

SYLLABUS FOR THE TRADE OF
MATERIAL HANDLING EQUIPMENT
MECHANIC – CUM – OPERATOR
UNDER APPRENTICESHIP TRAINING SCHEME

DESIGNED IN 1998

CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
MINISTRY OF LABOUR (DGE & T)
EN BLOCK, SECTOR – V , SALT LAKE, CALCUTTA - 700091

MEMBERS OF THE TRADE COMMITTEE FOR THE TRADE OF
"MATERIAL HANDLING EQUIPMENT MECHANIC-CUM-OPERATOR"
UNDER APPRENTICESHIP TRAINING SCHEME HELD
ON 24.11.97 AT CSTARI, CALCUTTA

CHAIRMAN

Mr. T. Chakravarty

A C K N O W L E D G E M E N T

We are grateful to Regional Service & Sales Manager of Voltas Ltd., Service Manager of Larsen & Tourbro Ltd and Dy. App. Advisor of Arab Ki Sarai ITI, New Delhi for their valuable contributions towards designing and developing the course curriculum of this trade under ATS.

GENERAL INFORMATION

1. Name of the Trade : Material Handling Equipment
Mechanic-cum-Operator.
2. N. C. O. Code No. :
3. Duration of Apprenticeship Training : 3 Years including 2 years
Basic Training.
4. Entry Qualification : Passed 10th Class Exam. of
10+2 System.
5. Rebate : 2 Years to Ex-ITI trainees of
Mill-Right Maint. Mech.Trade
6. Ratio of Apprentices to worker : 1 : 3

SYLLABUS FOR THE TRADE OF
MATERIAL HANDLING EQUIPMENT MECHANIC-CUM-OPERATOR
Under
APPRENTICESHIP TRAINING SCHEME

Period of Training : 3 Years

BASIC TRAINING : 2 YEARS

BASIC TRAINING (PRACTICAL)

1st Year

1.	Basic Bench Working Skills	...	18 Weeks
2.	Basic Machine Working Skills	...	12 Weeks
3.	Basic Hot Working Skills	...	6 Weeks
4.	Application of Basic Skills learnt	...	12 Weeks
5.	Revision and Test	...	4 Weeks

1. Basic Bench Working Skills (18 Weeks) :

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.

Rough and smooth filling to accurate dimensions of flat and round surfaces.

Hacksawing metal pieces, profiles, different length with hacksaw frame in horizontal and vertical positions.

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, countersinking, counterboring 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 rivetting of two components with different types of rivets.

Pipe cutting, pipe threading, pipe fitting, etc.

Punching of holes with hollow punches on leather gaskets and other packing materials.

Scraping flat and curved surfaces with different types of scrapers including power scrapers.

2. Basic Machine Working Skills (12 Weeks)

During this phase the trainees should be acquainted with the constructional features, working principles, different types of operations, care and maintenance of machine and the safety precautions to be observed in the use of different types of machine tools.

LATHE

Constructional features and working principle. Holding of work pieces and tools using different devices. Plain stepped, taper and form turning, knurling etc. Drilling, boring, counterboring and reaming on lathe. Screw cutting - external and internal - different types. Grinding of turning tools. Care and maintenance of machine. Safety precautions to be observed while handling the machine.

Milling Machine:

Constructional features and working principle. Different methods of holding of work piece and cutters. Parallel milling, angular milling and grooving including uses of end mills.

Simple indexing and gear cutting
Care and maintenance of machine
Safety precautions.

Shaping Machine:

Constructional features and working principle. Holding of work piece and tools.

Flat and angular shaping.

Grinding of tools.

Care and maintenance of machine.

Safety precautions.

Grinding Machine:

Constructional feature and working principle.

Holding of work piece.

External and Internal cylindrical grinding.

Surface grinding.

Care and maintenance of machine.

Safety precautions.

3. Basic Hot Working Skills (6 Weeks) :

Forging:

Bending of hot bars, drawing down of thicker sections.

Heating and forming popular sections.

Twisting, punching and drifting.

Care and use of forging tools.

Heat Treatment :

Hardening and tempering of hand tools.

Annealing of hardened components.

Case hardening of mild steel components.

Gas & Electric Welding & Flame Cutting :

Simple gas welding and flame cutting.

Simple arc welding.

Care and use of welding equipment.

Metal deposition technique.

Soldering and Brazing:

Use of hard and soft solders.

Soldering of ferrous and non-ferrous metals.

Brazing of ferrous and non-ferrous metals.

4. Application of Basic Skills Learnt (12 Weeks) :

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 dowels. etc.

Repairing case iron parts by brazing.

5. Revision and Test (4 Weeks) :

Achievement :

(i) He should be able to do good fitting jobs as a bench fitter upto accuracy of quality of and arc precision instruments of different types.

(ii) He should be able to make small spare parts for the purpose of fitting to functional accuracies and do simple metal joints and cracks repairing.

(iii) He should be able to carry out cleaning servicing and lubrication of machines.

(iv) He should be able to read simple blue prints and make simple sketches of machine parts.

SYLLABUS FOR RELATED INSTRUCTION

Under

APPRENTICESHIP TRAINING SCHEME

TRADE THEORY : (FIRST YEAR)

1. Fitters hand tools, their uses and maintenance.
2. Jointing and fastening devices.
3. Limits, fits and tolerances.
4. Machine tools and operations.
5. Hot working tools and processes.
6. Engineering materials and their properties.

1. 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. Types, uses and working principles of precision measuring instruments like micrometers, vernier calipers depth gauges, dial indicator, bevel protractor, etc.

Gauges for inspection : Purpose of gauges-thread gauges tool gauges, plug and ring gauges, square and radius gauges.

2. Jointing and fastening devices :

Permanent, semi-permanent and temporary fastening devices.

Fasteners of different types and their functions like bolts

3. Limits, fits and tolerances

Different system of limit, fits and tolerances - Hewell, ISI, British, DIN, ISO.

Details of ISI system.

Interchangeability and standardization.

Use of templates, jigs and fixtures, gauges for manufacturing of interchangeable parts.

4. Machines tools and operations

Constructional features, types, functions and uses of common machine tools like lathe machines, drilling machines, shaping machines, milling machines, boring machines, grinding machines and planing machines etc.

Their care and maintenance.

Common turning operations; cutting speeds and feeds, cutting tools angles, chucks and chucking, threads and threading use of coolants, gear boxes and drives.

Common milling operations, cutting feeds and speeds, indexing and gear cutting, milling attachments, cutters and materials, work holding devices.

Common drilling, boring and reaming operations, tools and materials, speeds and feeds, common faults and their rectification. Drills and drilling techniques.

Common shaping, slotting and planing operations, tools and materials, work holding methods, speeds and feeds.

Common grinding and other surface finishing operations.

Heat treatment - methods, hardening, tempering, normalising and annealing. Furnaces and Tools; Case hardening methods. Changes in the properties of materials due to heat effects. Soldering, brazing, tinning and sweating operation; tools, materials, fluxes and methods.

6. Engineering materials and their properties :

Properties and uses of ferrous and non-ferrous metals and their alloys such as cast iron, wrought iron, mild steel, carbon steel, tool steel, high speed steel, copper, tin, aluminium, brass, bronze, zinc, white metal, lead etc. and rubber and plastics.

Methods of producing cast iron and steel. Physical and mechanical properties of materials and testing of materials.

Meaning of tenacity, elasticity, malleability, ductility, toughness, etc.

WORKSHOP CALCULATION AND SCIENCE

FIRST YEAR :

Workshop Calculation

Conversion from F.P.S. to M.K.S. units & vice versa :

Conversion of units of length, area, volume, weight, pressure from one system to another system.

Square Root :

Finding square root of whole numbers and decimals.

Ratio, proportion and percentage :

Application to shop problems.

Algebra : Transposition problems - simple and simultaneous equations. Algebraic formula - $(a+b)$, $(a-b)$, $(a+b)^2$, $(a-b)^2$, etc.

Trigonometry :

Use of tables to find ratios and angles, simple practical shop problems.

Mensuration :

Area and perimeter of triangle, square, rectangle, hexagon, circle and sector.

Logarithm :

Use of log table in calculation involving positive characteristics, powers, square root, cube root, etc.

Force : Definition of force.

Resolution of forces, triangle and parallelogram of forces.

Density and specific gravity :

Definition of density and specific gravity.

Archimedes principle.

Determination of density and specific gravity of solid and liquids.

Pressure :

Atmospheric pressure, gauge pressure and absolute pressure.
Barometer. Relationship between pressure, volume and temperature
- Boyle's Law and Charles Law.

Head and Temperature :

Effect of heat on solid. Liquid and gas. Co-efficient of
Linear expansion, sp. heat and latent heat, unit of heat.
Conversion from one thermometer scale to another. Brief descrip-
tion of conduction, convection and radiation - Common instruments
for measuring temperature.

Work, power and energy :

Definition and unit, conversion from mechanical energy to
heat energy and vice-versa.

Magnetism :

Earth as a magnet.

Poles of magnet, magnetic field, inverse square law of
magnetism, magnetisation and de-magnetisation, uses of
magnet in industry.

Electricity :

Voltages, current, resistance, and their relationship.
Defects of cells, how to avoid defects.

Series and parallel connection of dry cells. Conductors and
insulators.

ENGINEERING DRAWING

FIRST YEAR :

INTRODUCTION : Drawing as a graphic language.

Fundamental principles of projection, projection of lines, plane figures and solids. orthographic projection - first angle and third angle projection.

Free hand sketching of simple models having flat and curve surfaces with holes and slots.

Dimensioning techniques - scale of drawing.

Construction of plane geometrical figures.

Drawing - Sectional views of different types of solids including prisms, cylinder, pyramids, cones, etc.

Representation of screw threads, bolts, nuts and screws.
Different locking arrangements.

Rivets and riveted joints, keys and keyways, cotter joints, knuckle joint, muff coupling, half lap coupling etc.

BASIC TRAINING (PRACTICAL)

2ND YEAR

1. Advanced bench working skills : 12 weeks
2. Skills involved in repairing of machine elements. 20 weeks
3. Basic skills involved in mechanical Handling of machine for transportation purpose. 4 weeks
- Levelling and testing of machine --
4. Basic skills involved in breakdown maintenance, preventive maintenance, and overhauling of machine. 12 weeks
5. Revision and test 4 weeks.

1. Advanced Bench Working Skills :

Making of different types of keys, keyways on pulleys gears, etc. by hand

Making of templates.

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.

Machine reaming.

Hand lapping practice.

Fabrication of special fixture required for machine maintenance.

2. Skill involved in repairing of machine elements: (20 weeks)

Removing of broken studs from machine parts.

Removal and 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 bearings, etc.

Checking and repairing of broken and wornout gears, shafts, pulleys, clutches, flanges, etc.

Replacement of damaged glands and seals.

Repairing of coolant pump.

3. Basic skills involved in mechanical handling of machine levelling and testing of machines (4 weeks) :

Practice on different types of knots with manila rope.

Correct use of slings. Use of lifting tackles (screw jack, chain pulley blocks, hoist, crane, etc.).

Levelling of machine by spirit levels, and use of metal wedges.

Testing of machines for any faults in alignment and proper functioning of various parts..

4. Basic skills involved in breakdown maintenance, preventive maintenance and overhauling of machine (12 weeks) :

Diagnosis of faults in machines.

Break-down maintenance of general machine tools (lathe drilling machine, etc.)

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 coatings under preventive maintenance programme.

Overhauling of Bench Drilling Machine, Pedestal Grinding Machine, Coolant pump and machine accessories e.g. chucks machine vice, steadies, tailstock, etc.

5. Revision and test (4 weeks) :

ACHIEVEMENT :

(i) He should be able to detect faults and undertake repair of the machines.

(ii) He should be able to inspect, align and test machines for their accurate functioning.

(iii) He should be able to assemble and dismantle machines and their parts and adjust them as per requirement.

(iv) He should be able to handle tools and machine parts for various machine purpose, erect and dismantle them.

RELATED INSTRUCTION - TRADE THEORY

2ND YEAR

1. Power transmission and machine drives.
2. Friction, lubrication and bearings.
3. Bearings.
4. mechanical handling of machines/equipments.
5. Foundations and alignment of machines.
6. Repair of machines including preventive maintenance.
7. Safety.

1. Power Transmission and 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.

Different kinds of shafts, rigids and flexibles.

Types and uses of keys and keyways -

Tooth gears and gearing - types and uses of gears, conversion of rotary motion into reciprocating motion, pinions and racks, etc.

Chains and sprockets - types and uses, methods of fixings.

Couplings - types and uses, solid, flexible, friction, universal etc.

Mechanical, hydraulic and pneumatic drives - basic principles and uses.

Care and maintenance for different types of drives.

Prime movers, line shafts and drive system, individual drive system, reciprocating drive, reverse drive, eccentric drive, crank drive, cam drive, rotary to linear drive and vice versa.

Systems of speed variation using stepped pulleys, gear box, disc-contact, etc.

2. Friction and Lubrication :

Friction - its effects, methods of reducing friction, 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.

3. Bearings :

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.

4. Mechanical handling of machines/equipments :

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 packings :

Mechanical advantages and velocity.

Use of inclined planes.

Special precautions in the handling of heavy equipments, removal and replacement of heavy parts.

5. Foundations and alignment of machines :

Methods employed for the installation and erection of machines. Location and excavation of foundations. Types of foundation. Method of installation of medium duty machines.

Machine alignment procedures, precautions to be taken for aligning levelling machines different types of alignment and testing for correct functioning of machine parts. Machine commissioning.

6. Repair of machines including preventive maintenance :

Importance of maintenance work, different types of maintenance.

Methods of maintenance and overhauling of machines and tools. Basic concepts on preventive maintenance.

7. Safety :

General safety rules and practices in a workshop.

Safe working habits and safety consciousness.

Safe working devices, guard, attachments etc.

First-aid practices.

Fire fighting equipment and practices.

(2ND YEAR)

Calculation :

Plotting of graphs

- Different types of graphs - straight line, curve etc.

Mensuration

- Surface area, volume and weight of solid bodies like cubes, cylinder, cone, pyramid, frustums of pyramid and cones, sphere, etc.

Developed length of bent pieces.

- Developed length of different work pieces.

Belt drive

- Transmission ratio, loss due to slip, belt length calculations.

Velocity & acceleration

- Calculation on velocity and acceleration vector representation of velocity, relative velocity. Laws of falling bodies.

Science :

Moment and torque

- Turning moment of force. Principle of moment, application of moment - simple levers and compound levers.

Centre of gravity

- General idea about C.G. Calculation of C.G. of regular geometrical figures.

Friction

- Friction, co-efficient of friction, angle of friction, problems on friction.

Electrical power

- Watts, KW, KWH, conversion from electrical to mechanical units & vice-versa.

Fluid pressure

- Pascal's law and its application.

Calculation on Hydraulic press, determination of force on the piston, etc.

ENGINEERING DRAWING (2 ND YEAR)

- Intersections - Intersection of cone and cylinders.
- Miterings - Methods adopted in marking work pieces for mitering; dimensions of miters for preparation of joints, bents, etc.
- Pictorial views- Isometric drawing, Isometric scale.
- Drawing of Isometric views of plane figures, simple solids like cubes, prisms, pyramids, cone, etc. Drawing of orthographic views from isometric drawings.
- Drawing of foundation bolts, flanged couplings, bearings, pulleys, springs.
- Details drawing with dimensions from actual assembly having various parts.
- Surface quality symbols as per I.S. 696.
- Practice in Blue Print Reading.

Csd/

LIST OF TOOLS & EQUIPMENT

Sl. No.	Name of tools & Equipments	Quantity
1.	2.	3.

TRAINEES TOOL KIT :

1. Scale B B 20	17 Nos.
2. Inside Spring Caliper 150 mm.	17 Nos.
3. Outside Spring Caliper 150 mm.	17 Nos.
4. Spring Divider 150 mm.	17 Nos.
5. Engineers Square 150 mm.	17 Nos.
6. Hacksaw Frame AB 250, 300.	17 Nos.
7. Engineer Ball Peen Hammer 200 complete with handle.	17 Nos.
8. Engineer Ball Peen Hammer 400 complete with handle.	17 Nos.
9. Flat Chisel 20 x 200 H	17 Nos.
10. Cross cut Chisel 10 x 150	17 Nos.
11. Half round Chisel 10 x 250	17 Nos.
12. Diamond Point Chisel 9.5 mm.	17 Nos.
13. Centre Punch 5	17 Nos.
14. Prick Punch 150 mm.	17 Nos.
15. Engineers File Flat Bastard 300 mm.	17 Nos.
16. Engineers File Flat 2nd cut 250 with two sq. edges.	17 Nos.
17. Engineers File Flat Bastard 350 mm.	17 Nos.
18. Engineers File Flat smooth 200 mm. two safe edges.	17 Nos.
19. Flat/Round Nose Plier	17 Nos.
20. Combination Plier	17 Nos.
21. Engg. Half Round File 2nd cut 250 mm	17 Nos.
22. Engg. Three sq. File Smooth	17 Nos.

1.	2.	3.
23.	Engg. Round File Smooth 200	17 Nos.
24.	Engg. Square File Smooth 200 mm.	17 Nos.
25.	Engg. Needle Set of 12	17 Sets.
26.	File Handle	170 Nos.
27.	Caliper Hermophrodite 150	17 Nos.
28.	Scraper A 250 mm.	17 Nos.
29.	Scraper D. 160	17 Nos.
30.	Scraper B 160	17 Nos.
31.	Spindle Blade Screw Driver	17 Nos.
32.	Keys Allen Hexagonal 2.5 to 12	17 Sets.
33.	Tap Wrench (adj.) and fixed	17 Sets.
34.	Die Holders	17 Sets.
35.	Card File	17 Sets.
36.	Scriber 300 mm.	17 Sets.

TOOLS & INSTRUMENTS FOR MAINTENANCE SHOP :

1.	Master Bar 45° scraping Bar 600 mm. width of bar 75 mm., thickness 25 mm., all sides an accuracy of 0.02 mm sea- soned.	1 No.
2.	-do-	1 No.
3.	Master Flat-scraping test bar 600 mm, length 75 x 75 mm sq. in cross section all sides scraped to an accuracy of 0.02 mm. per 300 mm. seasoned.	1 No.
4.	Hand tap M-6 to 12 each size set of 3 with tap wrench thread cutting die MM 6 to HS.	1 each
5.	Spanner Socket set of 8 with Ratchet 8, 12, 20.	1 each.
6.	Hexagonal Key 1.5 to 12.	1 Set.
7.	Hammer Soft (faced 30 mm dia. plastic tipped).	4 Nos.
8.	Pipe Wrench 450	2 Nos.
9.	Chain Pipe Wrench 650	1 No.
10.	Flat Nose Pliers Al 80	4 No.

1.	2.	3.
11.	Spindle Blade Screw Driver 150 mm.	1 No.
12.	Scriber Block Universal 300 mm.	4 Nos.
13.	Bench Vice 100	8 Nos.
14.	Bench Vice 150	8 Nos.
15.	Ring Spanner set of 6 S. A. E.	1 No.
16.	Double Ended Open Spanner 5.5 to 50 mm.	1 Set.
17.	Double Ended Off-set Ring spanner 5.5 to 50	1 Set.
18.	Gear Puller 150 mm. dia. capacity three leg type.	1 No.
19.	'C' Spanner C x 10	1 Set.
20.	Scale BB 80	8 Nos.
21.	Scale BB 20	1 No.
22.	Metric Steel Tape measure	1 No.
23.	Thread Pitch Gauge 0-25, 6-00, 150-60°	1 No.
24.	Thread Pitch Gauge metric screw threads	1 No.
25.	2/3 Cells Torch	2 Nos.
26.	Grease Gun	1 No.
27.	Level 1 P 300-0.05/metre	1 No.
28.	Engineer Square 400 blade	1 Set.
29.	Feeler Gauge (0.03 to 1 mm).	1 No.
30.	Magnetic Basic Off- On Type	1 No.
31.	Detachable Spout Oil Can 250	1 No.
32.	Single Ended Open Jaw adj. wrench A-200	1 No.
33.	Stationery Scissors Type-II 65	1 No.
34.	Gasket Hollow Punches 5, 6, 8, 10, 12, 19, 25 mm. dia.	1 Each
35.	Bar Type Torque Wrench	1 No.
36.	Hand operated Socket Wrench	1 Set.
37.	Taps & Dies Complete Set.	1 No.
38.	Cam Lock Type Screw Driver	1 No.
39.	Dial Indicator Type Torque	1 No.
40.	Propane Torch	1 No.

1.	2.	3.
41.	Ring Spanner SE of 8-25 mm.	1 Set.
42.	Box Spanner SE Hexagonal	1 Set.
43.	Heavy Duty Screw Driver	1 No.
44.	Spindle Blade Screw Driver (Enggr. 200 mm).	1 No.
45.	Hammer Soft	1 No.
46.	Pipe Cutter 19 mm dia. capacity	1 No.
47.	Flaring Tool	1 No.
48.	Tube Expander upto 62 mm.	1 Set.
49.	Cranked Double ended Ring Spanner	1 No.
50.	Box Spanner DE 8 to 20	1 Set.
51.	Gear Box Unit (for trg.)	1 No.
52.	Bearing Housing Unit (for trg.)	1 No.
53.	Shafting Unit with Pulleys as available (for trg.)	1 No.
54.	Horizontal Centrifugal Pumps (Gear and Spindle)	1 No.
55.	Air Compressor	1 No.
56.	Key Allen Hex	1 Set.
57.	Circclip Pliers (inside and out side).	1 Set.
58.	Right angle drill attachment 6 mm. capacity.	1 No.
59.	SRDG Ball Bearing.	1 No.
60.	DRDG Ball Bearing	1 No.
61.	Self aligning Ball Bearing.	1 No.
62.	SRAC Ball Bearing.	1 No.
63.	Ball Bearing Thrust Type	1 No.
64.	Needle Bearing	1 No.
65.	Single Row Cylindrical Roller Bearing.	1 No.
66.	Tapered Roller Bearing	1 No.
67.	Barrel Type Bearing	1 No.
68.	Plain Bush Bearing	1 No.
69.	Thin Walled Bearing	1 No.
70.	Thrust Roller Bearing.	1 No.

1.	2.	3.
71.	Self-alignment Roller Ball Bearings.	1 No.
72.	Telescopic Gauges	1 No.
73.	Arbour Press Bench Type	1 No.
74.	Lubricant Trolley-2409 x 1200 x 1200 mm (8 mm chamber).	1 No.
75.	Compressor Sprayer Machine	1 No.
76.	Tap Extractor	1 No.
77.	Gear Pump	1 No.
78.	Vane Pump (fixed and Variable delivery).	1 Each.
79.	Piston Pump (radial and axial)	1 Each.
80.	Relief Valve	1 No.
81.	Sequence Valve	1 No.
82.	Un-loading Valve	1 No.
83.	Pressure Reducing Valve	1 No.
84.	Check Valve	1 No.
85.	Directional Control Valve (rotary spool and sliding spool).	1 Each
86.	Flow Control Valve	1 No.
87.	Pressure Gauge	1 No.
88.	Reservoir	1 No.
89.	Linear Actuator (differential and non- differential);	1 Each
90.	Hydromotor	1 No.
91.	Accumulator (spring and gas)	1 Each
92.	Pneumatic tools (portable nut runner, pneumatic chisel, pneumatic ram etc.) for demonstration purpose.	1 Each
93.	Pneumatic Valves and Actuators.	1 Each
94.	Hydraulic and Pneumatic Board with necessary aggregates for different machine circuits.	1 Set.

PRECISION INSTRUMENT

Sl. No.	Name of tools & Equipments	Quantity
1.	2.	3.
1.	Vernier Height Gauge 500 mm.	1 No.
2.	Mechanical Bevel Protractor A 150	1 No.
3.	Vernier Caliper A 200	1 No.
4.	Vernier Caliper A 300	1 No.
5.	External Micrometer Gr. I	1 No.
6.	External Micrometer Gr. II	1 No.
7.	External Micrometer Gr. III	1 No.
8.	External Micrometer Gr. IV	1 No.
9.	External Micrometer Gr. V	1 No.
10.	Combination Set with 300 mm Scale, Centre Head sq. head & Protractor head.	1 No.
11.	Telescopic Gauge 12 mm to 150 mm Set.	1 Set
12.	Vernier Depth Gauge 200 with fine adjustment.	1 No.
13.	Sine Bar 200 mm.	1 No.
14.	Slip Gauge (in sets)	1 Set
15.	Engineers Square 450 B.	1 No.
16.	V-Block, Grade A & B.	1 Each.
17.	V-Block 50/5-40 A	1 No.
18.	Precision Angle Plate 250 x 150	1 No.
19.	Precision Angle Plate 19195 x 75	1 No.
20.	Micrometer Internal	1 No.
21.	Micrometer External	1 No.
22.	Vernier Gear Tooth Caliper.	1 No.
23.	Bevel Gauge 200	1 No.
24.	Dial Gauge Type 1 Gr. A (complete with clamping devices and stand).	2 Nos.
25.	Feeler Gauge (0.03 to 1)	1 No.
26.	Radius Gauge	1 No.

1.	2.	3.
27.	Radius Gauge	1 No.
28.	Thread Pitch Gauge 0.25 to 6, 15° x 60°	1 No.
29.	Thread Gauge 55° x 47½°	1 No.
30.	Thread Gauge 60°	1 No.
31.	Plug Gauge, Plain (designation of taper as per table 1)	1 No.
32.	Ring Gauge Morse Taper No. 1, 2, 3, 4.	1 Set
33.	Ring Gauge 5 to 25 by 2.5 mm.	1 No.
34.	Wire Gauge	1 No.
35.	Bore Dial Gauge (01 mm dial)	1 No.
36.	Indicator with Magnetic Base	1 No.
37.	Dial Gauge, Type 1, Gr. A complete with clamping devices.	1 No.
38.	Straight Edge 485 mm to 1445 mm.	1 Set
39.	Hand Tachometer for Checking the R. P. M. 0-10,000	1 No.
40.	Mandrels	1 Set

MASONARY :

1.	Double Face Sledge Hammer 1000	1 No.
2.	Wooden Straight Edge 300, 600, 900, 1200.	1 Each
3.	Man-on-chisel	1 No.
4.	Tasla	2 Nos.
5.	Pick Axes.	1 No.
6.	Bar Bending Tools and Cutting Tools	1 No.
7.	Spirit Level	1 No.
8.	Pocket Steel Tape 150 mm	1 No.
9.	Four Fold Foot Rule	1 No.
10.	Crow Bar	2 Nos.
11.	Plumb Bob	1 No.
12.	Masone Tool for Plaster Work	1 No.

1.	2.	3.
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LATHE TOOLS :

1. Drill Chuck 13	1 No.
2. Reduction Sleeve and Extension sockets	1 Each
3. Centre Drill A-4	1 Each
4. Revolving Centers	1 No.
5. Knurling Tool (straight, cross & diamond)	1 Set
6. Lathe Carriers upto 75 mm	1 Set
7. Centre Gauge	1 Set
8. Oil Stone 10 x 100	1 No.
9. Emmerly Cloth No. 00, 0, & 1.	1 Pkt.
10. Engg. File 50 length	1 No.
11. H.S.S. Tool Bits 8 & 10 sq. x 75	16 Nos.
12. Boring Tool Holder 10 mm sq. Bit Size x Length 200 mm.	2 Nos.

MACHINIST TOOLS :

1. Cylindrical Milling Cutter	1 No.
2. Side and Face Milling Cutter 150 x 10 x 27.	1 No.
3. Side & Face Cutter 100 x 6 x 27	1 No.
4. Equal Angle Milling Cutter 45° x 27 mm. 60 x 27 mm bore. bore	1 Each
5. Single Angle Milling Cutter 45° x 27 mm bore (LH) and (RH).	1 Each
6. Single Angle Milling Cutter 60° x 27 mm bore (LH) and (RH).	1 Each
7. Slot Milling Cutter with Parallel Shank	1 No.
8. Slot Milling Cutter with Parallel Shank 10 x 27 mm.	1 No.
9. Slitting Saw 3 mm Thick x 27 mm.	1 No.
10. Slitting Saw 4 mm Thick x 27 mm.	1 No.
11. Key Way Milling Cutter	1 Set
12. T-Slot Milling Cutter	1 Set

1.	2.	3.
13.	Convex Milling Cutter .	1 Set
14.	Concave Milling Cutter	1 Set
15.	Single Corner Rounding Milling Cutter	1 Set
16.	End Mill Cutter 3, 6, 10, 12, 16, 19.	1 Set
17.	Milling Cutter No. 8, 9, 10, 12, 16, 20, D. P. No. 1 to 8.	1 Set
18.	Rotary Gear Cutters for Spur and Helical, Gear.	1 Set
19.	Fly Cutter Holder	1 No.
20.	Hexagonal Bolt and Nut M 60 x 150.	1 Set
21.	Plain Washers	1 Set
22.	Plain Clamps	1 Set
23.	Engineers Parallel	1 Set
24.	Spanner D. E. G. P.	1 Set
25.	Hexagon Socket Screw Keys.	1 Set
26.	Engineers File	1 No.
27.	Single Ended Open Jaw adjustable Wrench A150	1 No.
28.	Table Chuck 3 Jaw with tightening arrangement and graduated in degrees.	1 No.
29.	Machine Vice 200 mm Swivel Base.	1 No.
30.	Machine Vice Swivel Base 160	1 No.
31.	Tool Holder L. H., R. H. & Straight.	1 Each.

GENERAL MACHINES :

1.	Centre Lathe with all accessories	1 No.
2.	Slotting Machine with accessories	1 No.
3.	Shaping Machine 450 (mechanical)	1 No.
4.	Milling Machine, Universal motorised No. 1 with all access.	1 No.
5.	Surface Grinding Machine	1 No.
6.	Cylindrical Universal Grinding Machine	1 No.
7.	Pedestal Grinder	1 No.
8.	Tool and Cutter Grinder	1 No.

1.	2.	3.
9.	Drilling Machine Pillar Type Sensitive 0-20 mm Cap. with Swivel Table Motorises with chuck and Key.	1 No.
10.	Drilling Machine Bench Sensitive 0-12.5 Cap. motorised with Chuck and Key and other access.	1 No.
11.	Portable Hand Grinder 150 mm. dia. motorised.	1 No.
12.	Flexible Hand Grinder 100 mm. dia. (lighter Type).	1 No.
13.	Arbour Type Straightening Press 5000 Kg. cap.	1 No.
14.	Portable Drilling Machine 6 mm. capacity.	1 No.

MACHINES FOR REPAIR AND RECONDITIONING :

1.	Old Lathe	2 Nos.
2.	Old Milling Machine	1 No.
3.	Old Grinding Machine	1 No.
4.	Old Shaper Machine	1 No.
5.	Old Press (power)	1 No.

WELDING WORK "A" (GAS WELDING PLANT) :

1.	Oxy-Acetylene Welding Cylinder Trolley	1 No.
2.	Welding Hose of Rubber with Woven Textile re-inforcement internal dia. 5.00 mm (black, red).	10. Nos.
3.	Hose Coupling Nipples	2 Nos.
4.	Hose Protractor	2 Nos.
5.	Pressure Regulator (oxgn.) for Gas Cylinder Pressure Regular (acety).	1 Each
6.	Blow-pipe with Tips High Pressure Low Pressure.	1 Each
7.	Gas Cutting Troch	1 No.
8.	Spark Lighter	6 Nos.
9.	Cup Type Goggles (welder) with filter glass.	2 Nos.

1.	2.	3.
10.	Apron Leather full Skirt Type	1 No.
11.	Leather Gauntlets for Welder size small 300 L, Medium 350 L, large 400 mm L.	1 No.
12.	Leather Sleeves. Outside length 350 to 600 mm in shop of 50.	1 No.
13.	Leg Guard	1 No.
14.	Light Shoes	1 Pair

ARC WELDING 'B' :

1.	DC Welding Generator 150-300 complete to AC Induction with all series.	1 No.
2.	Arc Welding Transformer single operator type 380, 440 Volts upto 350 amps maximum continuous low welding current.	1 No.
3.	Rectifier Type D.C. Arc Welder (Manual Metal Arc) 300 . 400 amp.	1 No.
4.	Insulated Cable 2 length with links fitted.	1 No.
5.	Electrode Holder the preferred rated current should be 200, 400 amps.	1 No.
6.	Welding Helmet Screen	1 No.
7.	Welders Chipping Hammer	1 No.
8.	Chipping Screen.	1 No.
9.	Brush, Welders 40 mm wide	1 No.

BLACKSMITH :

1.	Cast Iron Forge 1 M x 1 M 1 M with Blower.	1 No.
2.	Blacksmith's Anvil, 200 Kg.	1 No.
3.	Double Face Sledge Hammer 6.00 Kg.	1 No.
4.	Engineers Ball Peen Hammer 1 Kg.	1 No.
5.	Smiths Tongs, hollow but; smiths tongs flat (30 mm).	1 Each

1.	2.	3.
10.	Apron Leather full Skirt Type	1 No.
11.	Leather Gauntlets for Welder size small 300 L, Medium 350 L, large 400 mm L.	1 No.
12.	Leather Sleeves. Outside length 350 to 600 mm in shop of 50.	1 No.
13.	Leg Guard	1 No.
14.	Light Shoes	1 Pair

ARC WELDING 'B' :

1.	DC Welding Generator 150-300 amps. complete to AC Induction with accessories.	1 No.
2.	Arc Welding Transformer single operator type 380, 440 Volts upto 350 amps maximum continuous low welding current.	1 No.
3.	Rectifier Type D.C. Arc Welder (Manual Metal Arc) 300 . 4000 amps.	1 No.
4.	Insulated Cable 2 length with links fitted.	1 No.
5.	Electrode Holder the preferred rated current should be 200, 400 amps.	1 No.
6.	Welding Helmet Screen	1 No.
7.	Welders Chipping Hammer	1 No.
8.	Chipping Screen.	1 No.
9.	Brush, Welders 40 mm wide	1 No.

BLACKSMITH :

1.	Cast Iron Forge 1 M x 1 M 1 M with Blower.	1 No.
2.	Blacksmith's Anvil, 200 Kg.	1 No.
3.	Double Face Sledge Hammer 6.00 Kg.	1 No.
4.	Engineers Ball Peen Hammer 1 Kg.	1 No.
5.	Smiths Tongs, hollow bit, smiths tongs flat (30 mm).	1 Each

6. Cold Set with a handle	1 No.
7. Hot Set with a shandle	1 No.
8. Smiths Flatter A 65	1 No.
9. Hammer Set 1 Kg. and 2 Kg.	1 Each
10. Block Swage 300 x 300 x 1100 mm.	1 No.
11. Punch with handle in different size (6 to 25 by 3 mm).	1 Set
12. Drift in different size 6 to 25 by 3 mm.	1 Set
13. Water Tank (450 x 300 x 250 x 6 mm). Plate.	1 No.
14. Oil Bath for quenching 45 x 45 x 45 cm. x 6 mm thick plate.	1 No.
15. Top swaged 12.5, 20.00, 25.00 mm, Bottom swages 6.00, 12.5, 20.00	1 Set
16. Smiths Top Bottom Fuller	1 No.
17. L. Square (30 x 30 x 40 cm)	1 No.
18. Brass Rule 300 mm.	1 No.
19. Spade	1 No.
20. Rake	1 No.
21. Poker	1 No.
22. Sprinkler	1 No.
23. Wing Compass 200 mm.	1 No.

SHEET METAL WORK :

1. Forge Power Operated 458 mm, dia 150 mm blower.	1 No.
2. Acetylene Gas Soldering Blow Pipe (Soldering Acy. 432 V. 48 size)	1 No.
3. Inclined Burner Type Blow Lamp size-1, capacity 500 ml.	1 No.
4. Electric Soldering Iron 120 W, 250 V.	1 No.
5. Hand Shears, Universal	1 No.
6. Pistol Type Drill Machine 6 mm, capacity (wolf type).	1 No.
7. Soldering Copper Bit 450 gm. (hatchet type straight type).	1 Each.

1.	2.	3.
8.	Metal Cutting Shears F-250	2 Nos.
9.	Metal Cutting Shears E 250	1 No.
10.	Mallet (plastic or rose wood) ord. and rectangular 75 x 75 x 50 mm.	2 Nos.
11.	Conical Mallet	1 No.
12.	Combination side cutting pliers 160	1 No.
13.	Mandrel 120 mm long in different size	1 Set
14.	Half Moon Stake	1 No.
15.	Round Stake	1 No.
16.	Bottom Stake	1 No.
17.	Round Bottom Stake	1 No.
18.	Beak Iron	1 No.
19.	Funnel Stake	1 No.
20.	Hatchet Stake	1 No. -
21.	Tinmens Square 750 C	1 No.
22.	Snap A-3, B-4, A-6.	1 Set
23.	Pipe Bending Machine	1 No.

HOISTING EQUIPMENT :

1.	Portable Jacks	1 No.
2.	Cargo Winches 3, 5 & 8 tonnes.	1 No.
3.	Wall Hosts	1 No.
4.	Travelling & Gantry Cranes	1 No.
5.	Shear Legs (tripod)	1 No.
6.	Flat Pulley	1 No.
7.	Hand Operated Chain Pulley Block	1 No.
8.	Mobile Crane	1 No.
9.	Conveyor	1 No.
10.	Elevators	1 No.
11.	Fibre Rope Sling	1 No.
12.	Steel Wire Sling	1 No.
13.	Steel Chain Slings from 6.3 to 45 mm.	2 Nos.
14.	For fan, light catch	

1.	2.	3.
15.	Ramps and its fittings .	4 Nos.
16.	Crow Bar	4 Nos.
17.	Cut sizes of Timber	3 Sets
18.	Rollers (steel tubes) from 38 to 63.5 mm dia.	10 Nos.
19.	Block of Timber (various sizes)	10 Nos.
20.	Steel Skids or Wood Skids.	1 Set
21.	Steel Wedges	1 Each
22.	Manilor Rope 12 ϕ 20 ϕ 30 ϕ	1 Each
23.	Eye Bolt with Collars range m 10 to M 36	2 Nos.
24.	Channel	1 No.
25.	Rails	2 Nos.
26.	Ratchet Chain Pulley	1 No.
27.	Shackles	

EQUIPMENT FOR ELECTRICAL MAINTENANCE .

1.	Combination side cutting pliers with insulated.	1 No.
2.	Handle 180 mm.	1 No.
3.	Spindle blade screw driver 150 mm.	1 No.
4.	Double bladed electrician knife	1 No.
5.	Engineer's cross peen hammer 200 gm. with handle.	1 No.
6.	Spindle blade screw driver (electricians) 100 mm.	1 No.
7.	Neon Tester 500 V double prove type	1 No.
8.	Spindle blade screw driver engineer's 200.	1 No.
9.	Scale AA 300	1 No.
10.	Diagonal Cutting nippers 125	1 No.
11.	Hand drilling machine 6 mm capacity	1 No.
12.	Engineer's square 150 B	1 No.
13.	Hammer plastic faced	1 No.
14.	Test lamp 200 V. 25 W.	1 No.

1.	2.	3.
15.	Hacksaw frame AB 250-300	1 No.
16.	Techometer	1 No.
17.	Flat file rough, 250 mm with two square edges.	1 No.
18.	Moving iron voltmeter portable type class 1.0, 0-500 V.	1 No.
19.	Moving Iron Ammeter portable type class 1.0, 0-25 Amp.	1 No.
20.	Wattmeter 1:1 onless electro dynamo meter type, portable class 1.0, 0-3000 W, voltage range : 150 V, 300 V, 600 V. current range 2.5 A and 5 A.	1 No.
21.	Wire stripping pliers 150 A	1 No.
22.	Insulation resistance tester 500 V, 100 M-2.	1 No.
23.	(a) Reverse current cut out (b) Over load relay (c) No voltage relay	1 Each
24.	Starters for 3 phase 415 V, 50 Hz, 3.7 to 7.5 KW, AC. Motor. (a) Auto-transformer type (floormounted, manually operated) (b) Star-delta type with O/L and N.V. protection floor mounted and manually operated. (c) Direct on line starter with O/L and N.V. protection.	1 Each
25.	A.C. Motor 3 phase, 50 HZ, 415. (Induction motor).	1 No.

ERECTION TOOLS

1.	Foundation Bolt	8 Each
2.	Threaded fastener type-B	
3.	Threaded fastener type-C	
4.	Threaded fastener type-F	1 No.
5.	Plum bob	1 No.
6.	Square box wrenches	

1.	2.	3.
7.	Square Tee wrenches	1 No.
8.	Pipe wrenches	1 No.
9.	Chain pipe wrenches	1 No.
10.	Single ended open jaw adjustable wrench A 150 Gr. II.	1 No.
11.	Slide wrenches	1 No.
12.	Pulley and tackle	1 No.
13.	Crow bar	1 No.
14.	Straight edges 500 B	1 No.
15.	Engineers square 700 mm.	1 No.
16.	Excavation tools	1 No.
17.	Spirit level	1 No.

FURNITURES

1.	Metal lockers 8 lockers type with individual locks 1980 x 910 x 480 mm.	2-Nos.
2.	Metal office chair with arm, cane slit and back.	1 No.
3.	Metal shelving cabinet with 4 adjustable shelves 180 x 60 x 45 cm.	6 Nos.
4.	Metal office table with 3 drawers.	3 Nos.
5.	Metal shelving cabinet with 4 adjustable shelves 180 x 60 x 45 cm.	6 Nos.
6.	Work Bench	4 Nos.
7.	Metal shelving rack open type 1800 x 900 x 500 with adjustable shelves.	4 Nos.
8.	Desk	1 No.
9.	Stool	1 No.
10.	Black Board with easel	1 No.
11.	Portable fine extinguisher water type (constant).	2 Nos.
12.	Galvanised mild steel fire bucket 4 litres.	4 Nos.

SHOP FLOOR TRAINING

DURATION : ONE YEAR

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.

Operation

1. Introduction to Safety precautions on the Shop Floor- Unguarded, defective condition, unsafe design or construction, unsafe illumination and unsafe ventilation, and also unsafe acts of person like unsafe speed, unsafe loading, failure to use protective devices etc.
2. Operation of different Conveyors like Belt Conveyor, Pneumatic Conveyor, Wire Conveyor, Slat Conveyor, Bucket Elevator, Gravity Roller Conveyor, Powered Roller Conveyor, Wheel Conveyor, V-type Bucket Conveyor, Vibrative Conveyor, Screw Conveyor, Chain Conveyor etc. and Pneumatic Nozzle Tractor
- (a) Conveyor
- (b) Elevator
3. Operation of different types of cranes like Jib Crane, Gantry Cranes, Traveling Bridge Cranes and Mobile Cranes (Tyre mounted & Crawler mounted), Level Luffing Winches, Cranes, Derrick.
4. Operation of cable ways, drag scrapers, Rope-ways - Monorails, cables, bi-cables, Double track, shuttle Jig back systems.
5. Operation of other material handling equipments like excavators, Chute, fork-lifter, hoist, mobile elevator, pallet, dumper.

Maintenance

6. Application of Welding for maintenance
7. Application of hand tools for mechanical maintenance.
8. Basics of surface damage and repair techniques
9. Cooling and lubrication system
10. Overhauling of pumps, cooler, radiation in cooling and lubricating.

Diesel Engine

11. Removal of heads, adjustment of tappet setting
12. Pump installation and installation of fuel lines.

Hydraulic System

13. Maintenance of hydraulic system used for material handling equipments like hydraulic lift for machine hydraulic table, Hydraulic hand lift truck, hydraulic adjustable loading dock, Fork lift, Container handler, Reese stacker etc.

Transmission system

14. Overhauling and maintenance of gear box, transfer cases.
15. Overhauling and maintenance of fluid couplings. Fitting and maintenance of propeller shaft, universal joints.
16. Overhaul and adjustment of differential assembly.

Braking system

17. Inspection, Repair and adjustment of brake system and steering system.
18. Fitting of brake lining.
19. Brake shoe fittings and adjustment and bleeding.
20. Maintenance of steering system.
21. Checking of caster, camber, Toe-in & Toe-out and King-Pin inclination.

Suspension system

22. Service and adjustment of shock absorbers, springs etc.

Under Carriages

23. Storage and maintenance of tyres and tubes.
24. Maintenance of tyre record charges.
25. Fitting of tyres and tubes

Electrical system

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

Trouble Shooting

30. Fault diagnosis.
31. Use of operational manual and parts catalog productive/preventive maintenance.
32. Maintenance during storage.
33. Safe Towing practices.

Syllabus for Related Instruction

Related instruction should be imparted to all the apprentices during the entire period of training. The syllabus for R.I. should be considered as a guide.

A. Trade Theory

1. Safety and precaution as applicable to the trade.
2. Introduction, History and principles of Material Handling.
3. Horizontal and vertical movement of materials.
4. Overhead movements 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).
9. Record keeping and Reports.
10. Power and Transmission Units in different material Handling equipment - Cooling & Lubrication system.
11. Brake, Suspension and Steering systems in the material handling equipment.
12. Hydraulic systems :- Introduction, Principle of hydraulics, maintenance and repairs of hydraulic systems.
13. Instruments and control panel.
14. Electrical equipment, their working, repair, testing and maintenance etc.
15. Trouble Shooting and preventive maintenance.
16. Revision & Test.

B. Workshop Calculation & Science

1. Revision of the previous two years' work.
2. Further problems on mensuration, work, power and energy.
3. Elementary principles of parallelogram and triangle of forces. Application to lifting tackles.
4. Graphs : Plotting of points, plotting of graphs of simple equations, reading of graphs.
5. Torque and its relation to forces on engine mounting, steering gear, transmission.

6. Friction, Co-efficient of friction, Braking, Lubrication, Ball and roller bearings.
7. Properties of water and lubricants in relation to heat. Special gravity - Archimedes principle, Laws of floatation. Viscosity - change of viscosity with temperatures, importance of this relation to selection of lubricants for various purpose.
8. Properties of gases, compression and expansion of gases.
9. Electricity and its various effects. Electric current - positive and negative terminals. Use of switches and fuses, Units of power watt and kilo watt - relationship with board of trade unit. Electrical circuits. Measuring Instruments - Voltmeter, Ammeter, Ohmmeter, Megger & Wattmeter.
10. Hydraulics - elementary principles, Pascal's law.

C. Engineering Drawing

1. Revision of the previous two years' work.
2. Introduction to symbol used in material handling analysis.
3. Drawing of flow diagrams for describing material handling.
4. Free hand sketching of few common material handling equipment.
5. Free hand sketching of simple electrical circuits.
6. Reading of automotive and other equipment's electrical circuits.
7. Advanced Blue print reading.

D. Social Studies

The syllabus has already been approved and is same for all the trades.