DETAILED SYLLABUS FOR THE POST OF TRADESMAN - TOOL & DIE ENGINEERING IN TECHNICAL EDUCATION DEPARTMENT

(Total Marks – 100)

Module -1. safety precautions and importance of housekeeping (8 Marks)

Types of safety precautions -safety signs – first aid – PPE's – Response to emergencies – fire – fire extinguishers types and uses – Housekeeping-good shop floor practices – 5 S concept –waste material disposal and color codes for bins –methods of moving heavy equipments-basic understanding on hot work.

Module -2 Fitting & Welding (10 Marks)

Bench work – Metal working hand tools and devices –Work bench – vices – files – hacksaw– hammer – chisels – spanners– screw drivers – scrapers. 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. Drilling machines-types and their application, construction of Pillar & Radial drilling machine. Countersunk, counter bore and spot facing tools and nomenclature. Cutting Speed, feed, depth of cut and Drilling time calculations.

Interchangeability: Limit - 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. Geometrical tolerance. Metals, non-metals and heat treatment.

Gas welding, arc welding, soldering - MIG welding techniques - description of welding equipments and welding joints. Knowledge about flux, filler rod material. Die welding techniques.

Module-3 Marking & Measuring instruments (10 Marks)

Linear measurements- its units, steel rule, dividers, callipers types and uses, Punch – types and uses. Vernier calliper – its parts, principles, reading, uses and care. Outside micrometer – its parts, principles, reading, uses and care, vernier height gauge. Marking tools – scriber, Dividers, Dot punch, Centre punch. Marking out – Coordinates system, Rectangular – Polar Rules for marking. Bevel protractor, combination set their components, uses and cares. Marking off table, Surface gauges, Try-Square, Vernier calipers - Graduations and reading of vernier calipers. Outside micrometer - Graduations

of metric outside micrometer - Reading dimensions with outside micrometers, Vernier micrometer - graduation and reading, Letter punch and number punch, Vernier height gauge. Marking media, Surface plates, 'V' Blocks, Angle plates, Parallel blocks. Dial test indicators, Sine bar - Description and uses, determining taper using sine bar and slip gauges, Slip gauges - types uses and selection - Selection and determination of slip gauges for different sizes - Care and maintenance of slip gauges & sine bar.

Module -4 Lathe **(10 Marks)**

Parts and functions – Types –Specification – Operations – Lathe accessories and attachments – Cutting speed, feed, RPM – Lathe tools and angles – Driving mechanism – Chip breaker – Taper turning methods – Taper and its types – Taper calculation – Sine bar and slip gauges – Screw thread and elements – Forms of screw threads – Lathe centre's – Mandrel – Thread cutting – Single and multi-start threads – Simple gear train and compound gear train – Lathe dogs – Driving plate – Face plate – Rests.

Module -5 Milling **(10 Marks)**

Milling machine – classification – specification – parts, functions – Application – cutter holding devices – milling cutters – cutter material – types of cutters – Nomenclature of milling cutter – Different milling operations – Up milling and down milling – Straddle milling – Gang milling – Cutting speed, feed and machining time – Dividing head types and uses – Types of indexing and calculations – Types of gears and uses – Elements of spur gear – Spur gear calculation – Selection of gear cutter – Helix and spiral elements, applications – Difference between helix and spiral – Methods of checking gear and its parts – Rack elements, application – Cam types and applications.

Module -6 Grinding **(8 Marks)**

Types of grinding machines – parts and functions of each types – Different grinding operations – Construction of grinding wheel – Standard marking system of grinding wheels – Glazing and loading – Dressing and truing – Cutting speed, feed and depth of cut – Shapes of grinding wheel and applications – Selection of grinding wheel – Wheel balancing – Wet grinding and dry grinding – Tool and cutter grinder attachments and their uses.

Module -7 CNC **(8 Marks)**

Turning: Basic of CNC technology – CNC lathe machine elements and functions – Advantages and disadvantages – Controls , switches – NC co-ordinate system – Bed, chuck, tail stock, turret and spindle drive – slide ways, ball screw – ATC – Feedback encoder – open loop and closed loop control system – Axis's – Absolute and incremental modes – ISO G codes – ISO M codes – Edit and MDI mode functions – Cutting tool materials in CNC turning – Tool holders – Collisions – Process planning – Machining sequence – Cutting parameters – Work and tool offset – Machine operational modes-JOG, MPG, Edit memory – Entering and editing program – Use of emergency stop – Tool offset adjustments.

Vertical machining centers: CNC-VMC elements and their functions – Machining operations and tool paths – Geometric and axis co-ordinates – Program sequence as codes – G codes and M codes – Part programming – Structure of a part program – Cutting tool materials and their composition.

Module -8 Jigs & Fixtures, Hydraulics & Pneumatics **(12 Marks)**

Jigs and Fixtures: Plane of movements, possible movements of work piece, location of work piece, types of Jigs, Types of Fixtures, Jigs and machine relations. Method of restricting the possible movement (principle, 3-2-1 pin method). Locating method. Introduction of locating devices, its material, types of locators, locator for flat, surface, internal diameter and external profit. Clamping and work holding devices: Ejectors, clamping devices, types of clamps for jig and fixture. Material for ejector and clamps. Drill Bushes Type of drill jigs. Type of fixture. Fixture and machine relations, cutting force on jigs and fixtures, elements of jigs and fixtures, jigs and fixture cutting tool relations, design of jigs and fixtures, failure of jigs and fixtures.

Hydraulics & Pneumatics :

Basic principles of hydraulics/ pneumatics system, advantages and disadvantages of hydraulics and pneumatics systems, theory of Pascal's law, Brahma's press, Pressure and flow, types of valves used in hydraulics and pneumatics system.

Module -9 Moulds & Dies **(12 Marks)**

Electrical discharge machine (EDM) & Wire EDM – principle of operation, advantages and disadvantages and its applications. Types of plastics, differentiation of plastics, Properties, application, fillers and additives and reinforced plastics. Mould terminology: Core, cavity, impression, runner, gate, sprue bush, mould base etc. Parting line: Types of parting line, mould matching (Bedding down), vent and relief. Requirement for ejection: Types of ejector grids, ejector elements and ejector system. Feed System: Sprue, runner, gate - types, design, vent design, balancing. Shrinkage (Component Tolerance), Temperature controlling of moulds, Injection moulding machines, Selection number of cavities, under cut and splits, Side cores & side cavities, Moulding internal undercuts, Moulds for threaded components, Moulding of thermo set material, Mould heaters and thermocouples, Surface finish, Multi day light mould, Blow moulding - Faults and remedies for blow moulding. Two cavity mould with side core - Hot runner moulds - Moulding defects and remedies - Joining of plastics - Maintenance of moulds.

Module -10 Press Tools **(12 Marks)**

Types of press Tools and operations: Guide Plate tool, piercing tool, blanking tool, progressive tool, compound tool, cut off tool, parting tool, etc. Theory of Shearing: Shearing Theory Description in Press Tool, Critical Stage of shearing. Cutting clearance, Land and angular clearance, Basic design of guide plate tool, Alignment technique between Punch and Die while assembly, Guide Plate Tool: Construction, function of elements, related design, cutting force, selection of suitable press, method of reducing cutting force. Stock material, Strip layout, Punch: Cutting punches, non-cutting punches, hybrid punches, types of punches, selection of punches. Buckling of punches: Buckling theorem, problems, types of loading coming on a punch, determining of the size of the punch. Die Block: Types of dies. Stoppers, Gauge, Pilots. Side cutter, Shank and positioning. Die sets, presses, ejectors and shedders, shaving tool, bending tool, forming tools, drawing, deep drawing and fine blanking tool.

NOTE: - It may be noted that apart from the topics detailed above, questions from other topics prescribed for the educational qualification of the post may also appear in the question paper. There is no undertaking that all the topics above may be covered in the question paper.