

Syllabus	:	Trade Certificate in Machinist Grinder
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1. Introduction of First aid. Operation of electrical mains. Introduction of PPEs. Introduction to 5S concept & its application. Response to emergencies e.g.; power failure, fire, and system failure. Introduction to Grinding trade and machine safety precautions according to IS: 1991-1962.
2. Description of hand tools, Safety precautions, care and maintenance and material from which they are made. Ferrous and nonferrous metal and their identification by different methods. Heat treatment of metals, its importance, various methods of heat treatment such as hardening, tempering, normalizing, annealing etc.
3. Theory of Semi precision measuring instruments. General measuring tools (used in grinding shop) their description, use care and maintenance.
4. Relation between drill & tap sizes, care of taps and dies and their correct use. Types, properties and selection of coolants and lubricants.
5. Brief description of drilling machine use and care. Knowledge of tool fixing and job holding device on drilling machine.
6. Knowledge of different types of files according to cut and shape. Methods of filing operation. Knowledge of surface finish accuracy by filing.
7. Brief description of a Centre lathe, its use. Knowledge of transmission of speed from motor to spindle of a lathe. Knowledge of aligning a job on lathe. Lathe tools nomenclature. Knowledge of controlling cutting speed, feed and depth of cut. Lathe tools and their uses. Selection of tools for different operation in lathe. Taper and its types and problems. Taper turning methods and calculations. i.e. Form tool, TT attachment Compound rest etc.
8. Method of screw cutting and simple calculation. Knowledge of spindle speed mechanism related to lead screw of lathe.
9. Application and use of pedestal grinder. General dressing tools used in grinding section such as wheel, diamond dresser, steel type dresser, abrasive dresser and nonferrous dresser.
10. Precision measuring instruments English and metric micrometer, vernier caliper, dial test indicator etc. their description and uses. Knowledge of digital measuring instruments and its uses. Pneumatic gauges – its accessories and control device and use for checking dimensions.
11. Different types of abrasive, manufacture of grinding wheels, their grades.
12. Principle and value of grinding in finishing process, various types of grinding wheels their construction and characteristic glazed and loaded wheels.
13. Knowledge how to square up a workpiece using an angle plate. Checking of squareness. Multiple clamping of parts to achieve concentricity & uniformity in size.
14. Factors effecting selection of wheels, identification of wheel, marking system of grinding wheels IS: 551- 1966.
15. Grit and different types of bonds, such as vitrified, resinoid, rubber etc. Different types of metals and electroplated bond.
16. Grinding wheel speed, surface speed per minute conversion of peripheral speed to r.p.m. Depth of cut and range at usefulness. Depth micrometer and vernier caliper. Common types of surface grinding machine, plain surface, rotary surface, horizontal and vertical surface grinder etc. Method of grinding tapers.
17. Introduction Training- Revision of previous works. Common types of grinding machines. Plain cylindrical external and internal cylindrical grinder and universal grinder.

18. Test for alignment and checking, balancing at wheel, dressing different types of wheel, dressers, their description and uses.
19. Holding devices such as Magnetic chuck, chucks and face plates collets their description and uses. Method of holding jobs on magnetic chuck, face plate and chucks.
20. External grinding operational steps in external grinding of a job and precautions to be taken.
21. Holding devices such as jig and fixture angle plates 'V' blocks etc. their description and uses.
22. Internal grinding operational steps in internal grinding of a job precautions to be taken. Rough and finish grinding limit fit and tolerances as per ISI: 919-1963. Basic size and its deviation, position of tolerances as per ISI: 9191963. Basic size and its deviation, position of tolerance zones with respect of zero line. Fits different types clearance, interference and transition. Interchangeable system. Letter symbols for holes and shaft and fundamental deviation hole basis and shaft basis system.
23. Heat generated in grinding dry and wet grinding use of coolant, their composition and selection. Characteristic of coolant.
24. Grinding a square job grinding angular surface taper grinding by stone land taper and angle protractor. Grinding defects vibration, chattering, glazing and loading their causes and remedies. Tool and cutter grinding machine-parts and accessories, description use, care and maintenance, pedestal grinder and bench grinder-their description and uses.
25. Use of snap gauges, sine bar and slip gauges their description and uses. Polishing, lapping powder and emery clothes lapping flat surface.
26. Tools and cutter grinder their description, working principles, operations care and maintenance. Special types of grinding machines and centreless grinders. Their description, working principles, operations, care and maintenance. Diamond Wheel and Applications of diamond wheel in grinding.
27. Preventive maintenance and its necessity. Mode of frequency of lubrication. Preparation of Maintenance schedule, simple estimation, use of hand book and reference table. Total preventive Maintenance.
28. Cylindrical grinding machine, its parts, use care and maintenance surface grinding machine-its parts use care and maintenance Universal cylindrical grinding machines parts description use, care and maintenance. Internal grinding machine and its parts their description, use care and maintenance.
29. Milling cutters and its nomenclature. Grinding of bushes and cylinders steps and precautions to be taken.
30. Dial test indicators marking block, height gauge and surface plate their description.
31. Principle of vernier caliper, protractors, micrometers (O/S, I/S and depth) and other instruments having vernier graduations. Combination sets-their use care and maintenance.
32. Bonding materials their kinds description and uses. Grade and structure at grinding wheels. Brief about ISO- 9000. Importance of Quality.
33. Wheel marking system selection of wheels. Specification and types (shapes & size) of grinding wheels, diamond wheels and their uses.
34. Mounting of grinding wheels, grinding wheels, collets and mandrels, balancing of grinding wheels by different methods.
35. Types of dresses-steel type, abrasive Diamond tool and rotary dresses abrasive bricks and sticks their description, use, care and maintenance.
36. Dressing and truing of grinding wheels advantage of balancing, inspections and care of grinding wheels. Wheel storage. Heat generated in grinding dry and wet grinding, use of coolants their composition and selection, limit, fit and tolerances as per ISI: 919-1963. Basic size and its deviation position of tolerance zone with respect to zero lines. Fits different types clearance,

interference and transition Interchangeable system Letter symbols for holes and shafts and fundamental deviation hole basis and shaft basis systems.

37. Gauges-feeler, taper gauge radius, plug, ring snap (fixed and adjustable) and slip their description use care and maintenance. Inside micrometer depth gauge, special types of micrometers, universal dial test indicator their construction and function.
38. Special type of grinding machine centreless, thread crankshaft etc. their description, use care and maintenance. Essential mechanism of grinding machines, wheel is guards to IS: 1991-1962 machine guards etc. Process of cleaning and oiling at grinding machines (care and Maintenance) types of steady rests their description and use
39. Principle types of grinding fluids importance of uniform temperature, selection and use at grinding fluids, method of supplying grinding fluids.
40. Types of holding devices methods of holding work, type of centres - holding work between centres types of chucks and holding process in chucks. Holding work on face plate, pneumatic chuck and magnetic chuck. Precautions to taken before grinding, peripheral of surface speed of grinding wheels, importance of constant wheel speeds, calculations at S.F.P.M.
41. Calculation at R.P.M. and S.F.P.M. of grinding wheels calculation of work speed for cylindrical grinding speed and feeds for cylindrical grinding speed and feeds for internal grinding.
42. Traverse and over run of traverse, width of wheel and depth of cut in different types of grinding achiness. Grinding allowance and time estimation. Rough and finish grinding process.
43. Surface grinding methods of surface grinding by using periphery of grinding wheel and ring edge of grinding wheel. Types of surface grinding machines. Work finish, wheel selection holding of work.
44. Process of grinding angular surfaces. Grinding slots and grooves. Grinding "V" blocks. Recommended wheel speeds for surface grinding machines.
45. Hones and Honing, types of honing stones there description and use. Amount and rate of stock removal. Adjustment for elementary honing conditions, honing tolerances.
46. Cylindrical-types of cylindrical grinding operation traverse method, plunge cut method and form grinding method. Alignment of head stock and tail stock. grinding step-grinding and shoulder and face grinding. Method of grinding external and angle (simple) taper and steep. Taper double compound taper.
47. Use of universal head for angular grinding. Measuring and checking of taper and angles. Use of taper plug and ring gauges.
48. Taper and angle checking by using protractors, micrometer and rollers.
49. Use of sine bar and gauge block taper checking by sine bar gauge block D.T.I. micrometer and rollers. Other out of round surfaces. Holding work with fixed steady rest, in process gauges and pneumatic gauges.
50. Centreless grinding process of holding job, and types of operations. Effect of setting work above and below wheel centre. Jig and fixture holding work by fixture and vice non-electric and magnetic chuck. Use of three jaw and two jaw steady rest. Internal centreless grinding methods of holding jobs and processes of grinding. Selection of wheels. Internal grinding work movement and wheel movement. Rotation and reciprocation of job and wheel spindle, Internal grinding allowance, selection of wheels for internal grinding allowance, selection of wheels for internal grinding. Thread grinding method of holding jobs methods of grinding threads and thread calculation. Various types of thread grinding wheels and their selection. Types of dressers and process of process of dressing selection of coolants and their use.

51. Laps and lapping material, types of laps lapping abrasives rotary diamond lap lapping lubricants lapping pressures wet and dry lapping. Hand lapping and machine lapping. Lapping flat surface lapping cylindrical surface polishing wheels polishing operations abrasive buffing wheels.
52. Grinding defects and their corrections, inaccurate work out of round, out of parallel taper on and irregular marks spiral scratches, discoloured burnt surface etc. Waviness marks of surface, chatters-short close evenly spaced long and regularly spaced, marks in phase with vibration of floor, random marks, random waves etc. Glazing of wheel and loading of wheel.
53. Dressing and truing of grinding wheels advantage of balancing, inspections and care of grinding wheels. Wheel storage.
54. Importance of Technical English terms used in industry -(in simple definition only) Technical forms, process charts, activity logs, in required formats of industry, estimation, cycle time, productivity reports, job cards.
55. Introduction to CNC Technology CNC M/c. principle advantages classification, drives, controls. Basic information on CNC machine & maintenance of CNC M/c. computer aided CNC Language. Introduction to CNC grinding. Personal safety, safe material handling, and safe machine operation on CNC turning centers. CNC technology basics, Comparison between CNC and conventional lathes. Concepts of positioning accuracy, repeatability.
56. CNC lathe machine elements and their functions - bed, chuck, tailstock, turret, ball screws, guide ways, LM guides, coolant system, hydraulic system, chip conveyor, steady rest, console, spindle motor and drive, axes motors, tail stock, encoders, control switches. Feedback, CNC interpolation, open and close loop control systems. Machining operations and the tool paths in them – stock removal in turning and facing, grooving, face grooving, threading, drilling.
57. **Workshop Science and Calculation :**
 - Introduction to Iron and Steel. Differences in Iron & steel.
 - Introduction to Property and uses of C.I. and wrought Iron. , Iron and steel properties and uses.
 - Properties and uses of plain carbon steel and alloy steel.
 - Properties and uses of non ferrous metals and alloys Fraction and decimal - conversion fraction decimal and vice-versa.
 - Properties and uses of copper, zinc, lead, tin, aluminum.
 - Composition, properties and uses of brass, bronze, solder, bearing material, timber, rubber etc.
 - System of units, British, metric and SI units for length, area, volume capacity, weight, time, angle, their conversions. , Effect of alloying elements in the properties of C.I. & steel.
 - Unit of temperature for & related problems. Standard & absolute temp.
 - Mass, volume, density, weight, sp. Gravity & specific weight. S.I. M.K.S. and F.P.S. units of force, weight etc. their conversion to related problems.
 - Inertia, rest and motion, velocity and acceleration.
 - Types of forces, its units and Weight calculation.
 - Revision & Test , Power and roots Factor, Power base exponents number. Multiplication and division of power and root of a number. Square root of number and problems.
 - Heat & temperature, thermometric scales, their conversions.
 - Work energy and power, their units and applied problems.
 - Percentage, changing percentage to decimal and fraction and vice versa. Applied problems.
 - Problem on percentage related to trade.

- Different types of loads, stress, strain, modulus of elasticity. Ultimate strength, different types of stress, factor of safety, examples.
- Ratio & proportion- Ratio, finding forms ratio proportions, direct proportion and indirect proportion. Application of ratio and proportion & related problems.

58. Engineering Drawing :

- Engineering Drawing - introduction to Engg. Drawing and its importance.
- Use of drawing instruments –Drawing of straight, inclined and curved lines.
- Exercise on linear and angular measurements.
- Types of lines their meaning & application as per BIS SP: 46-2003.
- Simple conventional symbols for material and parts as per BIS SP: 46-2003. , Geometrical construction of rectangles, square, circles.
- Geometrical construction of polygon and ellipse, parabola & hyperbola.
- Geometrical construction of involutes, oval, and helix.
- Free hand sketching of straight lines, rectangles, circles, square, polygons, ellipse.
- Standard printing style for letters and numbers as per BIS : SP: 46-2003 using stencils
- Free hand sketching of simple geometrical solids, cube, cone, prism, cylinder, sphere, pyramids.
- Scales- Types & its use.
- Revision & Test, Construction of diagonal scale.
- Simple dimensioning technique, size and location, dimensions of parts, holes angles, taper, screw etc. as per BIS SP: 46-2003.
- Transferring measurements for linear, angular, circular dimensions from the given object to the related free hand sketches using different measuring instruments.
- Pictorial drawings, isometric drawings of simple geometrical solids.
- Oblique/orthographic projection of simple geometrical solids.
- Orthographic drawings: Application of both the first angle and third angle. Isometric drawing of simple machined & casting blocks.
- Free hand sketches of trade related hand tools and measuring tools

Note: The above syllabus is indicative and the questions in the test may include similar other topics pertaining to the level and content of essential qualification.