

## GROUP-31

### Fitter/ Turner (Level- ITI Certificate in Fitter/ Turner/ Mechanical Trade)

1) General awareness, Reasoning, Mathematics, Science, History including Haryana related history, current affairs, literature, Geography, Civics, Environment, Culture etc.-

(Weightage 20%)

2) Computer terminology, Fundamentals, word software, excel software, Power point, internet, web browsing, Communication, emails, downloading and uploading data on websites etc. -

(Weightage 10%)

3) Subject related syllabus-

(Weightage 70%)

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### Professional Skill

**Soft Skills**, its importance, Importance of safety and general precautions observed in the in the industry/shop floor. Introduction of First aid. Operation of electrical mains and electrical safety. Introduction of PPEs. Response to emergencies e.g.; power failure, fire, and system failure, Importance of housekeeping & good shop floor practices. Introduction to 5S concept & its application, **Occupational Safety & Health**: Health, Safety and Environment guidelines, legislations & regulations as applicable. Basic understanding on Hot work, confined space work and material handling equipment, Linear measurements - its units, dividers, callipers, hermaphrodite, centre punch, dot punch, prick punch their description and uses of different types of hammers. Description, use and care of 'V' Blocks, marking off table. Measuring standards (English, Metric Units), angular measurements, Bench vice construction, types, uses, care & maintenance, vice clamps, hacksaw 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, - description, classification, material, care & maintenance. Try square, ordinary depth gauge, protractor - description, uses and cares. Uses, care & maintenance of cold chisels - materials, types, cutting angles, marking media, marking blue, Prussian blue, red lead, chalk and their special application, description, Use, care and maintenance of scribing block. Surface plate and auxiliary marking equipment, 'V' block, angle plates, parallel block, description, types, uses, accuracy, care and maintenance.

**Physical properties of engineering metal**: colour, weight, structure, and conductivity, magnetic, fusibility, specific gravity.

**Mechanical properties**: ductility, malleability hardness, brittleness, toughness, tenacity, and elasticity. **Power Saw**, band saw, Circular saw machines used for metal cutting.

**Micrometre**- outside and inside – principle, constructional features, parts graduation, reading, use and care. Micrometre depth gauge, parts, graduation, reading, use and care. Digital micrometre, **Vernier callipers**, principle, construction, graduations, reading, use and care. Vernier bevel protractor, construction, graduations, reading, use and care, dial Vernier Calliper, Digital Vernier calliper, Vernier height gauge: material construction, parts, graduations (English & Metric) use, care and maintenance, **Drilling processes**: common type (bench type, pillar type, radial type), gang and multiple drilling machine. Determination of tap drill size.

**Sheet Metal Operations**-Safety precautions to be observed in a sheet metal workshop, sheet and sizes, Commercial sizes and various types of metal sheets, coated sheets and their uses as per BIS specifications. Shearing machine- description, parts and uses, Marking and measuring tools, wing compass, tin man's square tools, snips, types and uses. Tin man's hammers and mallets type-sheet metal tools, types, specifications, uses. Trammel- description, parts, uses. Hand grooves, specifications and uses. Sheet and wire gauge, Stakes-bench types, parts, their uses. Various types of metal joints, their selection and application, tolerance for various joints, their selection & application. Wired edges, Solder and soldering: Introduction-types of solder and flux. Composition of various types of solder and their heating media of soldering iron. Method of soldering, selection and application-joints. Hard solder, Introduction, types and method of brazing.

**Various rivets shape and form of heads**, importance of correct head size. Rivets-Tin man's rivets types, sizes, and selection for various works. Riveting tools, dolly snaps description and uses. Method of riveting, The spacing of rivets. Flash riveting, use of correct tools, compare hot and cold riveting.

**Safety-importance of safety and general precautions observed in a welding shop.** Precautions in electric and gas welding. (Before, during, after) Introduction to safety equipment and their uses. Machines and accessories, welding transformer, welding generators.

**Welding hand tools:** Hammers, welding description, types and uses, description, principle, method of operating, carbon dioxide welding. H.P. welding equipment: description, principle, method of operating L.P. welding equipment: description, principle, method of operating. Types of Joints-Butts and fillet as per BIS SP: 46-1988 specifications. Gases and gas cylinder description, kinds, main difference and uses, Setting up parameters for ARC welding machines-selection of Welding electrodes. Care to be taken in keeping electrode, Oxygen acetylene cutting, machine description, parts, uses, method of handling, cutting torch-description, parts, function and uses.

**Drill-** material, types, (Taper shank, straight shank) parts and sizes. Drill angle-cutting angle for different materials, cutting speed feed. R.P.M. for different materials. Drill holding devices- material, construction and their uses, Counter sink, counter bore and spot facing-tools and nomenclature, Reamer, material, types (Hand and machine reamer), kinds, parts and their uses, determining hole size (or reaming), Reaming procedure.

**Screw threads:** terminology, parts, types and their uses. Screw pitch gauge: material parts and uses. Taps British standard (B.S.W., B.S.F., B.A. & B.S.P.) and metric /BIS (coarse and fine) material, parts (shank body, flute, cutting edge).

**Tap wrench:** material, parts, types (solid & adjustable types) and their uses removal of broken tap, studs (tap stud extractor). Dies: British standard, metric and BIS standard, material, parts, types, Method of using dies. Die stock: material, parts and uses.

**Drill troubles:** causes and remedy. Equality of lips, correct clearance, dead centre, length of lips. Drill kinds: Fraction, metric, letters and numbers, grinding of drill.

**Grinding wheel:** Abrasive, grade structures, bond, specification, use, mounting and dressing. Selection of grinding wheels. Bench grinder parts and use.

**Gauges-** Introduction, necessity, types. Limit gauge: Ring gauge, snap gauge, plug gauge, description and uses. Description and uses of gauge types (feeler, screw, pitch, radius, wire gauge).

**Interchange ability:** Necessity in Engg., field definition, BIS. Definition, types of limits, terminology of limits and fits, basic size, actual size, deviation, high and low limit, zero-line, tolerance zone Different standard systems of fits and limits. British standard system, BIS system.

**Method of expressing tolerance as per BIS Fits:** Definition, types, description of each with sketch. Vernier height gauge: material construction, parts, graduations (English & Metric) use, care and maintenance

**Pig Iron:** types of pig Iron, properties and uses. Cast Iron: types, properties and uses, wrought iron: - properties and uses. Steel: plain carbon steels, types, properties and uses. Non-ferrous metals (copper, aluminium, tin, lead, zinc) properties and uses.

**Simple scraper-** flat, half round, triangular and hook scraper and their uses. Blue matching of scraped surfaces (flat and curved bearing surfaces). Testing scraped surfaces: ordinary surfaces without a master plate.

**Vernier micrometre,** material, parts, graduation, use, care and maintenance. Calibration of measuring instruments. Introduction to mechanical fasteners and its uses. Screw thread micrometre: Construction, graduation and use.

**Dial test indicator,** construction, parts, material, graduation, Method of use, care and maintenance. Digital dial indicator. Comparators measurement of quality in the cylinder bores.

**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 centres, works with catch plate, dog, simple description of a facing and roughing tool and their applications.

**Lathe cutting tools-** Nomenclature of single point & multipoint cutting tools, Tool selection based on different requirements and necessity of correct grinding, solid and tipped, throw away type tools, cutting speed and feed and comparison for H.S.S., carbide tools. Use of coolants and lubricants.

**Chucks** and chucking the independent four-jaw chuck. Reversible features of jaws, the back plate, Method of clearing the thread of the chuck-mounting and dismounting, chucks, chucking true, face plate, drilling - method of holding drills in the tail stock, Boring tools and enlargement of holes.

**General turning operations**-parallel or straight, turning. Stepped turning, grooving, and shape of tools for the above operations. Appropriate method of holding the tool-on-tool post or tool rest, Knurling: - tools description, grade, uses, speed and feed, coolant for knurling, speed, feed calculation. Taper – definition, use and method of expressing tapers. Standard tapers-taper, calculations Morse taper.

**Screw thread definition** – uses and application. Square, worm, buttress, acme (nonstandard-screw threads), Principle of cutting screw thread in centre lathe – principle of chasing the screw thread – use of centre gauge, setting tool for cutting internal and external threads, use of screw pitch gauge for checking the screw thread.

**Assembling techniques** such as aligning, bending, fixing, mechanical jointing, threaded jointing, sealing, and torquing. Dowel pins: material, construction, types, accuracy and uses.

**Screws:** material, designation, specifications, Property classes (e.g., 9.8 on screw head), Tools for tightening/ loosening of screw or bolts, Torque wrench, screw joint calculation uses. Power tools: its constructional features, uses & maintenance.

**Locking device:** Nuts- types (lock nut castle nut, slotted nuts, swam nut, grooved nut) Description and use. Various types of keys, allowable clearances & tapers, types, uses of key pullers.

**Special files:** types (pillar, Dread naught, Barrow, warding) description & their uses.

**Templates** and Radius/fillet gauge, feeler gauge, hole gauge, and their uses, care and maintenance.

**Slip gauge:** Necessity of using, classification & accuracy, set of blocks (English and Metric). Details of slip gauge. Metric sets 46: 103: 112. Wringing and building up of slip gauge and care and maintenance.

**Application of slip gauges** for measuring, Sine Bar-Principle, application & specification. Procedure to check adherence to specification and quality standards.

**Lapping:** Application of lapping, material for lapping tools, lapping abrasives, charging of lapping tool. Surface finish importance, equipment for testing-terms relation to surface finish. Equipment for tasting surfaces quality – dimensional tolerances of surface finish.

**Honing:** Application of honing, material for honing, tools shapes, grades, honing abrasives. Frosting- its aim and the methods of performance.

**Gauges** and types of gauges commonly used in gauging finished product-Method of selective assembly 'Go' system of gauges, hole plug basis of standardization.

**Bearing**-Introduction, classification (Journal and Thrust), Description of each, ball bearing: Single row, double row, description of each, and advantages of double row.

**Roller and needle bearings:** Types of rollers bearing, Description & use of each. Method of fitting ball and roller bearings.

**Bearing metals** – types, composition and uses. Synthetic materials for bearing: The plastic laminate materials, their properties and uses in bearings such as phenolic, Teflon polyamide (nylon).

**Pipes and pipe fitting**- commonly used pipes. Pipe schedule and standard sizes. Pipe bending methods. Use of bending fixture, pipe threadsStd. Pipe threads Die and Tap, pipe vices.

**Use of tools** such as pipe cutters, pipe wrenches, pipe dies, and tap, pipe bending machine etc.

**Standard pipe fitting**- Methods of fitting or replacing the above fitting, repairs and erection on rainwater drainage pipes and household taps and pipe work. Inspection & Quality Control-Basic SPC - Visual Inspection.

**Drilling jig**-constructional features, types and uses. Fixtures-Constructional features, types and uses.

**Power transmission elements.** The object of belts, their sizes and specifications, materials of which the belts are made, selection of the type of belts with the consideration of weather, load and tension methods of joining leather belts.

**Vee belts** and their advantages and disadvantages, use of commercial belts, dressing and resin creep and slipping, calculation. Power transmissions coupling types-flange coupling, -Hooks coupling, universal coupling and their different uses. Pulleys-types-solid, split and 'V' belt pulleys, standard calculation for determining size crowning of faces -loose and fast pulleys -jockey pulley. Types of drives -open and cross belt drives. The geometrical explanation of the belt drivers at an angle. Clutch: Type, positive clutch (straight tooth type, angular tooth type). Chains, wire ropes and clutches for power transmission. Their types and brief description.

**Power transmission** –by gears, most common form spur gear, set names of some essential parts of the set -The pitch circles, Diametral pitch, velocity ratio of a gear set, Helical gear, herring bone gears, bevel gearing, spiral bevel gearing, hypoid gearing, pinion and rack, worm gearing, velocity ratio of worm gearing. Repair of gear teeth by building up and dovetail method, Method of fixing geared wheels for various purpose drives. General cause of the wear and tear of the toothed wheels and their remedies, method of fitting spiral gears, helical gears, bevel gears, worm and worm wheels in relation to required drive. Care and maintenance of gears.

**Fluid power**, Pneumatics, Hydraulics and their comparison, Overview of a pneumatic system, Boyle's law. Overview of an industrial hydraulic system, Applications, Pascal's Law.

**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.

**Pneumatic valves:-** Classification, Symbols of pneumatic components, 3/2- way valves (NO & NC types) (manually-actuated & pneumatically-actuated) & 5/2-way valves, Check valves, Flow control valves, One-way flow control valve Pneumatic valves: Roller valve, Shuttle valve, Twopressure valve Electro-pneumatics: Introduction, 3/2-way single solenoid valve, 5/2-way single solenoid valve, 5/2-way double solenoid valve, Control components - Pushbuttons (NO & NC type) and Electromagnetic relay unit, Logic controls.

**Symbols of hydraulic components**, Hydraulic oils –function, properties, and types, Contamination in oils and its control - Hydraulic Filters – types, constructional features, and their typical installation locations, cavitation, Hazards & safety precautions in hydraulic systems - Hydraulic reservoir & accessories, Pumps, Classification – Gear/vane/ piston types, Pressure relief valves – Direct acting and pilot-operated types - Pipes, tubing, Hoses and fittings – Constructional details, Minimum bend radius, routing tips for hoses, valves and Pilot-operated check valves, Load holding function - Flow control valves: Types, Speed control methods – meter-in and meter-out - Preventive maintenance & troubleshooting of pneumatic & hydraulic systems, System malfunctions due to contamination, leakage, friction, improper mountings, cavitation, and proper sampling of hydraulic oils.

**Method of lubrication**-gravity feed, force (pressure) feed, splash lubrication. Cutting lubricants and coolants: Soluble off soaps, suds, paraffin, soda water, common lubricating oils and their commercial names, selection of lubricants. Washers-Types and calculation of washer sizes. The making of joints and fitting packing, Lubrication and lubricants, purpose of using different types, description and uses of each type. Method of lubrication. A good lubricant, viscosity of the lubricant, Main property of lubricant. How a film of oil is formed in journal Bearings.

**Foundation bolt:** types (Lewis's cotter bolt) description of each erection tools, pulley block, crowbar, 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.

**Important Note: The Weightage as mentioned against the syllabus is tentative & may vary.**