| SYLLABUS FOR MACHINIST GRINDER TRADE | | | |
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| **FIRST YEAR** | | | |
| **Duration** | **Reference Learning Outcome** | **Professional Skills (Trade Practical) With Indicative Hours** | **Professional Knowledge (Trade Theory)** |
| Professional Skill 100 Hrs;<br><br>Professional Knowledge 28 Hrs | Plan and organize the work to make job as per specification applying different types of basic fitting operation and check for dimensional accuracy by using steel rule, caliper etc. [Basic Fitting operation- marking, hack sawing, chiseling, filing, drilling, reaming, taping, off-hand grinding etc. accuracy±0.25mm] following safety precautions. | 1. Importance of trade training. (01 hr)<br>2. List of tools & Machinery used in the trade. (02 hrs)<br>3. Health & Safety: Introduction to safety equipments and their uses. (03 hr)<br>4. Introduction of First-aid. (01 hr)<br>5. Operation of Electrical mains. (01 hr)<br>6. Occupational Safety. (01 hr)<br>7. Health Importance of housekeeping & good shop floor practices. (02 hr)<br>8. Safety and Environment guidelines. (01 hr)<br>9. Legislations & regulations as applicable. (01hr)<br>10. Disposal procedure of waste materials like cotton waste, metal chips/burrs etc. (01 hr)<br>11. Basic safety introduction. (01 hr)<br>12. Personal protective Equipments (PPE):- Basic injury prevention. (02 hrs)<br>13. Hazard identification and avoidance. (02hrs)<br>14. Safety signs for Danger, Warning, caution & personal | Importance of safety and general precautions observed in the in the industry/shop floor. All necessary guidance to be provided to the new comers to become familiar with the working of Industrial Training Institute system including stores procedures.<br><br>**Soft Skills: its importance and Job area after completion of training.**<br>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.<br>Introduction to Grinding trade and machine safety precautions according to IS: 1991-1962. (07 hrs.) |

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| | | safety message. (03 hrs)<br>15. Preventive measures for electrical accidents & steps to be taken in such accidents. (02 hrs)<br>16. Use of Fire extinguishers. (01 hr) | |
| | | 17. Identify of tools &equipments as per desired specifications for marking & sawing (Hand tools, Fitting tools & Measuring tools) (05 hrs)<br>18. Select material as per application, Inspect visually of raw material for rusting, scaling, corrosion etc., (05 hrs)<br>19. Mark out lines on job, (02 hrs)<br>20. Grip suitably in vice, ( 01hr)<br>21. Cut different types of metals of different sections to given dimensions by a Hacksaw. (8 hrs)<br>22. Mark, punch and grind on pedestal grinder. (04 hrs) | Description of hand tools, Safety precautions, care and maintenance and material from which they are made.<br><br>Ferrous and nonferrous metal and their identification by different methods.<br><br>Heat treatment of metals, its importance, various methods of heat treatment such as hardening, tempering, normalizing, annealing etc. (07 hrs.) |
| | | 23. Measure different types of jobs by steel rule, caliper etc. and put dimension on freehand drawing (07hrs)<br>24. Taper by angular protractor. (06hrs) | Theory of Semi precision measuring instruments.<br>General measuring tools (used in grinding shop) their description, use care and maintenance. (04 hrs.) |
| | | 25. Drill different sizes of holes by hand, (04hrs)<br>26. Ream the holes, (04hrs)<br>27. Make thread in drilled holes by tap (01hrs) | Relation between drill & tap sizes, care of taps and dies and their correct use. Types, properties and selection of coolants and lubricants. |

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| | | 28. Prepare thread on a round bar (01hrs)<br>29. Match an internal and external thread cutting with taps and dies using coolants. (02hrs) | (03hrs.) |
| | | 30. Drill different sizes of holes by machine. (04hrs)<br>31. Use of screw drivers, spanners, pliers etc.(02hrs)<br>32. Make simple fitting job within accuracy ±0.4. (07hrs) | Brief description of drilling machine use and care.<br>Knowledge of tool fixing and job holding device on drilling machine. (04 hrs.) |
| | | 33. File a MS flat as given dimension, (07hrs)<br>34. Make simple fitting job within accuracy ±0.2. (05rs) | Knowledge of different types of files according to cut and shape.<br>Methods of filing operation.<br>Knowledge of surface finish accuracy by filing. (03 hrs.) |
| Professional Skill 75 Hrs;<br><br>Professional Knowledge 21 Hrs | Produce simple components by setting different machine parameters and performing different lathe operation [Different machine parameters: - Cutting, speed, feed, depth of cut; Different lathe operation – Facing, plain turning, taper turning, boring and simple thread cutting.] | 35. Identify Centre lathe and its parts, (05 hrs)<br>36. Set lathe machine and perform on lathe operation with idle or dry run. (10 hrs)<br>37. Grind Lathe Tools on Pedestal Grinder.(10 hrs) | Brief description of a Centre lathe, its use.<br>Knowledge of transmission of speed from motor to spindle of a lathe.<br>Knowledge of aligning a job on lathe.<br>Lathe tools nomenclature. (07 hrs.) |
| | | 38. Perform facing and turning on lathe (05hrs)<br>39. Perform drilling operation on lathe. (05hrs)<br>40. Perform taper turning using compound rest and taper turning attachment. (05hrs)<br>41. Perform boring operation on lathe (10hrs) | Knowledge of controlling cutting speed, feed and depth of cut.<br>Lathe tools and their uses.<br>Selection of tools for different operation in lathe.<br>Taper and its types and problems.<br>Taper turning methods and calculations.<br>i.e. Form tool, TT attachment, |

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| | | | Compound rest etc. (07 hrs.) |
| | | 42. Perform simple external screw cutting (13hrs)<br>43. Perform simple internal screw cutting (12hrs) | Method of screw cutting and simple calculation.<br>Knowledge of spindle speed mechanism related to lead screw of lathe. (07 hrs.) |
| Professional Skill 100 Hrs;<br><br>Professional Knowledge 28 Hrs | Perform grinding wheel mounting, balancing, dressing, truing and set surface grinder to make job by rough & finish grinding and check accuracy with precision measuring instrument [Accuracy limit:- ±0.25mm.] | 44. Set grinding wheel on wheel flange, truing and balancing of wheels. (20 hrs)<br>45. Dress grinding wheel. (05 hrs) | Application and use of pedestal grinder.<br>General dressing tools used in grinding section such as wheel, diamond dresser, steel type dresser, abrasive dresser and nonferrous dresser. (07 hrs.) |
| | | 46. Check and measure various types of jobs using micrometers, Vernier caliper, Height gauge etc. (08 hrs)<br>47. Identify different parts of surface grinding machine. (07 hrs)<br>48. Set surface grinding machine and perform operating with dry / idle run. (10 hrs) | Precision measuring instruments English and metric micrometer, vernier caliper, dial test indicator etc. their description and uses.<br>Knowledge of digital measuring instruments and its uses.<br>Pneumaticgauges – its accessories and control device and use for checking dimensions. (07 hrs.) |
| | | 49. Perform rough and finish grinding on surface work (20 hrs)<br>50. Perform rough and finish grinding on cylindrical job. (20 hrs)<br>51. Include diamond and CBN grinding wheel. (10 hrs) | Different types of abrasive, manufacture of grinding wheels, their grades. (14 hrs.) |
| Professional Skill 100Hrs;<br><br>Professional Knowledge | Set cylindrical grinder to produce job/ components by performing external and internal | 52. Perform grinding on surface grinding machine. (05 hrs)<br>53. Identify different parts of cylindrical grinding machine. (05 hrs) | Principle and value of grinding in finishing process, various types of grinding wheels their construction and characteristic glazed and |

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| 28Hrs | cylindrical operation and check accuracy [Accuracy limit: - ±0.25mm.] | 54. Set cylindrical grinding machine and perform operation with dry / idle run. (07 hrs)<br>55. Perform grinding on Cylindrical grinding machine (Grinding should be performed both on soft and hardened materials). (08 hrs) | loaded wheels. (07 hrs.) |
| | | 56. Grind parallel block within accuracy ±0.2mm. (06hrs)<br>57. Perform Plain-mandrel grinding to size within accuracy ± 0.2 (07hrs) | Knowledge how to square up a workpiece using an angle plate.<br>Checking of squareness.<br>Multiple clamping of parts to achieve concentricity & uniformity in size. (04 hrs.) |
| | | 58. Demonstrate selection of grinding wheels for grinding different metals, (05hrs)<br>59. Select of suitable wheel to obtain rough and IS: 1249-1958. (07hrs) | Factors effecting selection of wheels, identification of wheel, marking system of grinding wheels IS: 551- 1966. (03 hrs.) |
| | | 60. Grind different metals with suitable grinding wheels. (25 hrs) | Grit and different types of bonds, such as vitrified, resinoid, rubber etc. Different types of metals and electroplated bond. (07 hrs.) |
| | | 61. Perform externals cylindrical grinding operation within accuracy ± 0.1mm. (03 hrs)<br>62. Perform internal cylindrical grinding operation within accuracy ± 0.1mm. (03 hrs)<br>63. Change the recommended wheel speed and control depth of cut. (02 hrs)<br>64. Perform grinding of sockets both internal and external and check. | 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. (07 hrs.) |

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| | | (05 hrs)<br>65. Perform Morse taper grinding both internal and external and check. (05 hrs)<br>66. Perform grinding External sleeve and check. (05 hrs)<br>67. Perform depth checking by depth gauge micrometer. (02 hrs) | |
| Professional Skill 200 Hrs;<br><br>Professional Knowledge 56 Hrs | Set up cylindrical grinder for automatic movement to perform different cylindrical grinding operation using different machine accessories and check accuracy [Different cylindrical grinding:- straight parallel, taper, bush eccentric; Different machine accessories: - steady rest, chuck face plate, angle plate and check accuracy limit ±0.02 mm] | 68. Revise previous works.(05 hrs)<br>69. Perform machine setting for automatic movements. (10 hrs)<br>70. Perform parallel grinding on cylindrical grinder. (10 hrs) | Introduction Training-Revision of previous works. Common types of grinding machines. Plain cylindrical external and internal cylindrical grinder and universal grinder. (07 hrs.) |
| | | 71. Test and mount wheels, sleeves, check truing and rebalancing. (15 hrs)<br>72. Perform grinding parallel mandrel within ± 0.03mm.(10 hrs) | Test for alignment and checking, balancing at wheel, dressing different types of wheel, dressers, their description and uses. (07 hrs.) |
| | | 73. Perform wheel balance and dressing grinding long bar using steady rest. (25 hrs) | Test for alignment and checking, balancing of wheel, dressing different types of wheel, dressers their description and uses. (07 hrs.) |
| | | 74. Perform grinding different types of jobs using machine chuck, face angle plate collets. (25 hrs) | 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. (07 hrs.) |
| | | 75. Align table with the help of test bar and dial test indicator. (05 hrs)<br>76. Perform parallel grinding within accuracy ±0.02mm. | External grinding operational steps in external grinding of a job and precautions to be taken. (07 hrs.) |

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| | | (07 hrs)<br>77. Perform cylindrical Taper grinding (by swiveling machine table) (08 hrs) | |
| | | 78. Grind an eccentric job. (10 hrs)<br>79. Finish different types of jobs using jigs and fixtures, angle plates by grinding. (15 hrs) | Holding devices such as jig and fixture angle plates 'V' blocks etc. their description and uses. (07 hrs.) |
| | | 80. Perform grinding of job by using face plate angle plate etc. (25 hrs,) | Internal grinding operational steps in internal grinding of a job precautions to be taken. (07 hrs.) |
| | | 81. Finish surfaces of bushes on mandrel within ±0.02 mm by grinding. (25 hrs) | Rough and finish grinding limit fit and tolerances as per ISI: 919-1963. Basic size and its deviation, position of tolerances as per ISI: 919-1963. Basic size and its deviation, position of tolerance zones with respect of zero line. Fits different types clearance, interference and transition.<br>Interchangeable system. Letter symbols for holes and shaft and fundamental deviation hole basis and shaft basis system. (07 hrs.) |
| Professional Skill 200 Hrs;<br><br>Professional Knowledge 56 Hrs | Perform dry & wet grinding to make different shaped job of various metals and check accuracy. [Different shaped job: - square block angle plate, angular block; various metal: - cast iron, steel & accuracy | 82. Perform dry and wet grinding of different classes of metals such as cast iron, brazed carbide tip and different classes of steel. (25 hrs) | Heat generated in grinding dry and wet grinding use of coolant, their composition and selection. Characteristic of coolant. (07 hrs.) |
| | | 83. Grind square block within accuracy ±0.02mm. (08 hrs)<br>84. Grind angle plate within accuracy ±0.02mm (08 hrs)<br>85. Grind angular block within | Grinding a square job grinding angular surface taker grinding by stane land taper and angle protractor. (07 hrs.) |

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| | limit ±0.02 mm.] | accuracy ±0.02mm. (09 hrs) | |
| Professional Skill 25 Hrs;<br><br>Professional Knowledge 07 Hrs | Make a component by performing bore grinding and check accuracy by telescopic gauge. [Accuracy limit ±0.02 mm.] | 86. Perform bore grinding within accuracy ±0.02mm. (20 hrs)<br>87. Use of Telescopic gauge for checking of bore. (05 hrs) | Grinding defects vibration, chattering, glazing and loading their causes and remedies. (07 hrs.) |
| Professional Skill 25 Hrs;<br><br>Professional Knowledge 07 Hrs | Perform operations on tools & cutter grinder and re-sharpening different tools on pedestal grinder. [Different tools: - lathe tools, drill, tool bit] | 88. Perform operation on tools and cutter grinding machine. (12 hrs)<br>89. Manipulate and control tools and cutter grinding machine (05 hrs)<br>90. Mount jobs on mandrel in tools and cutter grinding machine. (01 hr)<br>91. Mount wheel and guards on pedestal grinder. (01 hr)<br>92. Sharpen lathe tools on pedestal grinder. (03 hrs)<br>93. Sharpen drill, tool-bit on pedestal grinder. (03 hrs) | Tool and cutter grinding machine-parts and accessories, description use, care and maintenance, pedestal grinder and bench grinder-their description and uses. (06 hrs.) |
| Professional Skill 100 Hrs;<br><br>Professional Knowledge 28 Hrs | Make components having angular and straight surface and check accuracy with different gauges and instruments.<br>[Different components: - V' block, parallel bar, drill point angle; Different gauges: - sine bar, slip gauge & DTI (dial test indicator) and accuracy limit ±0.02 mm.] | 94. Check tapered or angular jobs with help of sine bar, slip gauges and dial gauge. (25 hrs) | Use of snap gauges, sine bar and slip gauges their description and uses. Polishing, lapping powder and emery clothes lapping flat surface. (07 hrs.) |
| | | 95. Perform cylindrical and surfaces grinding operation (25 hrs) | Tools and cutter grinder their description, working principles, operations care and maintenance. (07 hrs.) |
| | | 96. Perform step grinding on cylindrical grinding machine. (25 hrs) | Special types of grinding machines and centreless grinders. Their description, working principles, operations, care and maintenance. (07 hrs.) |

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| | | 97. Grind Parallel block on surface grinding machine (12 hrs)<br>98. Grind gauges within finish accuracy ±0.02mm. (Rough and finish grinding using disc and diamond wheels). (13 hrs) | Diamond Wheel and Applications of diamond wheel in grinding. (07 hrs.) |
| Professional Skill 25 Hrs;<br><br>Professional Knowledge 07 Hrs | Perform preventive maintenance of grinding machines. [Grinding machines: - surface and cylindrical] | 99. Make simple utility jobs such as V' block, Parallel bar, Drill point angle checking gauge with surface and cylindrical grinders. (10 hrs)<br>100. Perform preventive maintenance of grinding machines. (15 hrs) | 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. (07 hrs.) |
| Professional Skill 50 Hrs;<br><br>Professional Knowledge 14 Hrs | Make job of different material by cylindrical parallel grinding with appropriate accuracy. [Different material: - soft & hard metals; Accuracy limit±0.01mm] | 101. Finish cylindrical surfaces by grinding within accuracy ±0.01mm (Maintaining parallelism) on both soft and hard metals. (50 hrs) | 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. (14 hrs.) |
| **In-plant training / Project work:**<br>a) Drilling jig<br>b) Parallel bar<br>c) Taper mandrel | | | |

| SYLLABUS FOR MACHINIST GRINDER TRADE | | | |
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| **SECOND YEAR** | | | |
| **Duration** | **Reference Learning Outcome** | **Professional Skills (Trade Practical) With Indicative Hours** | **Professional Knowledge (Trade Theory)** |
| Professional Skill 50 Hrs;<br><br>Professional Knowledge 18 Hrs | Perform re-sharpening of different milling cutters [Different milling cutters: - plain, slitting saw] | 102. Perform grinding of plain milling cutter. (25 hrs)<br>103. Perform grinding of slitting saw milling cutter. (25 hrs) | Milling cutters and its nomenclature. Grinding of bushes and cylinders steps and precautions to be taken. (18 hrs.) |
| Professional Skill 175 Hrs;<br><br>Professional Knowledge 63 Hrs | Make different components having straight & angular surface with close tolerance limit and check different fault. [Different components: - V' block, plain cylindrical bar, cube; tolerance limit - ±0.01mm; different faults - cracks, blow-holes, chatters] | 104. Perform grinding on plain flat surface in surface grinding machine with close tolerances (±0.01mm.) (25 hrs) | Dial test indicators marking block, height gauge and surface plate their description. (09 hrs.) |
| | | 105. Perform grinding on angular surface like 'V' block. (25 hrs) | 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. (09 hrs.) |
| | | 106. Grind parallel block on surface grinding machine within close limits (±0.01mm.) (13 hrs)<br>107. Perform plane cylindrical grinding to close limit with accuracy of h7. (12 hrs). | Bonding materials their kinds description and uses. Grade and structure at grinding wheels. Brief about ISO- 9000. Importance of Quality. (09 hrs.) |
| | | 108. Perform cylindrical bore grinding within accuracy ±0.01mm. (15 hrs)<br>109. Set and grind jobs on chucks and face plates. (10 hrs) | Wheel marking system selection of wheels. Specification and types (shapes & size) of grinding wheels, diamond wheels and their uses. (08 hrs.) (09 hrs.) |
| | | 110. Balance grinding wheel (06 hrs)<br>111. Mount grinding wheel. (03 | Mounting of grinding wheels, grinding wheels, collets and mandrels, balancing of grinding |

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| | | hrs)<br>112. Perform right angle grinding on surface grinding machine within accuracy ± 0.01mm. (16 hrs) | wheels by different methods. (09 hrs.) |
| | | 113. Perform wheel dressing for rough and finishing grinding. (01 hrs)<br>114. Grind a cube to close limit. (Tolerance within ±0.01mm.) (24 hrs) | Types of dresses-steel type, abrasive Diamond tool and rotary dresses abrasive bricks and sticks their description, use, care and maintenance. (09 hrs.) |
| | | 115. Perform shoulder grinding on cylinder-grinding machine to close limit h7. (08 hrs)<br>116. Perform slot grinding on surface grinding machines to close limits H7. (09hrs)<br>117. Find different faults while grinding. viz., Cracks, blow holes, chatters. (08 hrs) | Dressing and truing of grinding wheels advantage of balancing, inspections and care of grinding wheels. Wheel storage.<br>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. (09 hrs.) |
| Professional Skill 100Hrs;<br><br>Professional Knowledge 36Hrs | Make different gauges with close tolerance limit and check accuracy with different gauges. [Different gauges: - snap gauge, ring gauge; tolerance limit- (H7/h7); Checking gauges- ring, plug] | 118. Grind Snap gauge in close limit to H6. (25 hrs) | Gauges-feeler, taper gauge radius, plug, ring snap (fixed and adjustable) and slip their description use care and maintenance. (09 hrs.) |
| | | 119. Perform grinding on cylindrical taper using standards ring gauges. (25 hrs) | Inside micrometer depth gauge, special types of micrometers, universal dial test indicator their construction and function. (09 hrs.) |
| | | 120. Perform grinding of ring gauge using plug gauge. (25 hrs) | Special type of grinding machine centreless, thread crankshaft etc. their description, use care and |

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| | | | maintenance. (09 hrs.) |
| | | 121. Grinding long cylindrical using steady rest to close limit of h6. (25 hrs) | 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 (09 hrs.) |
| Professional Skill 75Hrs;<br><br>Professional Knowledge 27Hrs | Produce different components of non-ferrous metal within appropriate accuracy. [Different components - taper pin, rectangular bar; accuracy limit- ±0.01mm.] | 122. Grind thin plates to close limits of h6 using coolants. (25 hrs) | Principle types of grinding fluids importance of uniform temperature, selection and use at grinding fluids, method of supplying grinding fluids. (09 hrs.) |
| | | 123. Perform grinding on parallel and taper pins using chuck and collets-h6. (25 hrs) | Types of holding devices methods of holding work, type of centres - holding work between centres types of chucks and holding process in chucks. (09 hrs.) |
| | | 124. Select grinding wheel and perform grinding on rectangular bar of non-ferrous metals within accuracy ±0.01mm. (25 hrs) | 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. (09 hrs.) |
| Professional Skill 100 Hrs;<br><br>Professional Knowledge 36 Hrs | Produce different components involving cylindrical angular grinding operation to close limit accuracy. [Different components- lathe centre, milling machine arbor; accuracy:- h6 or H6] | 125. Perform grinding on machine centre to close limit h6 or H6. (25 hrs) | 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. (09 hrs.) |
| | | 126. Perform Facing and Chamfering within accuracy ±0.01mm or ± 5 minutes. (25 hrs) | 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. (09 hrs.) |
| | | 127. Perform step grinding on | Surface grinding methods of surface |

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| | | surface grinding machine to close limit h6 or H6. (25 hrs) | 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. (09 hrs.) |
| | | 128. Perform V-block grinding within accuracy ±0.01 mm, ± 5 minutes, surface finish N5. (25 hrs) | Process of grinding angular surfaces. Grinding slots and grooves. Grinding "V" blocks. Recommended wheel speeds for surface grinding machines. (09 hrs.) |
| Professional Skill 25Hrs; Professional Knowledge 09Hrs | Prepare surface of a component by honing operation & Check accuracy. [Accuracy limit: ±0.001mm] | 129. Grind cylindrical stepsand perform honing (25 hrs) | Hones and Honing, types of honing stones there description and use. Amount and rate of stock removal. Adjustment for elementary honing conditions, honing tolerances. (09 hrs.) |
| Professional Skill 150 Hrs; Professional Knowledge 54 Hrs | Produce components by different taper grinding operation and check accuracy. [Different taper grinding: - compound or double taper, steep taper, morse taper; accuracy limit - ±0.008mm.] | 130. Finish surface of Angular form grinding within accuracy of ±0.01mm. (25 hrs) | Cylindrical-types of cylindrical grinding operation traverse method, plunge cut method and form grinding method. Alignment of head stock and tail stock. (09 hrs.) |
| | | 131. Grind cylindrical steps with shoulder and chamfer within accuracy ±0.008mm. (25 hrs) | Method of plain cylindrical surface grinding step-grinding and shoulder and face grinding. (09 hrs.) |
| | | 132. Perform compound or double taper grinding accuracy of ±0.008mm. and surface finish of N5 (25 hrs) | Method of grinding external and angle (simple) taper and steep. Taper double compound taper. (09 hrs.) |
| | | 133. Perform steep taper grinding with in accuracy ±0.008mm. (12 hrs)<br>134. Grind lathe centre within accuracy ±0.008 mm. surface finish N4. (13 hrs) | Use of universal head for angular grinding. Measuring and checking of taper and angles. Use of taper plug and ring gauges. (09 hrs.) |
| | | 135. Make Morse taper within accuracy ±0.008 mm. surface | Taper and angle checking by using protractors, micrometer and rollers. |

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| | | finish N4. (08 hrs)<br>136. Perform Plug grinding within accuracy ±0.008 mm. surface finish N4. (08 hrs)<br>137. Finish Metric tapers by grinding within accuracy ±0.008 mm. surface finish N4. (09 hrs) | (09 hrs.) |
| | | 138. Perform Taper grinding using sine bar, D.T.I. and gauge blocks to close limit h6. (25 hrs) | 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. (09 hrs.) |
| Professional Skill 100 Hrs;<br><br>Professional Knowledge 36 Hrs | Produce male and female components by different grinding to close tolerance limit. [Different grinding: - step and slot grinding; tolerance limit-H6/h5] | 139. Grind Taper up to close limit H6. (12 hrs)<br>140. Grind lathe centre within h7. (13 hrs) | 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 (09 hrs.) |
| | | 141. Perform internal step grinding to close limit H6, (13 hrs)<br>142. Grind ring gauge to close limit-H7. (12 hrs) | 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. (09 hrs.) |
| | | 143. Perform slot grinding to close limit h5. (25 hrs) | Thread grinding method of holding jobs method of grinding threads and |

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| | | | thread calculation. (09 hrs.) |
| | | 144. Perform cylindrical step grinding (25 hrs) | Various types of thread grinding wheels and their selection. Types of dressers and process of process of dressing selection of coolants and their use. (09 hrs.) |
| Professional Skill 25 Hrs;<br><br>Professional Knowledge 09 Hrs | Prepare surface of a job by performing lapping & buffing to close limit h5. | 145. Perform Lapping on flat surface. (07hrs)<br>146. Perform Lapping on cylindrical surface (08hrs)<br>147. Perform Buffing to close limits h5. (10 hrs) | 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 (09 hrs.) |
| Professional Skill 100 Hrs;<br><br>Professional Knowledge 36 Hrs | Make components by different grinding to close tolerance limit and check accuracy. [Different grinding: - cylindrical taper, surface grinding & shoulder grinding; tolerance limit- h6] | 148. Perform cylindrical Taper grinding. (25 hrs) | -Do-<br>(09 hrs.) |
| | | 149. Perform surface grinding within accuracy ±0.01mm. (25 hrs) | Grinding defects and their corrections, inaccurate work out of round, out of parallel taper on and irregular marks spiral scratches, discoloured burnt surface etc. (09 hrs.) |
| | | 150. Perform Multi-step cylindrical grinding. (25 hrs) | Grinding defects and their correction. 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. (09 hrs.) |
| | | 151. Perform shoulder grinding on cylinder-grinding machine to close limit h7. (25 hrs) | Dressing and truing of grinding wheels advantage of balancing, inspections and care of grinding wheels. Wheel storage. (09 hrs.) |
| Professional Skill 100 Hrs;<br><br>Professional | Identify different components of CNC lathe to understand | 152. Prepare different types of documentation as per industrial need by different methods of recording | Importance of Technical English terms used in industry -(in simple definition only)Technical forms, process charts, activity logs, in |

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| Knowledge 36 Hrs | working and prepare part programme by using simulation software. | information. (25 hrs) | required formats of industry, estimation, cycle time, productivity reports, job cards. (09 hrs.) |
| | | 153. Identify CNC machine (05 hrs)<br>154. CNC machine operation like Jog, Reference Edit, MDI, Auto Mode Program. Call & Entry, Simulation, Tool off-set Tool changing /Orientation. (20 hrs) | Introduction to CNC Technology CNC M/c. principle advantages classification, drives, controls.<br>Basic information on CNC machine & maintenance of CNC M/c. computer aided CNC Language.<br>Introduction to CNC grinding. (09 hrs.) |
| | | 155. Know rules of personal and CNC machine safety, safe handling of tools, safety switches and material handling equipment using CNC didactic/ simulation software and equipment. (10 hrs)<br>156. Identify CNC lathe machine elements and their functions, on the machine. (15 hrs) | Personal safety, safe material handling, and safe machine operation on CNC turning centers.<br><br>CNC technology basics, Comparison between CNC and conventional lathes. Concepts of positioning accuracy, repeatability. (09 hrs.) |
| | | 157. Understand the working of parts of CNC lathe, explained using CNC didactic/ simulation software. (20 hrs)<br>158. Identify machine over travel limits and emergency stop, on the machine. (05 hr)<br>159. Decide tool path for turning, facing, grooving, threading, drilling. (20hrs)<br>160. Identify safety switches and interlocking of DIH modes. (05 hr) | 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.<br>Feedback, CNC interpolation, open and close loop control systems.<br>Machining operations and the tool paths in them – stock removal in turning and facing, grooving, face grooving, threading, drilling. (09 hrs.) |
| **In-plant training / Project work**<br>a) Morse taper<br>b) Lathe centre close to h6<br>c) Stepped taper ring close to H7 | | | |