	20 Nos
14.	Prick Punch 150 mm	20 Nos
15.	Engineers File Flat Bastard 300 mm	20 Nos
16.	Engineers File Flat 2nd cut 250 mm tow sq. edges	20 Nos
17.	Engineers File Flat Bastard 350 mm	20 Nos
18.	Engineers File Flat smooth 200 mm	20 Nos
19.	Flat / Round Nose Plier	20 Nos
20.	Combination Plier	20 Nos
21.	Engg. half round File 2nd cut 250 mm	20 Nos
22.	Engg. Three sq. File Smooth	20 Nos
23.	Engg. Round File smooth 200	20 Nos
24.	Engg. Square file smooth 200 mm	20 Nos
25.	Engg. Needle Set of 12	20 Nos
26.	File Handle	20 Nos

27.	Caliper Hermaphrodite 150	20 Nos
28.	Scraper A 250 mm	20 Nos
29.	Scraper B 160	20 Nos
30.	Scraper D 160	20 Nos
31.	Spindle Blade Screw Driver	20 Nos
32.	Keys Allen Hexagonal 2.5 to 12	20 Nos
33.	Tap Wrench (adj) and fixed	20 Nos
34.	Die Holders	20 Nos
35.	Card file	20 Nos
36.	Scriber 300 mm	20 Nos

B. TOOLS AND EQUIPMENT FOR MAINTENANCE SHOP:

SL. NO	NAME OF TOOL & EQUIPMENTS	QUANTITY
37.	Master Bar 45° scraping Bar 600 mm width of bar 75 mm thickness 25 mm all sider an accuracy of 0.02 mm seasoned.	1 No.
38.	-----Do----	1 No.
39.	Master Flat- scraping test bar 600mm, length 75 x 75 mm sq in cross section all sizes scraped of an accuracy of 0.02 mm per 300 mm seasoned.	1 No.
40.	Hand tap me – 6 to 12 each size set of 3 with tap wrench thread cutting die MM 60 to HS	1 each.
41.	Spanner socket set of 8 with Ratchet 8. 12, 20	1 each.
42.	Hexagonal Key 1.5 to 12.	1 set.
43.	Hammer Soft (faced 30 mm dia. plastic tipped)	4 Nos.
44.	Pipe Wrench 450	2 Nos.
45.	Chain Pipe Wrench 650	1 No.
46.	Flat Node Pliers AI 80	1 No.
47.	Spindle Blade Screw Driver 150 mm	1 No
48.	Scriber Block Universal 300 mm	4 Nos.
49.	Bench Vice 100	8 Nos.
50.	Bench Vice 150	8 Nos.
51.	Ring Spanner set of G.S.A.E.	1 No.
52.	Double Ended Open Spanner 5.5 to 50 mm	1 Set.
53.	Double Ended Off-Set Ring Spanner 5.5 to 50 mm	1 Set.
54.	Gear Puller 150 mm . dia capacity three leg type	1 No.
55.	‘C’ Spanner C x 10	1 Set.
56.	Scale BB 80	8 Nos.
57.	Scale BB 20	1 No.
58.	Metric Steel Tape measure	1 No.
59.	Thread Pitch Gauge 0-25, 6-00, 150-60°	1 No.

60.	Thread pitch Gauge metric screw threads	1 No.
61.	2/3 Cells torch	2 Nos.
62.	Grease Gum	1 No.
63.	Level 1 P 300-0. 05/ meter	1 No.
64.	Engineer Square 400 blade	1 No.
65.	Feeler gauge (0.03 to 1 mm)	1 Set
66.	Magnetic Basic Off- On type	1 No.
67.	Detachable spout oil can 250	1 No.
68.	Single ended open jaw adj wrench A-200	1 No.
69.	Stationery scissors type –II-65	1 No.
70.	Gasket hollow punches 5,6,8,10,12,19,25 mm dia	1 each
71.	bar type torque wrench	1 No.
72.	Hand operated socket wrench	1 set.
73.	Taps & dies complete set	1 No.
74.	Cam lock type screw driver	1 No.
75.	Dial indicator type torque	1 No.
76.	Propane torch	1 No.
77.	Ring spanner SE of 8-25 mm	1 Set.
78.	Box spanner SE hexagonal	1 Set.
79.	Heavy duty screw driver	1 No.
80.	spindle blade screw driver (Engg. 200 mm)	1 No.
81.	Hammer soft	1 No.
82.	Pipe cutter 10 mm dia, capacity	1 No.
83.	Elaring tool	1 No.
84.	Tube expander upto 62 mm	1 Set.
85.	Granked double ended Ring spanner	1 No.
86.	Box spanner DE 8 to 20	1 Set.
87.	Gear box unit (for trg.)	1 No.
88.	Bearing Housing Unit (for trg	1 No.
89.	Shafting unit with pulleys as available (for trg.)	1 No.
90.	Horizontal centrifugal pumps (Gear and spindle)	1 No.
91.	Air Compressor	1 No.
92.	Key Allen hex	1 Set.
93.	Circlip pliers (inside and outside)	1 Set.
94.	Right angle drill attachment 6 mm	1 No.
95.	SRDG ball bearing	1 No.
96.	DRDG ball bearing	1 No.
97.	Self aligning ball bearing	1 No.
98.	SRAC ball bearing	1 No.

99.	Ball bearing thrust type	1 No.
100.	Needle bearing	1 No.
101.	Single Row cylindrical Roller Bearing	1 No.
102.	Tapered roller bearing	1 No.
103.	Barrel type bearing	1 No.
104.	Plain bush bearing	1 No
105.	Thin Walled bearing	1 No.
106.	Thrust roller bearing	1 No.
107.	Self – alignment roller ball bearing	1 No
108.	Telescopic gauges	1 No.
109.	Arbour press bench type	1 No.
110.	Lubricant trolley – 2409 x 1200 x 1200 mm (8 mm chamber)	1 No.
111.	Compressor sprayer machine	1 No.
112.	Tap Extractor	1 No.
113.	Vane Pump (fixed and variable delivery)	1 each
114.	Piston pump (Raidal and axial)	1 each
115.	Relief valve	1 No.
116.	Sequence valve	1 No.
117.	Un- loading valve	1 No.
118.	Pressure reducing valve	1 No.
119.	Check valve	1 No.
120.	Directional control valve (rotary spool and sliding spool)	1 each
121.	Flow control valve	1 No.
122.	pressure gauge	1 No.
123.	Reservoir	1 No.
124.	Linear Actuator (differential and non-differential)	1 each
125.	Hydro motor	1 No.
126.	Accumulator (spring and gas)	1 each
127.	Pneumatic tools (Portable nut runner pneumatic chisel, pneumatic ram etc) for demonstration purpose.	1 each
128.	Pnewnatic valves and actuators	1 each
129.	Hydraulic and pneumatic Board with necessary aggregates for different machine circuts	1 No.

C. PRECISION INSTRUMENTS:

Sl. No.	Name of tools and equipments	Quantity
1	Vernier Bevel protractor with 150 mm blade	1 no.
2	Vernier caliper 200 mm with Inside and depth measurements	2 nos.
3	Dial vernier caliper 200 mm, with 0.02 mm least count	1 no.
4	Optical Bevel protractor	1 no.

5	Outside micrometer 0 to 25mm	1 no.
6	Outside micrometer 25 to 50 mm	1 no.
7	Outside micrometer 50 to 75 mm	1 no.
8	Combination set with 300 mm blade centre head, square head and protector head.	1 no.
9	Sine bar 200 mm	1 no.
10	Slip Gauge Box (workshop grade) - 87 pieces per set	1 no.
11	Inside micrometer 50 mm to 200mm, 0.01 mm least count with six extension rod.	1 no.
12	Gear tooth Micrometer (metric)	1 no.
13	Bevel gauge 200	1 no.
14	Dial test indicator – Plunger type-Range 0-10 mm , Graduation 0.01 mm & 0.001mm Reading 0-10 with revolution counter (complete with clamping devices and magnetic stand)	1 set
15	Dial test indicator – Puppitast type-Range 0-10 mm , Graduation 0.01 mm & 0.001 mm. Reading 0-10 with revolution counter (complete with clamping devices and magnetic stand)	1 set
16	Feeler gauge	1 no.
17	Radius gauge 1 to 25 mm radius	1 no.
18	Screw pitch gauge for metric, standard & fine pitches. BSP & BSW pitches (0.25 to 6 mm)	1 no.
19	Center gauge 55º x 47½º	1 no.
20	Center gauge 60º	1 no.
21	Plug gaugeMorse taper No.1, 2, 3, 4,	1 set
22	Ring gauge Morse taper No.1, 2, 3, 4,	1 set
23	Ring gauge Ø20mm (Go and No Go)	1 no.
24	Limit plug gauges Ø20mm	1 no.
25	Wire gauges	1 no.
26	Bore gauge with dial indicator (1 mm range, 0-0.01 mm graduation)-Range of bore gauge 18-150 mm)	1 no.
27	Straight edge 485 mm to 1445 mm	1 set
28	Bearing fitting tool	1 set
29	Multimeter	2 Nos.
30	Tong tester	1 No.
31	Megger	1 No.
32	Wire stripper cum cutter	1 No.
33	Crimping Tool	1 No.

D. GENERAL MACHINERIES:

SL. NO	NAME OF TOOL & EQUIPMENTS	QUANTITY
1.	Pedestal grinder	1 No.
2.	Drilling Machine pillar type sensitive 0-20 mm Cap. with swivel Table Motorizes with chuck and key	1 No.
3.	Portable Hand grinder 150 mm dia motorised	1 No.
4.	Flexible hand grinder 100 mm dia (lighter type)	1 No.
5.	Diesel engine (Running condition) Stationary type	1 No.

E. OLD MACHINES FOR JOB WORK (REPAIR & RECONDITIONING):

Sl. No.	Name of tools and equipments	Quantity
1.	Old Centre lathe	1no
2.	Old Milling Machine (Universal)	1no
3.	Old Grinding Machine (Universal)	1no
4.	Old Shaping Machine	1no
5.	Old Gear Box (any type)	1no
6.	Revolving Centre	1no
7	Old hydraulic power pack with hydraulic cylinder	1 no
8	Old hydraulic power press	1 no
9	Old Gear pump	1 no.
10	Old Vane pump fixed and variable delivery	1each
11	Old Piston pump (Radial & Axial)	1each

F. WELDING WORK:

1. GAS WELDING -

Sl. No.	Name of tools and equipments	Quantity
1.	Oxy-acetylene welding Cylinder Trolley	1 no.
2.	Welding hose P.V.C. flexible internal dia. 6 mm (Blue and red)	5m
3.	Hose coupling Nipples	2 nos.
4.	Hose Protractor	2 nos.
5.	Double stage Pressure regulator for Oxygen and Acetylene	1no. each
6.	High Pressure blow pipe with tips	1 no.
7.	Gas cutting torch with cutting tips	1 no
8.	Welding gloves pair (Leather)	1 pair
9.	Goggles (4A) for Gas. Welding	4 nos.
10.	Spark lighter	2 nos.
11.	Spindle key	1 no.
12.	Gas Welding table with fire bricks.	1 no.

2. ARC WELDING -

(**If welding trade is available in the institute may be used-otherwise to be provided as per list given below**)

Sl. No.	Name of tools and equipments	Quantity
1.	Welding Machine DC or AC, (Single phase / 3 phase), 150 – 300 Amps capacity with all accessories	1 no.

G. HOISTING EQUIPMENT

SL. NO	NAME OF TOOL & EQUIPMENTS	QUANTITY
1.	Portable Jacks	1 No.

2.	Shear Legs (tripod)	1 No.
3.	Flat Pulley	1 No.
4.	Hand Operator Chain Pulley Block	1 No.
5.	Fibre Rope Sling	1 No.
6.	Steel Wire Sling	1 No.
7.	Steel Chain Sling from 6,3 to 45 mm	1 No.
8.	Crow Bar	4 Nos
9.	Cut Sizes of Timber	3 Sets
10.	Rollers (Steel tubes) from 38 to 63.5 mm	10 Nos.
11.	Block of Timber (various Sizes)	10 Nos.
12.	Steel Skids or Wood Skids.	1 Set.
13.	Steel Wedges	1 Each.
14.	Manilor Rope 12 ∅, 20 ∅, 30 ∅	1 Each.
15.	Eye Bolt with Collars range M 10 to M 36	2 Nos.
16.	Ratchet chain Pulley	1 No.

H. EQUIPMENT FOR ELECTRICAL MAINTENACE

SL. NO	NAME OF TOOL & EQUIPMENTS	QUANTITY
1.	Combination Plier insulated 200mm	1 No.
2.	Screw Driver Insulated 6mm X150mm,	1 No.
3.	Screw Driver Insulated (Diamond Thread) 4mm X150mm,	1 No.
4.	Double bladed electrician knife	1 No.
5.	Engineering's cross peen hammer 200 gm. with handle	1 No.
6.	Digital Micrometer	1 No.
7.	Electrician Screw Driver thin stem 4mm X100mm insulated handle	1 No.
8.	Hydrometer	1 No.
9.	Test lamp 220 V 60W	1 No.
10.	Hammer plastic faced	1 No.
11.	Soldering Iron 50w, 230V	1 No.
12.	Digital Thermometer 0°C - 150°C	1 No.
13.	Flat file rough, 250 mm with two square edges	1 No.
14.	Wire stripping Plier 6 inch, 150mm	1 No.

INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

TRADE: MATERIAL HANDLING EQUIPMENT MECHANIC-CUM-OPERATOR

LIST OF TOOLS & EQUIPMENTS FOR 20 APPRENTICES

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

2) Infrastructure:

A : TRAINEES TOOL KIT:-

Sl. No.	Name of the items	Quantity (indicative)
1.	Draughtsman drawing instrument box	20 Nos.
2.	Set square celluloid 45^0 (250 X 1.5 mm)	20 Nos.
3.	Set square celluloid 30^0-60^0 (250 X 1.5 mm)	20 Nos.
4.	Mini drafter	20 Nos.
5.	Drawing board (700mm x500 mm) IS: 1444	20 Nos.

B : FURNITURE REQUIRED

Sl. No.	Name of the items	Quantity (indicative)
1	Drawing Board	20 Nos.
2	Models : Solid & cut section	as required
3	Drawing Table for trainees	as required
4	Stool for trainees	as required
5	Cupboard (big)	01
6	White Board (size: 8ft. x 4ft.)	01
7	Trainer's Table	01
8	Trainer's Chair	01

ANNEXURE – II

INFRASTRUCTURE FOR ON-JOB TRAINING

TRADE: MATERIAL HANDLING EQUIPMENT MECHANIC-CUM-OPERATOR

For Batch of 20 APPRENTICES

Actual training will depend on the existing facilities available in the establishments. However, the industry should ensure that the broad skills defined against On-Job Training part (i.e. 9 months + 9 months) are imparted. In case of any short fall the concern industry may impart the training in cluster mode/ any other industry/ at ITI.

ANNEXURE-III

GUIDELINES FOR INSTRUCTORS AND PAPER SETTERS

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

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

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

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