

Syllabus for
MILLWRIGHT / MAINTENANCE MECHANIC

Under
CRAFTSMEN TRAINING SCHEME
&
APPRENTICESHIP TRAINING SCHEME

As approved by GOVERNMENT OF INDIA

In consultation with
THE NATIONAL COUNCIL FOR VOCATIONAL TRAINING
&
CENTRAL APPRENTICESHIP COUNCIL

GENERAL INFORMATION

1. Name of the Trade : Millwright/Maintenance Mechanic
2. N.C.O. Code No. : 845.50
3. Duration of Craftsman Training : 2 Years
4. Duration of Apprenticeship Training : 3 Years including one year of Basic training.
5. Rebate for Ex-craftsman Trainees :

TRADE : PERIOD :

Millwright / Maintenance Full

6. Ratio of Apprentice to Workers. : 1 : 7

SYLLABUS FOR THE TRADE OF MILLWRIGHT / MAINTENANCE MECHANIC

Under
CRAFTSMEN TRAINING SCHEME

Period of Trg. : 2 Years

FIRST YEAR: TRADE PRACTICAL

1. Basic Bench Working Skills	..	18 Weeks
2. Basic Machine Working Skills	..	12 Weeks
3. Basic Hot Working Machines	..	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 of marked lines, punching with number and letter punches.

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

Hacksawing metal pieces, prefiles, 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 use 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 features 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 bolts, nuts, keys, screws, pins and dewels etc.

Repairing cast 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 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 THEORETICAL INSTRUCTORS

Under

CRAFTSMAN TRAINING SCHEME

TRADE THEORY :(First Year)

1. Fitters hand tools, their uses & 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. Fitter 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 gauge, dial indicator, bevel protractors etc.

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

2. Jointing and fastening device :

Permanent, semi-permanent and temporary fastening devices.

Fasteners of different types and their functions like bolts, washers, rivets, studs, pins, cotters, keys etc.

Rivets and rivetting – types, sizes, rivetting tools etc.

Pipes 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

3. Limits, fits and tolerances :

Different system of limit, fits and tolerances – Newall, 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 tool 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.

5. Hot working tools and processes :

Hand forging – tools, operations and effect of heat on the grain structure of materials, forge welding.

Gas and electric welding – tools and equipment, principle of fusion welding, types of joints and method of welding.

Care and maintenance of equipment, welding defects etc.

Flame cutting – use of equipment principle involved.

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 swaging 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.

TRADE THEORY UNDER CRAFTSMEN TRG. SCHEME

(2ND YEAR)

1. Power transmission and machine drives.
2. Friction, lubrication and bearings.
3. Bearings.
4. handling of machines/equipment's.
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, rigid and flexible.

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 dis-mounting, 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. Machine foundations and alignment :

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.