

**SYLLABUS FOR INSTRUCTOR  
(MACHINISTS)**



1. **Metrology and Measurements:**

Measuring standards; Linear measurements devices; steel rule, dividers, callipers, Punch; hammers- types and application; Description, use and care of marking off table; Bench vice construction- types, uses, care & maintenance, vice clamps; hacksaw frames and blades- specification, description, types and their uses, method of using hacksaws; Files- elements, types, specification and their uses; Methods of filing; Care and maintenance of files; Marking off and layout tools, care & maintenance; chisels- materials, types, cutting angles, care & maintenance. Combination set- its components, uses and cares; Marking media- special application, description; Surface plate and auxiliary marking equipment- description, types, uses, accuracy, care and maintenance; Interchangeability; Limit, fits- basic and tolerance; Geometrical tolerances; Different standard systems of fits and limits; Vernier calliper, Inside Micrometer & Outside micrometre, Dial test indicator, Vernier Bevel Protractor, Depth Micrometer, Telescopic gauge, Bore Dial Gauge, Vernier height gauge- its parts, principle, reading, uses & care; Gauges – different types and their uses; Screw thread; Square thread and its form and calculation; single and multi-start threads- their uses, merits and demerits; Measurement of threads by three wire methods : Sine Bar – description & uses. Slip gauge – description and uses; Roughness values and their symbols.

2. **Workshops:** Definition of machine & machine tool and its classification; Introduction to lathe- its types, construction, detail function of parts, specification; lever positions and various lubrication; Safety; Lathe cutting tool- different types, material, shapes and different angles (clearance, rake etc.) and their effects, specification of lathe tools, grinding process of tools; Driving mechanism, speed and feed mechanism of Lathe; Lathe operations- facing, turning, parting-off, grooving, chamfering, boring etc. Knurling- types, grade & its necessity; job holding devices on lathe; taper turning; taper calculations; screw cutting in a lathe; Slotter- Classification, principle, construction, Safety precaution, indexing process on a Slotter; Driving mechanisms, quick return motion and speed ratio; Safety points; Slotting tools; Spline; Coolant & lubricant; Lubricating system; Job holding devices; Jigs and fixtures.

3. **Engineering Materials:** Physical properties and Mechanical properties of engineering metal; Pig Iron, Cast Iron, wrought iron, Steel- types properties and uses; Non-ferrous metals (Aluminium, copper and its alloy, aluminium, tin, lead, zinc) properties and uses. Heat treatment process- normalizing, annealing, hardening and tempering, Case hardening and carburising.

4. **Manufacturing Technology:**

Metal Cutting- Orthogonal and Oblique Cutting; Cutting tool geometry; Types of chips, chip breaker; Tool life, factors affecting tool life; Tool wear, tool life; Cutting tool materials;

Drilling machines- types & their application; Cutting Speed, feed, depth of cut and Drilling time calculations; Twist drill; Countersunk; counter bore and spot facing- tools and nomenclature;

Reamer – types, elements, materials, working principle and Calculations; cutter selection; grinding machine- Use, care and safety aspect.

Die- types & application;

Milling Machine- Introduction, types, parts, construction and specification; milling cutters & their use; milling operations; types of milling attachments and their uses; Indexing - direct and simple indexing.

Grinding – Introduction, grinding wheel abrasive, types, bond, grade, grid, structure; standard marking system of grinding wheel, selection of the grinding wheel; Surface Grinder; Cylindrical grinder; Cutting speed, feed, depth of cut, machining time calculation; Wet grinding and dry grinding; grinding defects and remedies. Maintenance- Dressing; Glazing and Loading; Tool & cutter grinder; methods of cutter grinding; grinding attachments and their uses.

Gear- Types, construction and specifications; methods of checking gears; gear calculations

CNC technology basics: Concept of Co-ordinate geometry. concept of machine coordinate axis; Absolute and incremental programming; Feedback, CNC interpolation, open and close loop control systems; Program execution in different modes like MDI, single block and auto; Canned cycles, part

- programs; Concepts of positioning accuracy, repeatability; radius compensation; Work offset, tool length offset, tool radius offset; ISO G and M codes;  
CNC Lathe; Comparison between CNC and conventional lathes;; CNC lathe machine elements and their functions; Cutting parameters- cutting speed, feed rate, depth of cut, constant surface speed, limiting spindle speed.
5. **Operational Research:**  
Process planning & sequencing; Machine Productivity concepts, cycle time, machine down time, causes of down time - breaks, machine breakdown, inspection, part loading and unloading, chip cleaning. Effect of down time on profitability, reducing down time. Machine hour rate, components of machine hour rate - principal repayment, interest, overheads (power, tooling, space, salaries, indirect expenses). Calculation of machining cost, cost of down time; Maintenance: Definition, types and its necessity; System of symbol and colour coding; Possible causes for failure and remedies
6. **Theory of Machine & Mechanisms:**  
Gear introduction; Gear types and its applications; Testing of Gear and error; Gear Calculation; Cam-types, elements & application; Worm wheel-application, elements & calculation.
7. **Engineering Drawing:**  
Introduction to Engineering Drawing and Drawing Instruments – Conventions, Sizes and layout of drawing sheets; Drawing Instrument Lines- Types and applications; Free hand drawing of – Geometrical figures and blocks with dimension, hand tools and measuring tools; Drawing of Geometrical figures- Angle, Triangle, Circle, Rectangle, Square, Parallelogram; Lettering & Numbering; Concept of axes plane and quadrant, Orthographic and Isometric projections ; angle and third angle projections; Reading of drawing of nuts, bolt, screw thread, locking devices e.g., Double nut, Castle nut, Pin, etc.; Reading of foundation drawing; Reading of Rivets and rivetted joints, welded joints, pipes and pipe joints Job Drawing; Sectional View & Assembly view.
8. **Basic Mathematics & Basic Science:**  
Fractions; unit system; HCF, LCM and problems Fractions - Addition, subtraction, multiplication & division; Decimal fractions - Addition, subtraction, multiplication; Ratio and Proportions, Percentage; Square and square root; Applications of Pythagoras theorem; Mensuration Area and perimeter of common geometrical plane; volume of solids of common geometrical plane; Trigonometry Measurement of angles; Trigonometrical ratios; Trigonometrical tables.  
Levers and Simple machines - Effort and load, mechanical advantage, velocity ratio, efficiency of machine, relationship between efficiency, velocity ratio and mechanical advantage  
Related problems for mass, volume, density, weight and specific gravity, Speed and Velocity, Work, Power and Energy Work, power, energy, HP, IHP, BHP and efficiency Heat & Temperature; boiling point & melting point of different metals and non-metals; Concept of pressure;  
Basic Electricity Introduction and uses of electricity, molecule, atom; electric current AC, DC their comparison, voltage, resistance and their units;  
Friction - Advantages and disadvantages, Laws of friction, coefficient of friction, angle of friction;  
Centre of Gravity- practical application Area of cut out regular surfaces and area of irregular surfaces;  
Area of cut out regular surfaces and application; Elasticity- Elastic, plastic materials, stress, strain and their units and young's modulus Elasticity - Ultimate stress and working stress.