

Syllabus for the post of Technician Gr.-IV

Notification Sl. No. 9

Qualification – NCVT/ITI in Mechanic Machine Tool Maintenance

### **Bench Fitting:**

Linear measurements- its units, steel rule dividers, callipers – types and uses, Punch – types and uses. Uses of different types of hammers. Description, use and care of marking off table.

Bench vice construction, types, uses, care & maintenance, vice clamps, hack saw frames and blades, specification, description, types and their uses, method of using hacksaws.

Files- specifications, description, materials, grades, cuts, file elements, uses. Types of files, care and maintenance of files. Measuring standards (English, Metric Units), angular measurements.

Marking off and layout tools, dividers, scribing block, odd leg callipers, punches- description, classification, material, care & maintenance. Try square, ordinary depth gauge, protractor- description, uses and cares. Callipers- types, material, constructional details, uses, care & maintenance of cold chisels- materials, types, cutting angles.

Marking media, Prussian blue, red lead, chalk and their special application, description.

Surface plate and auxiliary marking equipment, 'V' block, angle plates, parallel block, description, types, uses, accuracy, care and maintenance.

Drill, Tap, Die-types & application. Determination of tap drill size. Reamer- material, types (Hand and machine reamer), parts and their uses, determining hole size for reaming, Reaming procedure.

Micrometer- outside and inside – principle, constructional features, parts graduation, leading, use and care. Micrometer depth gauge, parts, graduation, leading, use and care. Digital micrometer.

Vernier calipers, principle, construction, graduations, reading, use and care.

Vernier bevel protractor, construction, graduations, reading, use and care, dial Vernier Calliper, Digital vernier calliper.

Pedestal grinder – Introduction, care & use. Procedure of wheel mounting & wheel dressing. Related hazards, risk and precautions.

Drilling machines-types & their application, construction of Pillar & Radial drilling machine. Counter sunk, counter bore and spot facing- tools and nomenclature. Cutting Speed, feed, depth of cut and Drilling time calculations.

Interchange ability: Necessity in Engg, field, Limit- Definition, types,

terminology of limits and fits-basic size, actual size, deviation, high and low limit, zero line, tolerance zone, allowances. Different standard systems of fits and limits. (British standard system & BIS system)

#### **Scrapers:**

Introduction, Its types, material and use. Types of nuts, bolts, studs, locking devices for nut, wrench and spanner, pliers, screw drivers, Circlip, split pin, washers, spring washer.

Concept of torque & torque wrench.

Different types of rivets and their applications.

Identification of different

fasteners & operating them by using proper hand tool

Surface finish - importance, symbol, measuring techniques.

Lapping & honing process.

#### **Milling:**

Introduction to milling machine, parts & constructional details, types.

Safety precaution followed during milling operation.

Milling machine attachments. Different types of milling cutters and its materials.

Nomenclature of milling cutters.

Milling cutter holding devices, work holding devices, Milling machine operations, Up milling and Down milling.

Calculation of cutting speed, feed, machining time for milling machine.

Indexing methods and its calculations.

#### **Heat Treatment:**

Iron Carbon Equilibrium Diagram, Time-Temperature-Transformation Curve.

Annealing, Case Hardening, Tempering, Normalizing and Quenching

Classification, construction, materials and functional detail of Chisels & Hammers.

Chipping technique. Related hazards, risk and precautions while working.

#### **Grinding:**

Grinding machine – introduction, parts & constructional details, types

– surface grinding and cylindrical grinding machines. Safety precaution

followed while working on grinding machines. Grinding wheels – abrasives,

bond and bonding process, grit, grade, and structure of grinding wheels and

its marking system.

Procedure for mounting of grinding wheels, balancing of grinding wheels, dressing and truing of grinding wheels, glazing and loading in grinding wheel.

Preventive and break down maintenance of grinding machine.

switches, Fuse And Circuit Breakers. Introduction To Sensors--

Fundamental Of Sensor. Potentiometer -Ultrasonic And Optical Sensors-

Industrial Application. Basic principles of DC generators and motors,

Alternators and AC motors and transformers. Various types of switches,

circuit breakers, fuses, lamps, proximity switches, relays and contactor in

electrical circuits. Passive circuit elements – resistors, capacitors and

inductors. Its identification and testing. Colour code.

#### **Gauges:**

Classification and uses of Sine bar, Slip gauge, Limit gauge, Feeler gauge, thread gauge, screw pitch gauge, taper gauge.

#### **Fasteners:**

Introduction to fasteners, screw threads, related terminology and specification. Keys- types & use, (parallel, sunk, tangential, gib head, woodruff, key ways.) Related hazards, risk and precautions, while working.

#### **Transmission of Power**

Elements of mechanical power transmission, type of spindles and shafts (Universal spindle, Plain shaft, Hollow shaft, crank shaft, cam shaft). Positive and Non-positive drive, Friction drive, Gear drive, Belt drive, Chain drive and Rope drive.

#### **Clutches**

Function of Clutches, its types and use in power transmission system. Function of mechanical & electro magnetic system in clutch mechanism.

#### **Couplings:**

Concept of coupling and its type viz. Rigid coupling- Muff coupling, Flange 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.

### **Belts-**

Belt types (Flat and V) and specifications. Pulleys used for belt drive.  
Installation, Alignment of belts. Problems related to belts (Creep and slip)  
Belt maintenance.

Sheave alignment, Chain drive- Roller chain, Silent chain, alignment of sprockets, and maintenance of chain drive.

### **Bearing:**

Description and function of bearing, its types - Solid Bush, Split Bush, Collar, Pivot and Plummer Block Bearing. Mounting of bearings, measurement and adjustment of clearances in bearings. Types of bearing fitting on shaft and hubs. Type of Roller contact bearings- Ball bearings- single row & double row, Deep groove ball bearing, Angular contact, Self aligning and Thrust bearing. Roller bearing- Cylindrical, Needle roller, Taper roller, Spherical roller, self aligning and Spherical roller thrust bearing.

Mounting-dismounting and adjustment of Taper bore bearings with adopter and withdrawal sleeve. Handling and storage of bearings. Related hazards, risk and precautions. Rigging Knowledge of different tools & tackles used in rigging.

Construction and capacity of wire rope/steel rope/belts. Application of knots and hitches. Care and maintenance of all types of ropes.

### **Gear:**

Type, description and function of gears-Spur, Helical, Spiral, Bevel, Straight and Spiral bevel, Worm gears, Rack and pinion. Gear Terminology. Gear train- simple, compound, reverted and epicyclic.

Types of Gear box

Gear meshing: Checking of backlash and root clearances with Feeler Gauge, Dial Test Indicator and lead wire. Impression testing of gear mesh with Prussian blue. Running maintenance Related hazards, risk and precautions. Lubrication and its importance, lubricating systems Concept of lubrication Types and properties of Oil and Grease.

Methods of oil lubrication- Once through and centralized lubrication system.

Methods of grease lubrication system- grease guns, centralized lubrication system.

Warning & protective devices used in centralized lubrication system (Pressure switch, temperature gauge, level Cutting Fluids and Coolants. Essential parts of a basic coolant system used in the cutting of metals. Various types of coolants, its properties and uses coolant system type-soluble oils-soaps, suds paraffin, sodawater etc. Effect of cutting fluids in metal cutting. Difference between coolant and lubricants.

#### **MACHINE FOUNDATION:**

Purpose & methods employed for installation & erection of precision & heavy duty machines.

**Location & excavation for foundation. Different types of foundations –** structural, reinforced, wooden, isolated foundations.

Foundation bolt: types (rag, Lewis cotter bolt) description of each erection tools, pulley block, crow bar, spirit level, Plumb bob, wire rope, manila rope, wooden block.

The use of lifting appliances, extractor presses and their use. Practical method of obtaining mechanical advantage. The slings and handling of heavy machinery, special precautions in the removal and replacement of heavy parts. Energy usage in relevance for Mechanical assembly.

#### **Maintenance:**

Total productive maintenance

Predictive maintenance

Routine maintenance

Maintenance schedule

Preventive maintenance- objective and function of Preventive maintenance, section inspection. Visual and detailed, lubrication survey, system of symbol and colour coding. Revision, simple estimation of materials, use of handbooks and reference table. Possible causes for assembly failures and remedies. Hazardous waste management.

#### **Welding**

**Arc Welding:** Introduction to arc welding and its safety. Welding types, Common tools used in welding.

**Gas Welding:** Introduction to gas welding process, its classifications, accessories and its safety.

**Gas Cutting:** Principle of gas cutting. Systems of Oxy-Acetylene Welding-

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Flashback & backfire. Types of Oxy- Acetylene flames: - Gases used in welding & Gas flame combination.

Safety in gas cutting process.

#### **Basic Electrical:**

Study of basic Electricals-Voltage –Current etc.

Electrical power, HP, energy and units of electrical energy

Working Of Solenoids, Inductors, Motors, Generator Based on Electro magnetic Induction Principle.

#### **Lathe:**

Safely precautions to be observed while working on a lathe, Lathe specifications, and constructional features. Lathe main parts descriptions- bed, head stock, carriage, tail stock, feeding and thread cutting mechanisms. Holding of job between centers, works with catch plate, dog, simple description of a facing and roughing tool and their applications.

#### **ENGINEERING DRAWING:**

Introduction to Engineering Drawing and Drawing Instruments – Conventions

Sizes and layout of drawing sheets

Title Block, its position and content

Drawing Instrument

Lines-Types and applications in drawing Free hand drawing of-

Geometrical figures and blocks with dimension

Transferring measurement from the given object to the freehand sketches.

Freehand drawing of hand tools and measuring tools. Drawing of

Geometrical figures:

Angle, Triangle, Circle, Rectangle, Square, Parallelogram.

Lettering & Numbering–Single Stroke. Dimensioning

Types of arrow head

Leader line with text

Position of dimensioning (Unidirectional, Aligned)

Symbolic representation–

Different symbols used in the related trades. Concept and reading



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of Drawing in Concept of axes plane and quadrant

Concept of Orthographic and Isometric projections

Method of first angle and third angle projections (definition and difference)

Reading of Job drawing of related trades.

Reading of drawing of nuts, bolt, screw thread, different types of locking devices e.g., Double nut, Castle nut, Pin, etc.

Reading of foundation drawing

Reading of Rivets and riveted joints, welded joints

Reading of drawing of pipes and pipe joints

Reading of Job Drawing, Sectional View & Assembly view

### **WORKSHOP CALCULATION & SCIENCE:**

Unit, Fractions

Classification of unit system

Fundamental and Derived units F.P.S, C.G.S, M.K.S and SI units

Measurement units and conversion

Factors, HCF, LCM and problems

Fractions - Addition, subtraction, multiplication & division

Decimal fractions - Addition, subtraction, multiplication & division

Solving problems by using calculator

Square root, Ratio and Proportions, Percentage

Square and square root

Simple problems using calculator

Applications of Pythagoras theorem and related problems

Ratio and proportion

Percentage

Percentage - Changing percentage to decimal and fraction

#### **Friction**

Friction - Advantages and disadvantages, Laws of friction, co-efficient of friction, angle of friction, simple problems related to friction

Friction - Lubrication

Friction - Co-efficient of friction, application and effects of friction in workshop practice

#### **Centre of Gravity**

Centre of gravity - Centre of gravity and its practical application

Related problems of area of cut out regular surfaces - circle, segment and sector of circle

Area of irregular surfaces and application related to shop problems

### **Elasticity**

Elasticity - Elastic, plastic materials, stress, strain and their units

### **Material Science:**

Types metals, types of ferrous and non-ferrous metals

Physical and mechanical properties of metals

Introduction of iron and cast iron

Difference between iron & steel, alloy steel

Properties and uses of insulating materials

### **Heat Treatment**

Heat treatment and advantages

Heat treatment - Different heat treatment process – Hardening, tempering, annealing, normalising and case hardening

### **Estimation and Costing**

Estimation and costing - Simple estimation of the requirement of material etc., as applicable to the trade

Estimation and costing - Problems on estimation and costing

### **Mensuration:**

Area and perimeter of square, rectangle and parallelogram Area and perimeter of Triangles

Area and perimeter of circle, semi-circle, circular ring, sector of circle, hexagon and ellipse

Surface area and volume of solids - cube, cuboid, cylinder, sphere and hollow cylinder

### **Hydraulics & Pneumatics**

Basic principles of Hydraulics Advantages & limitation of hydraulic system,

Control valves: Different type of control valves used in hydraulic System.

Function of pressure control valve, directional control valve, check valve, flow control valve.

Compressed air generation and conditioning, Air compressors, Pressure regulation, Dryers, Air receiver, Conductors and fittings, FRL unit, Applications of pneumatics, Hazards & safety precautions in pneumatic systems.

Pneumatic actuators:- Types, Basic operation, Force, Stroke length, Single-acting and double-acting cylinders.

Breakdown maintenance and preventive maintenance of machines.

### **BASIC ELECTRONICS**



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Introduction to electronics and its industrial applications.

Study of electronic circuit –macro level with block diagram.

#### **PLC:**

Overview of different control systems. Introduction about PLC. Block diagram of PLC. Different types of PLC, PLC Architectures (Fixed and Modular).

#### **Pump**

Function of pump.

Types and working principle of centrifugal pump (machinerelated).

Constructional detail of pump Starting and stopping

Pump performance and characteristics.

Capitation & aeration Preventive & schedule maintenance of pumps.

Gland packing changing procedure.

Concept of Mechanical seal

Trouble shooting in pump.

#### **Fan & Blowers:**

Types and working principle Constructional detail of Fans & Blowers. Starting and stopping of Fans and Blowers Different parts of Fans & Blowers Concept of surge. Preventive & scheduled maintenance.

#### **Compressors:**

Compression theory, Types of compressors Constructional detail of compressors, working mechanism

Different parts and their function.

Loading unloading system Concept of air dryer.

Preventive & schedule maintenance.

Different type of jacks, chain block and pull lift.

Knowledge of different types of scaffolding.

Material movement by using different rigging tools and techniques.

Safety appliances & precautions in rigging. Maintenance of tools and tackles.

Bulk Material Handling (Conveyor belt, Vibratory screen, Feeders) Principle & mode of material handling. Various components used in belt convey or system & their functions. (Pulleys, idlers, scrapers, skirts, belt, take up unit system and

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safety devices). Vibratory screen- working mechanism. Feeders- types, working mechanism. Maintenance practice- Pulley lagging, belt sway control belt joining methods.

