



GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP
DIRECTORATE GENERAL OF TRAINING

COMPETENCY BASED CURRICULUM

MACHINIST GRINDER

(Duration: Two years)

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL- 5



SECTOR –PRODUCTION & MANUFACTURING

MACHINIST GRINDER

(Engineering Trade)

(Revised in 2018)



CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL - 5

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Developed By

Ministry of Skill Development and Entrepreneurship

Directorate General of Training

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| List of Expert members contributed/ participated for finalizing the course curriculum of Machinist Grinder trade held on 16.01.2018 at Govt. ITI, Nashik. | | | |
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1. COURSE INFORMATION

During the two-year duration, a candidate is trained on subjects Professional Skill, Professional Knowledge, Engineering Drawing, Workshop Science & Calculation and Employability Skills. In addition to this, a candidate is entrusted to make/do project work and Extra Curricular Activities to build up confidence. The practical skills are imparted in simple to complex manner & simultaneously theory subject is taught in the same fashion to apply cognitive knowledge while executing task.

The course covers the detail aspect of Machinist (Grinder). The broad components covered under Professional Skill subject are as below:

1st Semester– The practical part starts with basic fitting covering components like filing, sawing, drilling, tapping, chipping, grinding and different fits. The accuracy proposed is of $\pm 0.2\text{mm}$ and angular accuracy of 1° . Different turning operations on lathe viz., plain, facing, boring, grooving, step turning, parting, chamfering, knurling and different thread cutting by setting the different parameter, are covered in the practical part. In addition mounting, balancing, dressing and truing of grinding wheel are to be performed. In assignment part production of plain and cylindrical surfaces, viz. parallel block, plain mandrel, socket, Morse taper, sleeve, etc. within accuracy of $\pm 0.1\text{mm}$ are involved.

2nd Semester– Different milling operations (plain, stepped, angular, dovetail, T-slot, contour, gear) along with surface & cylindrical grinding to an accuracy of $\pm 0.02\text{mm}$ are covered. Setting up of cylindrical grinder for automatic movement, grinding long parallel mandrel, alignment of table for taper grinding, eccentric grinding, etc. are the part of practical. This semester includes making of bush, square block, V-block, angle plate, re-sharpening of side & face milling cutter.

3rd Semester– Working on cylindrical and surface grinder is part of practical training and produce components with an accuracy of $\pm 0.01\text{mm}$ using the same. Grinding shoulder of h7 and slot of H7, snap gauge, ring gauge of H6 and machine centre of h6 are taught in the practical part. This semester includes practical on cylindrical bore grinding within accuracy of $\pm 0.01\text{mm}$., grinding long cylinder close to h6 and grinding jobs using different accessories.

4th Semester– Developed skills on cylindrical grinding and honing, finishing angular form, steps, shoulder, compound or double taper, steep taper, lathe centre, plug, Morse taper, Metric

taper within accuracy of ± 0.008 mm. and surface finish of N5/N4. Use of centerless grinding process, lapping on flat surface, lapping on cylindrical surface and buffing to limit of h5 are included. Practical part includes CNC machine operation like jog, reference edits, MDI, auto-mode program, call & entry, simulation, tool offset and changing and developed skill on operating CNC turning centre as per drawing by preparing Part-program.

In addition, components like Workshop Calculation & Science and Engineering Drawing which are related and develop basic fundamental with regard to the trade are extensively covered along with Employability Skills. These skills are essential skills which are necessary to perform the job in any given situation.



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2. TRAINING SYSTEM

2.1 GENERAL

Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers range of vocational training courses catering to the need of different sectors of Labour market. The vocational training programmes are running under aegis of National Council of Vocational Training (NCVT). Craftsman Training Scheme (CTS) and Apprenticeship Training Scheme (ATS) are two pioneer programmes under NCVT for propagating vocational training.

Machinist Grinder trade under CTS is one of the popular courses delivered nationwide through a network of ITIs. The course is of two years (04 semester) duration. It mainly consists of Domain area and Core area. In the Domain area (Trade Theory & Practical) impart professional skills and knowledge, while Core area (Workshop Calculation science, Engineering Drawing and Employability Skills) impart requisite core skill & knowledge and life skills. After passing out of the training programme, the trainee is awarded National Trade Certificate (NTC) by NCVT which is recognized worldwide.

Broadly candidates need to demonstrate that they are able to:

- Read & interpret technical parameters/documentation, plan and organize work processes, identify necessary materials and tools;
- Perform task with due consideration to safety rules, accident prevention regulations and environmental protection stipulations;
- Apply professional knowledge, core skills & employability skills while performing the job and maintenance work.
- Check the task/job for functioning, identify and rectify errors in task/job.
- Document the technical parameters related to the task undertaken.

2.2 CAREER PROGRESSION PATHWAYS

- Can appear in 10+2 examination through National Institute of Open Schooling (NIOS) for acquiring higher secondary certificate and can go further for General/ Technical education.
- Can take admission in diploma course in notified branches of Engineering by lateral entry.
- Can join Apprenticeship programme in different types of industries leading to National Apprenticeship certificate (NAC).
- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming instructor in ITIs.

2.3 COURSE STRUCTURE

Table below depicts the distribution of training hours across various course elements during a period of two years (04 semesters):

| S No. | Course Element | Notional Training Hours |
|-------|---------------------------------------|-------------------------|
| 1 | Professional Skill (Trade Practical) | 2104 |
| 2 | Professional Knowledge (Trade Theory) | 492 |
| 3 | Workshop Calculation & Science | 164 |
| 4 | Engineering Drawing | 246 |
| 5 | Employability Skills | 110 |
| 6 | Library & Extracurricular activities | 164 |
| 7 | Project work | 400 |
| 8 | Revision & Examination | 480 |
| | Total | 4160 |

2.4 ASSESSMENT & CERTIFICATION

The trainee will be tested for his skill, knowledge and attitude during the period of course and at the end of the training programme as notified by Govt. of India from time to time. The Employability Skills will be tested in first two semesters itself.

a) The **Internal Assessment** during the period of training will be done by **Formative Assessment Method** by testing for assessment criteria listed against learning outcomes. The training institute have to maintain individual *trainee portfolio* as detailed in assessment guideline. The marks of internal assessment will be as per the template (Annexure – II).

b) The final assessment will be in the form of summative assessment method. The All India Trade Test for awarding NTC will be conducted by NCVT at the end of each semester as per guideline of Govt. of India. The pattern and marking structure is being notified by Govt. of India from time to time. **The learning outcome and assessment criteria will be basis for setting question papers for final assessment. The examiner during final examination will also check** individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

2.4.1 PASS REGULATION

The minimum pass percentage for Practical is 60% and minimum pass percentage for Theory subjects is 40%. For the purposes of determining the overall result, 25% weightage is applied to the result of each semester examination.

2.4.2 ASSESSMENT GUIDELINE

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking assessment. Due consideration should be given while assessing for team work, avoidance/reduction of scrap/wastage and disposal of scrap/wastage as per procedure, behavioral attitude, sensitivity to environment and regularity in training. The sensitivity towards OSHE and self-learning attitude are to be considered while assessing competency.

Assessment will be evidence based comprising the following:

- Job carried out in labs/workshop
- Record book/ daily diary
- Answer sheet of assessment
- Viva-voce
- Progress chart
- Attendance and punctuality
- Assignment
- Project work

Evidences of internal assessments are to be preserved until forthcoming semester examination for audit and verification by examination body. The following marking pattern to be adopted while assessing:

| Performance Level | Evidence |
|---|---|
| (a) Weightage in the range of 60 -75% to be allotted during assessment | |
| For performance in this grade, the candidate should produce work which demonstrates attainment of an acceptable standard of craftsmanship with occasional guidance, and due regard for safety procedures and practices. | <ul style="list-style-type: none"> • Demonstration of good skill in the use of hand tools, machine tools and workshop equipment. • Below 70% tolerance dimension achieved while undertaking different work with those demanded by the component/job. • A fairly good level of neatness and consistency in the finish. • Occasional support in completing the project/job. |
| (b)Weightage in the range of 75% - 90% to be allotted during assessment | |
| For this grade, a candidate should produce work which demonstrates attainment of a reasonable standard of craftsmanship, with little guidance, and regard for safety | <ul style="list-style-type: none"> • Good skill levels in the use of hand tools, machine tools and workshop equipment. • 70-80% tolerance dimension achieved while undertaking different work with |

| | |
|---|---|
| procedures and practices. | <p>those demanded by the component/job.</p> <ul style="list-style-type: none"> • A good level of neatness and consistency in the finish. • Little support in completing the project/job. |
| (c) Weightage in the range of above 90% to be allotted during assessment | |
| <p>For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship.</p> | <ul style="list-style-type: none"> • High skill levels in the use of hand tools, machine tools and workshop equipment. • Above 80% tolerance dimension achieved while undertaking different work with those demanded by the component/job. • A high level of neatness and consistency in the finish. • Minimal or no support in completing the project. |



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MACHINIST GRINDER:

Grinder, General Grinder General grinds and smoothens metal surfaces to specified accuracy using one or more type of grinding machine. Examines drawings and other specifications of part to be ground. Selects grinding wheel of appropriate size, shape and abrasive quality and fastens it on spindle of machine. Mounts metal part accurately in position on machine using chucks, jigs, fixtures or between centres of head and tail stock of machine as required and sets it accurately either parallel or at angle in relation to grinding wheel as specified using appropriate devices and instruments necessary. Adjusts machine table, guides, stops and other controls to determine direction and limit of metal and grinding wheel movements. Selects grinding wheel speed and starts machine for grinding. Manipulates hand wheel or sets and starts automatic controls to bring grinding wheel in contact with work. Checks progress of grinding with measuring instruments and gauges for accuracy. May balance dress or change grinding wheel, stone or abrasive. May oil and clean machine.

Surface Grinder Surface Grinder grinds flat surfaces of machined metal objects to required finish and thickness by surface grinding machine. Studies drawings and other specifications for nature of grinding operations required. Selects appropriate grinding wheel and fits it on machine spindle. Places work in position on magnetic chuck on the machine. Sets required speed of grinding wheel and feed of machine and adjust guides and stops to control to and fro travel of machine table. Starts machine and brings grinding wheel into contact with work. Applies cut and observes progress of operation. Stops machine and measure work as necessary to ensure required accuracy. Removes work from machine when grinding completed. May operate horizontal or vertical spindle surface grinding machine. May oil and clean machine.

Roll Grinder Roll Grinder grinds shafts, rollers, commutator etc., to accurate finish for various mechanical purposes by centreless, cylindrical or universal grinding machine. Studies drawing and other specifications of parts to be ground. Selects and mounts appropriate abrasive wheels on machine. Turns hand wheel to adjust gap between rims of wheels according to diameter of part to be ground. Moves levers to select appropriate speeds for each wheel. Sets feed guide to guide work into position between two wheel rims and clamps coil guide properly to receive work from between wheel rims. Starts machine and feeds work on to feed guide or keeps hopper filled with objects that are automatically fed between wheels. Observes progress of work and checks periodically ground parts with micrometre or gauge to ensure that they conform to prescribed specifications. May do cylindrical grinding of parallel, step and taper shafts and internal bores set between centres or otherwise by processes of traverse plunge or angular grinding and be designated as CYLINDRICAL GRINDER or INTERNAL GRINDER as appropriate. May set or adjust grinding wheel distance for different operations. May clean and oil machine.

Honer/Honing Machine Operator Honer grinds internal surface of bores and cylinders to accurate mirror like finish with honing machine. Mounts ground cylinder accurately in position on machine, using clamps, jigs and other fixtures. Selects appropriate honing stick (abrasive tool) and clamps it on spindle of machine. Aligns cylinder accurately so that honing tool goes smoothly inside cylinder bore. Sets machine to feed and rotate hone at appropriate speed and starts machine. Expands tool to required diameter and manipulates hand wheel to feed tool into cylinder. Engages automatic feed that oscillates hone within cylinder and regulates supply of cutting lubricant over honing tool. Checks progress of honing as required with measuring instruments and makes necessary adjustments to ensure accuracy. Removes work when honing is completed. May do internal grinding of cylinders and bores. May oil and clean machine.

Lapper Lapper smoothens hardened flat, cylindrical, spherical or other metal surfaces mechanically or manually to glossy finish by rubbing surfaces with fine abrasives. Examines drawings and other specifications of part to be lapped and selects appropriate abrasive dust. Fits lapping wheel and sets object to be lapped on machine. Applies abrasive dust on metal surface and wheel and starts machine. Brings metal objects in contact with lapping wheel or holds work by hand over lapping wheel and polishes surface to required finish. Applies abrasive compound where necessary to attain high degree of finish. Smoothens or polishes surface for set period. Removes metal and cleans it in special liquids. May do hand lapping by enclosing object in container and vigorously rubbing by hand top plate of container with abrasive compound on metal surface to attain high degree of polish and accurate finish.

Grinder, Tool and Cutter Grinder, Tool and Cutter grinds machine tools and cutter to correct specifications by special grinding machines and wheel. Studies drawings and other specifications to understand nature of grinding operation required. Fastens appropriate abrasive wheel to spindle of machine. Mounts cutting tool to be ground on machine using dividing head, jig or fixture as required. Manipulates swivel tables, wheel head and work holding device, guide finger, etc. as necessary to set machine to appropriate angle for grinding desired level on cutting edges of tool selects and sets speed and feed to machine according to nature of work and wheel used. Starts machine, brings rotating grinding wheel in contact with edge of tool and grinds proper angles, clearance, flutes etc. as required on tool or cutter set, frequently checking it with gauge or measuring instrument while grinding to ensure accuracy. Rotates work through proper angle by dividing head or otherwise to set next flute or teeth of tool or cutter for grinding and continues operation. Uses cutting fluid or coolant as found necessary and ensures that no part of work gets burnt or damaged while grinding. Stops machine and removes tool when grinding is completed. Changes grinding wheel and position of tool as and when required. May give final finish to cutting edge by hand using hones. May oil and clean machine. May specialize in grinding a particular type of tool and be designated accordingly. May check ground tool or cutter by shadow projector to ensure accurate finish.

Plan and organize assigned work and detect & resolve issues during execution. Demonstrate possible solutions and agree tasks within the team. Communicate with required clarity and understand technical English. Sensitive to environment, self-learning and productivity.

May be designated as Mechanic Machine Tool Maintenance according to nature of work done

Reference NCO-2015:

- a) 7224.0100
- b) 7224.0400
- c) 7224.0300
- d) 7224.0600
- e) 7224.0700
- f) 7223.2200



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4. GENERAL INFORMATION

| | |
|--|---|
| Name of the Trade | MACHINIST GRINDER |
| NCO - 2015 | 7224.0100, 7224.0400, 7224.0300, 7224.0600, 7224.0700, 7223.2200 |
| NSQF Level | Level – 5 |
| Duration of Craftsmen Training | Two years (Four semesters each of six months duration). |
| Entry Qualification | Passed 10th Class with Science and Mathematics under 10+2 system of Education or its equivalent |
| Unit Strength (No. Of Student) | 12 (Supernumeraries/Ex-Trainee allowed: 4) |
| Space Norms | 102 Sq. m |
| Power Norms | 23.4 KW |
| Instructors Qualification for | |
| 1. Machinist Grinder Trade | <p>Degree in Mechanical Engineering from recognized university with one year post qualification experience in the relevant field OR Diploma in Mechanical Engineering from recognized Board of Technical Education with two years' post qualification experience in the relevant field. OR NTC/NAC in the Trade of “Machinist (Grinder)” with 3 years post qualification experience in the relevant field.</p> <p>Desirable: - Preference will be given to a candidate with CIC (Craft Instructor Certificate) in Machinist Grinder trade.</p> <p><i>Out of two Instructors required for the unit of 2(1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications.</i></p> |
| 2. Workshop Calculation & Science | <p>Degree in Engineering with one year experience. OR Diploma in Engineering with two years experience.</p> <p>Desirable: Craft Instructor Certificate in RoD& A course under NCVT.</p> |
| 3. Engineering Drawing | <p>Degree in Engineering with one year experience. OR Diploma in Engineering with two years experience. OR NTC/ NAC in the Draughtsman (Mechanical) with three years</p> |

| | <p>experience.</p> <p>Desirable: Craft Instructor Certificate in RoD& A course under NCVT.</p> | | | | | |
|--|---|--------------|---------------------|-------------------------------------|----------------------|---------------------------|
| 4. Employability Skill | <p>MBA OR BBA with two years experience OR Graduate in Sociology/ Social Welfare/ Economics with Two years experience OR Graduate/ Diploma with Two years experience and trained in Employability Skills from DGT institutes.</p> <p style="text-align: center;">AND</p> <p>Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above.</p> <p style="text-align: center;">OR</p> <p>Existing Social Studies Instructors duly trained in Employability Skills from DGT institutes</p> | | | | | |
| List of Tools and Equipment | As per Annexure – I | | | | | |
| Distribution of training on Hourly basis: (Indicative only) | | | | | | |
| Total Hours/Week | Trade Practical | Trade Theory | Work shop Cal. &Sc. | Engg. Drawing/ Mould Design Drawing | Employability Skills | Extra-curricular Activity |
| 40 Hours | 25 Hours | 6 Hours | 2 Hours | 3 Hours | 2 Hours | 2 Hours |

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5. NSQF LEVEL COMPLIANCE

NSQF level for **Machinist Grinder** trade under CTS: **Level 5**.

As per notification issued by Govt. of India dated- 27.12.2013 on National Skill Qualification Framework total 10 (Ten) Levels are defined.

Each level of the NSQF is associated with a set of descriptors made up of five outcome statements, which describe in general terms, the minimum knowledge, skills and attributes that a learner needs to acquire in order to be certified for that level.

Each level of the NSQF is described by a statement of learning outcomes in five domains, known as level descriptors. These five domains are:

- a. Process
- b. Professional Knowledge
- c. Professional Skill
- d. Core Skill
- e. Responsibility

The broad learning outcome of **Machinist Grinder** trade under CTS mostly matches with the Level descriptor at Level- 5.

The NSQF Level-5 descriptor is given below:

| Level | Process Required | Professional Knowledge | Professional Skill | Core Skill | Responsibility |
|----------------|--|--|---|--|--|
| Level 5 | Job that requires well developed skill, with clear choice of procedures in familiar context. | Knowledge of facts, principles, processes and general concepts, in a field of work or study. | A range of cognitive and practical skills required to accomplish tasks and solve problem by selecting and applying basic methods, tools, materials and information. | Desired mathematical skill, understanding of social, political and some skill of collecting and organizing information, communication. | Responsibility for own work and learning and some responsibility for other's works and learning. |

6. LEARNING/ ASSESSMENT OUTCOME

Learning outcomes are a reflection of total competencies of a trainee and assessment will be carried out as per the assessment criteria.

6.1 GENERIC LEARNING OUTCOME

1. Recognize & comply safe working practices, environment regulation and housekeeping.
2. Understand and explain different mathematical calculation & science in the field of study including basic electrical. [*Different mathematical calculation & science -Work, Power & Energy, Algebra, Geometry & Mensuration, Trigonometry, Heat & Temperature, Levers & Simple machine, graph, Statistics, Centre of gravity, Power transmission, Pressure*]
3. Interpret specifications, different engineering drawing and apply for different application in the field of work. [*Different engineering drawing-Geometrical construction, Dimensioning, Layout, Method of representation, Symbol, scales, Different Projections, Machined components & different thread forms, Assembly drawing, Sectional views, Estimation of material, Electrical & electronic symbol*]
4. Select and ascertain measuring instrument and measure dimension of components and record data.
5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.
6. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.
7. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.
8. Plan and organize the work related to the occupation.

6.2 SPECIFIC LEARNING OUTCOME

Semester - I

9. 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, tapping, off-hand grinding etc. accuracy \pm 0.25mm*]

10. 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.]
11. 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:- ± 0.25 mm.]
12. Set cylindrical grinder to produce job/ components by performing external and internal cylindrical operation and check accuracy [Accuracy limit:- ± 0.25 mm.]

Semester – II

13. 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]
14. 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 limit ± 0.02 mm.]
15. Make a component by performing bore grinding and check accuracy by telescopic gauge. [Accuracy limit ± 0.02 mm.]
16. Perform operations on tools & cutter grinder and re-sharpening different tools on pedestal grinder. [Different tools: - lathe tools, drill, tool bit]
17. Make components having angular and straight surface and check accuracy with different gauges and instruments. [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.]
18. Perform preventive maintenance of grinding machines. [Grinding machines: - surface and cylindrical]
19. Make job of different material by cylindrical parallel grinding with appropriate accuracy. [Different material: - soft & hard metals; Accuracy limit ± 0.01 mm]

Semester - III

20. Perform re-sharpening of different milling cutters [Different milling cutters: -plain, slitting saw]
21. 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 - ± 0.01 mm; different faults - cracks, blow-holes, chatters]
22. 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]
23. Produce different components of non-ferrous metal within appropriate accuracy. [Different components - taper pin, rectangular bar; accuracy limit- ± 0.01 mm.]
24. Produce different components involving cylindrical angular grinding operation to close limit accuracy. [Different components- lathe centre, milling machine arbor; accuracy:- h6 or H6]

Semester - IV

25. Prepare surface of a component by honing operation & Check accuracy. [Accuracy limit: ± 0.001 mm]
26. Produce components by different taper grinding operation and check accuracy. [Different taper grinding: - compound or double taper, steep taper, morse taper; accuracy limit- ± 0.008 mm.]
27. Produce male and female components by different grinding to close tolerance limit. [Different grinding: - step and slot grinding; tolerance limit- H6/h5]
28. Prepare surface of a job by performing lapping & buffing to close limit h5.
29. Make components by different grinding to close tolerance limit and check accuracy. [Different grinding: - cylindrical taper, surface grinding & shoulder grinding; tolerance limit- h6]
30. Identify different components of CNC lathe to understand working and prepare part programme by using simulation software.

7. LEARNING OUTCOME WITH ASSESSMENT CRITERIA

| GENERIC LEARNING/ ASSESSABLE OUTCOME | |
|---|---|
| LEARNING/ ASSESSABLE OUTCOME | ASSESSMENT CRITERIA |
| 1. Recognize & comply with safe working practices, environment regulation and housekeeping. | 1.1 Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements. |
| | 1.2 Recognize and report all unsafe situations according to site policy. |
| | 1.3 Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures. |
| | 1.4 Identify, handle and store/ dispose of dangerous/unsalvageable goods and substances according to site policy and procedures following safety regulations and requirements. |
| | 1.5 Identify and observe site policies and procedures in regard to illness or accident. |
| | 1.6 Identify safety alarms accurately. |
| | 1.7 Report supervisor/ Competent authority in the event of accident or sickness of any staff and record accident details correctly according to site accident/injury procedures. |
| | 1.8 Identify and observe site evacuation procedures according to site policy. |
| | 1.9 Identify Personal Protective Equipment (PPE) and use the same as per related working environment. |
| | 1.10 Identify basic first aid and use them under different circumstances. |
| | 1.11 Identify different fire extinguisher and use the same as per requirement. |
| | 1.12 Identify environmental pollution and contribute to avoidance of same. |
| | 1.13 Take opportunities to use energy and materials in an environmentally friendly manner. |
| | 1.14 Avoid waste and dispose waste as per procedure. |
| | 1.15 Recognize different components of 5S and apply the same in the working environment. |
| 2. Understand, explain different mathematical calculation & science in the field of study including basic electrical and apply in | 2.1 Explain concept of basic science related to the field such as Material science, Mass, weight, density, speed, velocity, heat & temperature, force, motion, pressure, heat treatment, centre of gravity, friction. |
| | 2.2 Measure dimensions as per drawing. |

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| <p>day-to-day work. [<i>Different mathematical calculation & science-Work, Power & Energy, Algebra, Geometry & Mensuration, Trigonometry, Heat & Temperature, Levers & Simple machine, graph, Statistics, Centre of gravity, Power transmission, Pressure</i>]</p> | 2.3 Use scale/ tapes to measure for fitting to specification. |
| | 2.4 Comply with given tolerance. |
| | 2.5 Prepare list of appropriate materials by interpreting detail drawings and determine quantities of such materials. |
| | 2.6 Ensure dimensional accuracy of assembly by using different instruments/gauges. |
| | 2.7 Explain basic electricity, insulation & earthing. |
| <p>3. Interpret specifications, different engineering drawing and apply for different application in the field of work. [<i>Different engineering drawing- Geometrical construction, Dimensioning, Layout, Method of representation, Symbol, scales, Different Projections, Machined components & different thread forms, Assembly drawing, Sectional views, Estimation of material</i>]</p> | 3.1 Read & interpret the information on drawings and apply in executing practical work. |
| | 3.2 Read & analyse the specification to ascertain the material requirement, tools, and machining/assembly/maintenance parameters. |
| | 3.3 Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work. |
| <p>4. Select and ascertain measuring instrument and measure dimension of components and record data.</p> | 4.1 Select appropriate measuring instruments such as micrometers, vernier calipers, dial gauge, bevel protector and height gauge (as per tool list). |
| | 4.2 Ascertain the functionality & correctness of the instrument. |
| | 4.3 Measure dimension of the components & record data to analyse with the given drawing/measurement. |
| <p>5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day-to-day work to improve productivity & quality.</p> | 5.1 Explain the concept of productivity and quality tools and apply during execution of job. |
| | 5.2 Understand the basic concept of labour welfare legislation and adhere to responsibilities and remain sensitive towards such laws. |
| | 5.3 Knows benefits guaranteed under various acts. |
| <p>6. Explain energy conservation, global warming and pollution and contribute in day-to-day</p> | 6.1 Explain the concept of energy conservation, global warming, pollution and utilize the available resources optimally & remain sensitive to avoid environment |

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| work by optimally using available resources. | pollution. |
| | 6.2 Dispose waste following standard procedure. |
| 7. Explain personnel finance, entrepreneurship and manage/organize related task in day-to-day work for personal & societal growth. | 7.1 Explain personnel finance and entrepreneurship. |
| | 7.2 Explain role of various schemes and institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non-financing support agencies to familiarize with the Policies/Programmes, procedure and the available scheme. |
| | 7.3 Prepare project report to become an entrepreneur for submission to financial institutions. |
| 8. Plan and organize the work related to the occupation. | 8.1 Use documents, drawings and recognize hazards in the work site. |
| | 8.2 Plan workplace/ assembly location with due consideration to operational stipulation. |
| | 8.3 Communicate effectively with others and plan project tasks. |
| | 8.4 Assign roles and responsibilities of the co-trainees for execution of the task effectively and monitor the same. |

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| SPECIFIC LEARNING/ ASSESSABLE OUTCOME | |
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| LEARNING/ ASSESSABLE OUTCOME | ASSESSMENT CRITERIA |
| Semester-I | |
| <p>9. 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, tapping, off-hand grinding etc. accuracy\pm0.25mm]</p> | 9.1 Plan & identify tools, instruments and equipments for marking and make this available for use in a timely manner. |
| | 9.2 Select raw material and visual inspection for defects. |
| | 9.3 Mark as per specification applying desired mathematical calculation and observing standard procedure. |
| | 9.4 Measure all dimensions in accordance with standard specifications and tolerances. |
| | 9.5 Identify hand tools for different fitting operations and make these available for use in a timely manner. |
| | 9.6 Prepare the job for Hacksawing, chiselling, filing, drilling, tapping, grinding. |
| | 9.7 Perform basic fitting operations viz., Hacksawing, filing, drilling, tapping and grinding to close tolerance as per specification to make the job. |
| | 9.8 Observe safety procedure during above operation as per standard norms and company guidelines. |
| | 9.9 Check for dimensional accuracy as per standard procedure. |
| | 9.10 Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal. |
| <p>10. 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.]</p> | 10.1 Identify and acquaint with lathe machine operation with its components. |
| | 10.2 Identify different work holding devices and acquaint with functional application of each device. |
| | 10.3 Mount the appropriate work holding device and check for its functional usage to perform turning operations. |
| | 10.4 Set the job on chuck as per shape. |
| | 10.5 Set the lathe on appropriate speed & feed. |
| | 10.6 Operate the lathe to demonstrate lathe operation, observing standard operating practice. |
| | 10.7 Perform lathe operation viz., facing, plain turning, taper turning, boring and simple thread cutting to make components as per specification. |
| | 10.8 Check accuracy/ correctness of job using appropriate gauge and measuring instruments for their functional requirement. |
| | 10.9 Observe safety procedure during above operation as per |

| standard norms and company guidelines. | |
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| 11. 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:- ± 0.25 mm.] | 11.1 Acquaintance of basic working principles and safety aspect of grinding wheel mounting, balancing, dressing and truing of grinding wheel. |
| | 11.2 Explain functional application of different levers, stoppers, adjustment etc for surface grinder. |
| | 11.3 Identify different lubrication points of surface grinder. |
| | 11.4 Identify lubricants and their usage for application in surface grinder as for machine manual. |
| | 11.5 Identify different grinding wheel mounting devices and acquaint with functional application of each device. |
| | 11.6 Mount the grinding wheel with required alignment and check for its functional usage to perform surface grinding operations. |
| | 11.7 Solve problem by applying basic methods and information during setting. |
| | 11.8 Observe safety procedure during mounting as per standard norms |
| | 11.9 Plan & select appropriate method to produce different operation rough & finish. |
| | 11.10 Check accuracy of job using appropriate measuring instrument. |
| 12. Set cylindrical grinder to produce job/ components by performing external and internal cylindrical operation and check accuracy [Accuracy limit:- ± 0.25 mm.] | 12.1 Explain the constructional features, working principles and safety aspect of cylindrical grinder. |
| | 12.2 Explain functional application of different levers, stoppers, adjustment etc. |
| | 12.3 Identify different lubrication points of cylindrical grinder. |
| | 12.4 Identify lubricants and their usage for application in cylindrical grinder as per machine manual. |
| | 12.5 Identify different work and tool holding devices and acquaint with functional application of each device. |
| | 12.6 Mount the work and tool holding devices with required alignment and check for its functional usage to perform cylindrical grinding operations. |
| | 12.7 Solve problem by applying basic methods, tools, materials and information during setting. |
| | 12.8 Observe safety procedure during mounting as per standard norms |
| | 12.9 Plan & select appropriate method to grind external & internal operation |
| | 12.10 Check accuracy set job using appropriate precision measuring instrument. |

| Semester-II | |
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| <p>13. 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]</p> | 13.1 Plan & select appropriate machine parameters to set for automatic movements |
| | 13.2 Plan & select appropriate method to perform straight, parallel, taper, lush, rentic grinding chuck, face plate, angle plate |
| | 13.3 Carryout and apply standard method to make different components as required. |
| | 13.4 Set up and produce component as per standard operating procedure for form grinding. |
| | 13.5 Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal. |
| <p>14. 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 limit ± 0.02 mm.]</p> | 14.1 Identify different work material and select the grinding wheel. |
| | 14.2 Observe heat generated in grinding for different types of metal. |
| | 14.3 Select appropriate coolant for different types of metal grinding. |
| | 14.4 Solve problem by applying desired mathematical skill, basic methods, select speed, feed, depth of cut and organize information during setting. |
| | 14.5 Observe safety procedure during operation as per standard norms. |
| <p>15. Make a component by performing bore grinding and check accuracy by telescopic gauge. [Accuracy limit ± 0.02 mm.]</p> | 15.1 Plan and select appropriate method to produce components. |
| | 15.2 Demonstrate possible solutions using desired mathematical skills, knowledge of facts, principles, processes and general concept in the field of work and collect and organize information to determine use of specific machine |
| | 15.3 Set up and produce component with bore as per standard |
| | 15.4 operating procedure of internal cylindrical grinding. |
| | 15.5 Measure the dimensions with instruments/gauges as per drawing. |
| | 15.6 Comply with safety rules when performing the above operations. |
| <p>16. Perform operations on tools & cutter grinder and re-sharpening different tools on</p> | 16.1 Plan and select appropriate method to resharpen the lathe tools, drill bit. |
| | 16.2 Dress the grinding wheel and set the tool. |

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| pedestal grinder. [Different tools: - lathe tools, drill, tool bit] | 16.3 | Work out and apply off-grinding parameters as per different components to be re sharpened. |
| | 16.4 | Set and sharpen the tools as per standard operating procedure |
| | 16.5 | Solve problems during operation by selecting and applying basic methods, tools, material, collect and organize information for quality output. |
| | 16.6 | Measure with instruments/gauges as per drawing and check functionality of tools. |
| | 16.7 | Comply with safety rules when performing the above operations. |
| 17. Make components having angular and straight surface and check accuracy with different gauges and instruments. [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.] | 17.1 | Plan and select appropriate method to produce various components with the help of surface grinder. |
| | 17.2 | Select the appropriate grinding wheel and work holding devices. |
| | 17.3 | Apply desired mathematical skills, collect and organize information to work out the machining parameters |
| | 17.4 | Produce components as per drawing |
| | 17.5 | Check accuracy/ correctness of job using appropriate gauge and measuring instruments for their functional requirement. |
| | 17.6 | Comply with safety rules when performing the above operations. |
| 18. Perform preventive maintenance of grinding machines. [Grinding machines: - surface and cylindrical] | 18.1 | Identify tools & equipment and collect relevant information from appropriate source. |
| | 18.2 | Ascertain for the aligning / parallelism of grinding machines. |
| | 18.3 | Plan work for lubrication schedule, simple estimation. |
| | 18.4 | Observe mechanism, driving system of grinding machines and set properly if required. |
| | 18.5 | Observe safety procedure during operation as per standard norms. |
| 19. Make job of different material by cylindrical parallel grinding with appropriate accuracy. [Different material: - soft & hard metals; Accuracy limit ± 0.01 mm] | 19.1 | Plan and select appropriate method to produce various components with the help of cylindrical grinder. |
| | 19.2 | Select the appropriate grinding wheel according to material to be ground and work holding devices. |
| | 19.3 | Apply desired mathematical skills, collect and organize information to work out the machining parameters |
| | 19.4 | Produce components as per drawing |
| | 19.5 | Check accuracy/ correctness of job using appropriate |

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| | gauge and measuring instruments for their functional requirement. |
| | 19.6 Observe safety procedure during operation as per standard norms |
| Semester-III | |
| 20. Perform re-sharpening of different milling cutters [Different milling cutters: - plain, slitting saw] | 20.1 Plan and select appropriate method to resharpen the plain, side and face milling cutter |
| | 20.2 Set up milling cutter and resharpen the milling cutter as per standard operating procedure of the machine. |
| | 20.3 Measure the dimensions with instruments/gauges. |
| | 20.4 Comply with safety rules when performing the above operations. |
| 21. 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 - ± 0.01 mm; different faults - cracks, blow-holes, chatters] | 21.1 Plan and select appropriate method to produce various components with the help of surface grinder and cylindrical grinder. |
| | 21.2 Select the appropriate grinding wheel and work holding devices. |
| | 21.3 Apply desired mathematical skills, collect and organize information to work out the machining parameters |
| | 21.4 Produce components as per drawing. |
| | 21.5 Check accuracy/ correctness of job using appropriate gauge and measuring instruments for their functional requirement. |
| | 21.6 Observe safety procedure during operation as per standard norms. |
| 22. 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] | 22.1 Plan and select appropriate method to produce various components with the help of surface grinder and cylindrical grinder. |
| | 22.2 Select the appropriate grinding wheel and work holding devices. |
| | 22.3 Apply desired mathematical skills, collect and organize information to work out the machining parameters |
| | 22.4 Produce components as per drawing. |
| | 22.5 Check accuracy/ correctness of job using appropriate gauge and measuring instruments for their functional requirement. |
| | 22.6 Comply with safety rules when performing the above operations. |
| 23. Produce different components of non-ferrous metal within appropriate accuracy. [Different | 23.1 Plan and select appropriate method to perform the precession components of non ferrous viz. dowel pin, rectangular bar. |
| | 23.2 Set and produce the precession components as per |

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| components - taper pin, rectangular bar; accuracy limit- ± 0.01 mm.] | drawing. |
| | 23.3 Solve problems during operation by selecting and applying basic methods, tools, materials and information and using quality concept. |
| | 23.4 Check for accuracy of the precession components. |
| | 23.5 Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal. |
| | 23.6 Observe safety/ precaution during machining. |
| 24. Produce different components involving cylindrical angular grinding operation to close limit accuracy. [Different components- lathe centre, milling machine arbor; accuracy:- h6 or H6] | 24.1 Plan and select appropriate method to perform lathe centre, milling machine arbor grinding. |
| | 24.2 Set up and produce component as per standard operating procedure of lathe centre, milling machine arbor grinding. |
| | 24.3 Solve problems during operation by selecting and applying basic methods, tools, materials and information and using quality concept. |
| | 24.4 Apply mathematical skill, knowledge of facts, principles, processes and general concepts in the field of lathe centre, milling machine arbor grinding. |
| | 24.5 Measure with instruments/gauges as per drawing and check functionality of component. |
| | 24.6 Comply with safety rules when performing the above operations. |
| Semester-IV | |
| 25. Prepare surface of a component by honing operation & Check accuracy. [Accuracy limit: ± 0.001 mm] | 25.1 Plan and select appropriate method to finish the work piece by honing as per drawing. |
| | 25.2 Select appropriate tools, equipment and machine to produce the work piece as per drawing and make these available for use in a timely manner. |
| | 25.3 Honed the work piece as per standard operating practice. |
| | 25.4 Check the dimension of job by precession instrument. |
| | 25.5 Observe safety precautions during operation. |
| | 25.6 Check for desired performance. |
| 26. Produce components by different taper grinding operation and check accuracy. [Different taper grinding: - compound or double taper, steep taper, morse taper; | 26.1 Plan and select appropriate method to produce the various taper work piece as per drawing. |
| | 26.2 Set up and produce component as per standard operating procedure of taper grinding. |
| | 26.3 Solve problems during operation by selecting and applying basic methods, tools, materials and |

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| accuracy limit-±0.008mm.] | information and using quality concept. |
| | 26.4 Apply mathematical skill, knowledge of facts, principles, processes and general concepts in the field of steep taper grinding. |
| | 26.5 Measure with instruments/gauges as per drawing and check functionality of component. |
| | 26.6 Comply with safety rules when performing the above operations. |
| 27. Produce male and female components by different grinding to close tolerance limit. [Different grinding: - step and slot grinding; tolerance limit- H6/h5] | 27.1 Plan and select appropriate method to produce male female components as per drawing. |
| | 27.2 Select appropriate grinding wheel, equipment and machine to produce the work pieces as per drawing and make these available for use in a timely manner. |
| | 27.3 Set the job on grinding machine and grind the components as per specification/drawing following Standard operating practice. |
| | 27.4 Check the dimension of components by precession instrument. |
| | 27.5 Observe safety precautions during operation. |
| | 27.6 Check for desired performance of assembled components. |
| 28. Prepare surface of a job by performing lapping & buffing to close limit h5. | 28.1 Plan and select appropriate method to produce the work piece as per drawing. |
| | 28.2 Select appropriate tools, equipment and machine to produce the work piece as per drawing and make these available for use in a timely manner. |
| | 28.3 Lapping/buffing the product following standard operating practice. |
| | 28.4 Set the job and finish the surfaces as per specification/drawing following standard operating practice. |
| | 28.5 Check the dimension of job by precession instrument. |
| | 28.6 Observe safety precautions during operation. |
| 29. Make components by different grinding to close tolerance limit and check accuracy. [Different grinding: - cylindrical taper, surface grinding & shoulder grinding; tolerance limit- h6] | 29.1 Plan and select appropriate method to produce the work piece with close tolerance as per drawing. |
| | 29.2 Set the job on grinding machine and grind the components as per specification/drawing following Standard operating practice. |
| | 29.3 Solve problem by applying basic methods, tools, materials and information during machining |
| | 29.4 Check the dimension of components by precession instrument. |
| | 29.5 Dispose waste as per procedure. |

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| | 29.6 Observe safety precautions during operation. |
| 30. Identify different components of CNC lathe to understand working and prepare part programme by using simulation software. | 30.1 Identify different components of CNC. |
| | 30.2 Plan and prepare part programme as per drawing. |
| | 30.3 Simulate for its correctness with simulation software. |
| | 30.4 Demonstrate possible solutions within the team. |
| | 30.5 Solve problems during simulation by selecting and applying basic methods, information and using quality concept. |
| | 30.6 Check accuracy/ correctness of part program. |
| | 30.7 Observe safety/ precaution during simulation. |



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SYLLABUS FOR MACHINIST GRINDER

First Semester - Six Months

| Week No. | Ref. Learning Outcome | Professional Skills (Trade Practical) With Indicative Hours | Professional Knowledge (Trade Theory) |
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| 1 | Observe safety and know the use of personal protection and fire safety equipments. | <ol style="list-style-type: none"> 1. Importance of trade training, (01 hr) 2. List of tools & Machinery used in the trade. (02 hrs) 3. Health & Safety: Introduction to safety equipments and their uses. (03 hr) 4. Introduction of First-aid, (01 hr) 5. Operation of Electrical mains. (01 hr) 6. Occupational Safety. (01 hr) 7. Health Importance of housekeeping & good shop floor practices. (02 hr) 8. Safety and Environment guidelines, (01 hr) 9. Legislations & regulations as applicable. (01hr) 10. Disposal procedure of waste materials like cotton waste, metal chips/burrs etc. (01 hr) 11. Basic safety introduction. (01 hr) 12. Personal protective Equipments (PPE):-Basic injury prevention. (02 hrs) 13. Hazard identification and avoidance. (02 hrs) 14. Safety signs for Danger, Warning, caution & personal safety message. (03 hrs) 15. Preventive measures for electrical accidents & steps to be taken in such accidents. (02 hrs) 16. Use of Fire extinguishers. (01 hr) | <p>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.</p> <p>Soft Skills: its importance and Job area after completion of training.</p> <p>Introduction of First aid. Operation of electrical mains. Introduction of PPEs. Introduction to 5S concept & its application. Response to emergencies eg; power failure, fire, and system failure.</p> <p>Introduction to Grinding trade and machine safety precautions according to IS: 1991-1962.</p> |
| 2 | Plan and organize the work to make | 17. Identify of tools & equipments as per desired specifications for | Description of hand tools, Safety precautions, care and maintenance |

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| | 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, tapping, off-hand grinding etc. accuracy \pm 0.25mm] | <p>marking & sawing (Hand tools, Fitting tools & Measuring tools) (05 hrs)</p> <p>18. Select material as per application, Inspect visually of raw material for rusting, scaling, corrosion etc., (05 hrs)</p> <p>19. Mark out lines on job, (02 hrs)</p> <p>20. Grip suitably in vice, (01 hr)</p> <p>21. Cut different types of metals of different sections to given dimensions by a Hacksaw. (8 hrs)</p> <p>22. Mark, punch and grind on pedestal grinder. (04 hrs)</p> | <p>and material from which they are made.</p> <p>Ferrous and nonferrous metal and their identification by different methods.</p> <p>Heat treatment of metals, its importance, various methods of heat treatment such as hardening, tempering, normalizing, annealing etc.</p> |
| 3 | -do- | <p>23. Measure different types of jobs by steel rule, caliper etc. and put dimension on freehand drawing (15 hrs)</p> <p>24. Taper by angular protractor. (10 hrs)</p> | <p>Theory of Semi precision measuring instruments.</p> <p>General measuring tools (used in grinding shop) their description, use care and maintenance.</p> |
| 4 | -do- | <p>25. Drill different sizes of holes by hand, (07 hrs)</p> <p>26. Ream the holes, (06 hrs)</p> <p>27. Make thread in drilled holes by tap (03 hrs)</p> <p>28. Prepare thread on a round bar (03hrs)</p> <p>29. Match an internal and external thread cutting with taps and dies using coolants. (06 hrs)</p> | <p>Relation between drill & tap sizes, care of taps and dies and their correct use. Types, properties and selection of coolants and lubricants.</p> |
| 5 | -do- | <p>30. Drill different sizes of holes by machine. (08 hrs)</p> <p>31. Use of screw drivers, spanners, pliers etc. (07 hrs)</p> <p>32. Make simple fitting job within accuracy \pm0.4. (10 hrs)</p> | <p>Brief description of drilling machine use and care.</p> <p>Knowledge of tool fixing and job holding device on drilling machine.</p> |
| 6-7 | -do- | <p>33. File a MS flat as given dimension, (25 hrs)</p> <p>34. Make simple fitting job within accuracy \pm0.2. (25 hrs)</p> | <p>Knowledge of different types of files according to cut and shape.</p> <p>Methods of filing operation.</p> <p>Knowledge of surface finish accuracy by filing.</p> |
| 8 | Produce simple components by | <p>35. Identify Centre lathe and its parts, (05 hrs)</p> | <p>Brief description of a Centre lathe, its use.</p> |

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| | 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.] | 36. Set lathe machine and perform on lathe operation with idle or dry run. (10 hrs) 37. Grind Lathe Tools on Pedestal Grinder. (10 hrs) | Knowledge of transmission of speed from motor to spindle of a lathe. Knowledge of aligning a job on lathe. Lathe tools nomenclature. |
| 9-10 | -do- | 38. Perform facing and turning on lathe (12 hrs) 39. Perform drilling operation on lathe. (08 hrs) 40. Perform taper turning using compound rest and taper turning attachment. (20 hrs) 41. Perform boring operation on lathe (10 hrs) | 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. |
| 11-12 | -do- | 42. Perform simple external screw cutting (25 hrs) 43. Perform simple internal screw cutting (25 hrs) | Method of screw cutting and simple calculation. Knowledge of spindle speed mechanism related to lead screw of lathe. |
| 13 | 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:- $\pm 0.25\text{mm.}$] | 44. Set grinding wheel on wheel flange, truing and balancing of wheels. (20 hrs) 45. Dress grinding wheel. (05 hrs) | 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. |
| 14 | -do- | 46. Check and measure various types of jobs using micrometers, Vernier caliper, Height gauge etc. (08 hrs) | Precision measuring instruments English and metric micrometer, vernier caliper, dial test indicator etc. their description and uses. |

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| | | <p>47. Identify different parts of surface grinding machine. (07 hrs)</p> <p>48. Set surface grinding machine and perform operating with dry / idle run. (10 hrs)</p> | <p>Knowledge of digital measuring instruments and its uses.</p> <p>Pneumatic gauges – its accessories and control device and use for checking dimensions.</p> |
| 15-16 | -do- | <p>49. Perform rough and finish grinding on surface work (20 hrs)</p> <p>50. Perform rough and finish grinding on cylindrical job. (20 hrs)</p> <p>51. Include diamond and CBN grinding wheel. (10 hrs)</p> | <p>Different types of abrasive, manufacture of grinding wheels, their grades.</p> |
| 17 | Set cylindrical grinder to produce job/ components by performing external and internal cylindrical operation and check accuracy [Accuracy limit:- $\pm 0.25\text{mm}$.] | <p>52. Perform grinding on surface grinding machine. (05 hrs)</p> <p>53. Identify different parts of cylindrical grinding machine. (05 hrs)</p> <p>54. Set cylindrical grinding machine and perform operation with dry / idle run. (07 hrs)</p> <p>55. Perform grinding on Cylindrical grinding machine (Grinding should be performed both on soft and hardened materials). (08 hrs)</p> | <p>Principle and value of grinding in finishing process, various types of grinding wheels their construction and characteristic glazed and loaded wheels.</p> |
| 18 | -do- | <p>56. Grind parallel block within accuracy $\pm 0.2\text{mm}$. (12 hrs)</p> <p>57. Perform Plain-mandrel grinding to size within accuracy ± 0.2 (13 hrs)</p> | <p>Knowledge how to square up a work piece using an angle plate.</p> <p>Checking of squareness.</p> <p>Multiple clamping of parts to achieve concentricity & uniformity in size.</p> |
| 19 | -do- | <p>58. Demonstrate selection of grinding wheels for grinding different metals, (10 hrs)</p> <p>59. Select of suitable wheel to obtain rough and IS: 1249-1958. (15 hrs)</p> | <p>Factors effecting selection of wheels, identification of wheel, marking system of grinding wheels IS: 551- 1966.</p> |
| 20 | -do- | <p>60. Grind different metals with suitable grinding wheels. (25 hrs)</p> | <p>Grit and different types of bonds, such as vitrified, resinoid, rubber etc. Different types of metals and electroplated bond.</p> |
| 21 | -do- | <p>61. Perform externals cylindrical grinding operation within accuracy $\pm 0.1\text{mm}$. (03 hrs)</p> <p>62. Perform internal cylindrical grinding operation within</p> | <p>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.</p> |

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| | | <p>accuracy ± 0.1mm. (03 hrs)</p> <p>63. Change the recommended wheel speed and control depth of cut. (02 hrs)</p> <p>64. Perform grinding of sockets both internal and external and check. (05 hrs)</p> <p>65. Perform Morse taper grinding both internal and external and check. (05 hrs)</p> <p>66. Perform grinding External sleeve and check. (05 hrs)</p> <p>67. Perform depth checking by depth gauge micrometer. (02 hrs)</p> | <p>Common types of surface grinding machine, plain surface, rotary surface, horizontal and vertical surface grinder etc. Method of grinding tapers.</p> |
| 22-25 | Revision | | |
| 26 | Examination | | |

Note:

More emphasis to be given on video/real-life pictures during theoretical classes. Some real-life pictures/videos of production of different components. Turning of complex job, etc., may be shown to the trainees to give a feel of Industry and their future assignment.

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SYLLABUS FOR MACHINIST GRINDER

Second Semester - Six Months

| Week No. | Ref. Learning Outcome | Professional Skills (Trade Practical) With Indicative Hours | Professional Knowledge (Trade Theory) |
|----------|--|--|---|
| 27 | 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) 69. Perform machine setting for automatic movements. (10 hrs) 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. |
| 28 | -do- | 71. Test and mount wheels, sleeves, check truing and rebalancing. (15 hrs) 72. Perform grinding parallel mandrel within ± 0.03 mm. (10 hrs) | Test for alignment and checking, balancing at wheel, dressing different types of wheel, dressers, their description and uses. |
| 29 | -do- | 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. |
| 30 | -do- | 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. |
| 31 | -do- | 75. Align table with the help of test bar and dial test indicator. (05 hrs) 76. Perform parallel grinding | External grinding operational steps in external grinding of a job and precautions to be taken. |

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| | | within accuracy $\pm 0.02\text{mm}$. (07 hrs) 77. Perform cylindrical Taper grinding (by swiveling machine table) (08 hrs) | |
| 32 | -do- | 78. Grind an eccentric job. (10 hrs) 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. |
| 33 | -do- | 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. |
| 34 | -do- | 81. Finish surfaces of bushes on mandrel within $\pm 0.02\text{ mm}$ by grinding. (25 hrs) | Rough and finish grinding limit fit and tolerances as per ISI: 919-1963. Basic size and its deviation, position of 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. |
| 35 | 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 limit $\pm 0.02\text{ mm}$.] | 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. |
| 36 | -do- | 83. Grind square block within accuracy $\pm 0.02\text{mm}$. (08 hrs) 84. Grind angle plate within accuracy $\pm 0.02\text{mm}$ (08 hrs) 85. Grind angular block within accuracy $\pm 0.02\text{mm}$. (09 hrs) | Grinding a square job grinding angular surface taker grinding by stane land taper and angle protractor. |
| 37 | Make a component by performing bore grinding and check accuracy by telescopic gauge. | 86. Perform bore grinding within accuracy $\pm 0.02\text{mm}$. (20 hrs) 87. Use of Telescopic gauge for checking of bore. (05 hrs) | Grinding defects vibration, chattering, glazing and loading their causes and remedies. |

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| | [Accuracy limit ±0.02 mm.] | | |
| 38 | Perform operations on tools & cutter grinder and re-sharpening different tools on pedestal grinder. [Different tools: - lathe tools, drill, tool bit] | <p>88. Perform operation on tools and cutter grinding machine. (12 hrs)</p> <p>89. Manipulate and control tools and cutter grinding machine (05 hrs)</p> <p>90. Mount jobs on mandrel in tools and cutter grinding machine. (01 hr)</p> <p>91. Mount wheel and guards on pedestal grinder. (01 hr)</p> <p>92. Sharpen lathe tools on pedestal grinder. (03 hrs)</p> <p>93. Sharpen drill, tool-bit on pedestal grinder. (03 hrs)</p> | Tool and cutter grinding machine-parts and accessories, description use, care and maintenance, pedestal grinder and bench grinder-their description and uses. |
| 39 | Make components having angular and straight surface and check accuracy with different gauges and instruments. [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.] | <p>94. Check tapered or angular jobs with help of sine bar, slip gauges and dial gauge. (25 hrs)</p> | Use of snap gauges, sine bar and slip gauges their description and uses. Polishing, lapping powder and emery clothes lapping flat surface. |
| 40 | -do- | 95. Perform cylindrical and surfaces grinding operation (25 hrs) | Tools and cutter grinder their description, working principles, operations care and maintenance. |
| 41 | -do- | 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. |
| 42 | -do- | <p>97. Grind Parallel block on surface grinding machine (12 hrs)</p> <p>98. Grind gauges within finish accuracy ±0.02mm. (Rough and finish grinding using disc and diamond wheels). (13 hrs)</p> | Diamond Wheel and Applications of diamond wheel in grinding. |
| 43 | Perform preventive | 99. Make simple utility jobs such as | Preventive maintenance and its |

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| | maintenance of grinding machines. [Grinding machines: - surface and cylindrical] | V' block, Parallel bar, Drill point angle checking gauge with surface and cylindrical grinders. (10 hrs) 100. Perform preventive maintenance of grinding machines. (15 hrs) | necessity. Mode of frequency of lubrication. Preparation of Maintenance schedule, simple estimation, use of hand book and reference table. Total preventive Maintenance. |
| 44-45 | Make job of different material by cylindrical parallel grinding with appropriate accuracy. [Different material: - soft & hard metals; Accuracy limit \pm 0.01mm] | 101. Finish cylindrical surfaces by grinding within accuracy \pm 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. |
| 46-49 | In-plant training / Project work: a) Drilling jig b) Parallel bar c) Taper mandrel | | |
| 50-51 | Revision | | |
| 52 | Examination | | |

Note:

1. Some of the sample project works (indicative only) are given against each semester.
2. Instructor may design their own project and also inputs from local industry may be taken for designing such new project.
3. The project should broadly covered maximum skills in the particular trade and must involve some problem solving skill. Emphasis should be on Teamwork: Knowing the power of synergy/ collaboration, Work to be assigned in a group (Group of at least 4 trainees). The group should demonstrate Planning, Execution, Contribution and application of Learning. They need to submit Project report.
4. If the instructor feels that for execution of specific project more time is required then he may plan accordingly to produce components/ sub-assemblies in appropriate time i.e., may be in the previous semester or during execution of normal trade practical.
5. More emphasis to be given on video/real-life pictures during theoretical classes.

SYLLABUS FOR MACHINIST GRINDER

Third Semester - Six Months

| Week No. | Ref. Learning Outcome | Professional Skills (Trade Practical) With Indicative Hours | Professional Knowledge (Trade Theory) |
|----------|--|---|--|
| 53-54 | Perform re-sharpening of different milling cutters [Different milling cutters: - plain, slitting saw] | 102. Perform grinding of plain milling cutter (25 hrs) 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. |
| 55 | 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 - $\pm 0.01\text{mm}$; different faults - cracks, blow-holes, chatters] | 104. Perform grinding on plain flat surface in surface grinding machine with close tolerances ($\pm 0.01\text{mm}$.) (25 hrs) | Dial test indicators marking block, height gauge and surface plate their description. |
| 56 | -do- | 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. |
| 57 | -do- | 106. Grind parallel block on surface grinding machine within close limits ($\pm 0.01\text{mm}$.) (13 hrs) 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. |
| 58 | -do- | 108. Perform cylindrical bore grinding within accuracy $\pm 0.01\text{mm}$. (15 hrs) 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. |
| 59 | -do- | 110. Balance grinding wheel (06 hrs) 111. Mount grinding wheel (03 hrs) 112. Perform right angle grinding on surface grinding machine within accuracy $\pm 0.01\text{mm}$. (16 hrs) | Mounting of grinding wheels, grinding wheels, collets and mandrels, balancing of grinding wheels by different methods. |

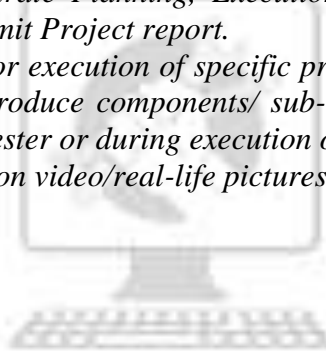
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| 60 | -do- | 113. Perform wheel dressing for rough and finishing grinding. (01 hrs) 114. Grind a cube to close limit. (Tolerance within ± 0.01 mm.) (24 hrs) | Types of dresses-steel type, abrasive Diamond tool and rotary dresses abrasive bricks and sticks their description, use, care and maintenance. |
| 61 | -do- | 115. 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. |
| 62 | -do- | 116. Perform slot grinding on surface grinding machines to close limits H7. (15 hrs) 117. Find different faults while grinding. viz., Cracks, blow holes, chatters. (10 hrs) | 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. |
| 63 | 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. |
| 64 | -do- | 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. |
| 65 | -do- | 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 maintenance. |
| 66 | -do- | 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 |
| 67 | Produce different components of non- | 122. Grind thin plates to close limits of h6 using coolants. (25 hrs) | Principle types of grinding fluids importance of uniform temperature, |

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| | ferrous metal within appropriate accuracy. [Different components - taper pin, rectangular bar; accuracy limit- ± 0.01 mm.] | | selection and use at grinding fluids, method of supplying grinding fluids. |
| 68 | -do- | 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. |
| 69 | -do- | 124. Select grinding wheel and perform grinding on rectangular bar of non-ferrous metals within accuracy ± 0.01 mm. (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. |
| 70 | 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. |
| 71 | -do- | 126. Perform Facing and Chamfering within accuracy ± 0.01 mm 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. |
| 72 | -do- | 127. Perform step grinding on surface grinding machine to close limit h6 or H6. (25 hrs) | 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. |
| 73 | -do- | 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. |
| 74-76 | In-plant training / Project work: a) Slip gauge b) Ring gauge | | |

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| | c) V-block |
| 77 | Revision |
| 78 | Examination |

Note:

1. *Some of the sample project works (indicative only) are given against each semester.*
2. *Instructor may design their own project and also inputs from local industry may be taken for designing such new project.*
3. *The project should broadly cover maximum skills in the particular trade and must involve some problem solving skill. Emphasis should be on Teamwork: Knowing the power of synergy/ collaboration, Work to be assigned in a group (Group of at least 4 trainees). The group should demonstrate Planning, Execution, Contribution and application of Learning. They need to submit Project report.*
4. *If the instructor feels that for execution of specific project, more time is required than he may plan accordingly to produce components/ sub-assemblies in appropriate time i.e., may be in the previous semester or during execution of normal trade practical.*
5. *More emphasis to be given on video/real-life pictures during theoretical classes.*



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SYLLABUS FOR MACHINIST GRINDER

Fourth Semester - Six Months

| Week No. | Ref. Learning Outcome | Professional Skills (Trade Practical) With Indicative Hours | Professional Knowledge (Trade Theory) |
|----------|---|---|---|
| 79 | Prepare surface of a component by honing operation & Check accuracy. [Accuracy limit: $\pm 0.001\text{mm}$] | 131. Grind cylindrical steps and 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. |
| 80 | Produce components by different taper grinding operation and check accuracy. [Different taper grinding: - compound or double taper, steep taper, morse taper; accuracy limit- $\pm 0.008\text{mm}$.] | 132. Finish surface of Angular form grinding within accuracy of $\pm 0.01\text{mm}$. (25 hrs) | Cylindrical-types of cylindrical grinding operation traverse method, plunge cut method and form grinding method. Alignment of head stock and tail stock. |
| 81 | -do- | 133. Grind cylindrical steps with shoulder and chamfer within accuracy $\pm 0.008\text{mm}$. (25 hrs) | Method of plain cylindrical surface grinding step-grinding and shoulder and face grinding. |
| 82 | -do- | 134. Perform compound or double taper grinding accuracy of $\pm 0.008\text{mm}$. and surface finish of N5 (25 hrs) | Method of grinding external and angle (simple) taper and steep. Taper double compound taper. |
| 83 | -do- | 135. Perform steep taper grinding with in accuracy $\pm 0.008\text{mm}$. (12 hrs) 136. Grind lathe centre within accuracy $\pm 0.008\text{mm}$. 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. |
| 84 | -do- | 137. Make Morse taper within accuracy $\pm 0.008\text{mm}$. surface finish N4. (08 hrs) 138. Perform Plug grinding within accuracy $\pm 0.008\text{mm}$. surface finish N4. (08 hrs) 139. Finish Metric tapers by grinding within accuracy $\pm 0.008\text{mm}$. surface finish N4. (09 hrs) | Taper and angle checking by using protractors, micrometer and rollers. |
| 85 | -do- | 140. Perform Taper grinding using sine bar, D.T.I. and gauge blocks | Use of sine bar and gauge block-taper checking by sine bar gauge |

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| | | to close limit h6. (25 hrs) | block D.T.I. micrometer and rollers. Other out of round surfaces. Holding work with fixed steady rest, in process gauges and pneumatic gauges. |
| 86 | Produce male and female components by different grinding to close tolerance limit. [Different grinding: - step and slot grinding; tolerance limit-H6/h5] | 141. Grind Taper up to close limit H6. (12 hrs) 142. 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 |
| 87 | -do- | 143. Perform internal step grinding to close limit H6, (13 hrs) 144. 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. |
| 88 | -do- | 145. Perform slot grinding to close limit h5. (25 hrs) | Thread grinding method of holding jobs method of grinding threads and thread calculation. |
| 89 | -do- | 159. 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. |
| 90 | Prepare surface of a job by performing lapping & buffing to close limit h5. | 160. Perform Lapping on flat surface. (07 hrs) 161. Perform Lapping on cylindrical surface (08 hrs) 162. 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 |

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| 91 | Make components by different grinding to close tolerance limit and check accuracy. [Different grinding: - cylindrical taper, surface grinding & shoulder grinding; tolerance limit- h6] | 163. Perform cylindrical Taper grinding. (25 hrs) | -Do- |
| 92 | -do- | 164. Perform surface grinding within accuracy ± 0.01 mm. (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. |
| 93 | -do- | 165. 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. |
| 94 | -do- | 166. 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. |
| 95 | Identify different components of CNC lathe to understand working and prepare part programme by using simulation software. | 167. Prepare different types of documentation as per industrial need by different methods of recording information. (25 hrs) | 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. |
| 96 | -do- | 168. Identify CNC machine (05 hrs) 169. 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. Basic information on CNC machine & maintenance of CNC M/c. computer aided CNC Language. Introduction to CNC grinding. |
| 97 | -do- | 170. Know rules of personal and CNC machine safety, safe handling of tools, safety switches and | Personal safety, safe material handling, and safe machine operation on CNC turning |

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| | | material handling equipment using CNC didactic/ simulation software and equipment. (10 hrs) 171. Identify CNC lathe machine elements and their functions, on the machine. (15 hrs) | centers. CNC technology basics, Comparison between CNC and conventional lathes. Concepts of positioning accuracy, repeatability. |
| 98 | -do- | 172. Understand the working of parts of CNC lathe, explained using CNC didactic/ simulation software. (20 hrs) 173. Identify machine over travel limits and emergency stop, on the machine. (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. |
| 99 | -do- | 173. Decide tool path for turning, facing, grooving, threading, drilling. (20hrs) 174. Identify safety switches and interlocking of DIH modes. (05 hr) | 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. |
| 100-102 | In-plant training / Project work a) Morse taper b) Lathe centre close to h6 c) Stepped taper ring close to H7 | | |
| 103 | Revision | | |
| 104 | Examination | | |

NOTE:

1. *Some of the sample project works (indicative only) are given against each semester.*
2. *Instructor may design their own project and also inputs from local industry may be taken for designing such new project.*
3. *The project should broadly cover maximum skills in the particular trade and must involve some problem solving skill. Emphasis should be on Teamwork: Knowing the power of synergy/ collaboration, Work to be assigned in a group (Group of at least 4 trainees). The group should demonstrate Planning, Execution, Contribution and application of Learning. They need to submit Project report.*

4. *If the instructor feels that for execution of specific project, more time is required than he may plan accordingly to produce components/ sub-assemblies in appropriate time i.e., may be in the previous semester or during execution of normal trade practical.*
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9. SYLLABUS - CORE SKILLS

9.1 WORKSHOP CALCULATION SCIENCE & ENGINEERING DRAWING

| First Semester Duration: Six Month | | |
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| S No. | Workshop Calculation and Science | Engineering Drawing |
| 1. | Unit: Systems of unit- FPS, CGS, MKS/SI unit, unit of length, Mass and time, Conversion of units | Engineering Drawing: Introduction and its importance <ul style="list-style-type: none"> - Relationship to other technical drawing types - Conventions - Viewing of engineering drawing sheets. - Method of Folding of printed Drawing Sheet as per BIS SP:46-2003 |
| 2. | Fractions : Fractions, Decimal fraction, L.C.M., H.C.F., Multiplication and Division of Fractions and Decimals, conversion of Fraction to Decimal and vice versa. Simple problems using Scientific Calculator. | Drawing Instruments : their Standard and uses <ul style="list-style-type: none"> - Drawing board, T-Square, Drafter (Drafting M/c), Set Squares, Protractor, Drawing Instrument Box (Compass, Dividers, Scale, Diagonal Scales etc.), Pencils of different Grades, Drawing pins / Clips. |
| 3. | Square Root : Square and Square Root, method of finding out square roots, Simple problem using calculator. | Lines : <ul style="list-style-type: none"> - Definition, types and applications in Drawing as per BIS SP:46-2003 - Classification of lines (Hidden, centre, construction, Extension, Dimension, Section) - Drawing lines of given length (Straight, curved) - Drawing of parallel lines, perpendicular line - Methods of Division of line segment |
| 4. | Ratio & Proportion : Simple calculation on related problems. | Drawing of Geometrical Figures: Definition, nomenclature and practice of <ul style="list-style-type: none"> - Angle: Measurement and its types, method of bisecting. - Triangle -different types - Rectangle, Square, Rhombus, Parallelogram. - Circle and its elements. |
| 5. | Percentage : Introduction, Simple | Lettering and Numbering as per BIS SP46-2003: |

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| | calculation. Changing percentage to decimal and fraction and vice-versa. | <ul style="list-style-type: none"> - Single Stroke, Double Stroke, inclined, Upper case and Lower case. |
| 6. | Material Science : properties - Physical & Mechanical, Types – Ferrous & Non-Ferrous, difference between Ferrous and Non-Ferrous metals, introduction of Iron, Cast Iron, Wrought Iron, Steel, difference between Iron and Steel, Alloy steel, carbon steel, stainless steel, Non-Ferrous metals, Non-Ferrous Alloys. | Dimensioning: <ul style="list-style-type: none"> - Definition, types and methods of dimensioning (functional, non-functional and auxiliary) - Types of arrowhead - Leader Line with text |
| 7. | Mass, Weight and Density : Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density, specific gravity of metals. | Free hand drawing of <ul style="list-style-type: none"> - Lines, polygons, ellipse, etc. - geometrical figures and blocks with dimension - Transferring measurement from the given object to the free hand sketches. |
| 8. | Speed and Velocity : Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation, equations of motions, simple related problems. | Sizes and Layout of Drawing Sheets <ul style="list-style-type: none"> - Basic principle of Sheet Size - Designation of sizes - Selection of sizes - Title Block, its position and content - Borders and Frames (Orientation marks and graduations) - Grid Reference - Item Reference on Drawing Sheet (Item List) |
| 9. | Work, Power and Energy : work, unit of work, power, unit of power, Horse power of engines, mechanical efficiency, energy, use of energy, potential and kinetic energy, examples of potential energy and kinetic energy. | Method of presentation of Engineering Drawing <ul style="list-style-type: none"> - Pictorial View - Orthogonal View - Isometric view |
| 10. | ----- | Symbolic Representation (as per BIS SP:46-2003) of : <ul style="list-style-type: none"> - Fastener (Rivets, Bolts and Nuts) - Bars and profile sections - Weld, brazed and soldered joints. - Electrical and electronics element - Piping joints and fittings |

| Second Semester | | |
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| Duration: Six Month | | |
| S No. | Workshop Calculation and Science | Engineering Drawing |
| 1. | Algebra : Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables). | Construction of Scales and diagonal scale |
| 2. | Mensuration : Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle, Volume of solids – cube, cuboids, cylinder and Sphere. Surface area of solids – cube, cuboids, cylinder and Sphere. | Practice of Lettering and Title Block |
| 3. | Trigonometry: Trigonometrical ratios, measurement of angles. Trigonometric tables | Dimensioning practice: <ul style="list-style-type: none"> - Position of dimensioning (unidirectional, aligned, oblique as per BIS SP:46-2003) - Symbols preceding the value of dimension and dimensional tolerance. - Text of dimension of repeated features, equidistance elements, circumferential objects. |
| 4. | Heat & Temperature: Heat and temperature, their units, difference between heat and temperature, boiling point, melting point, scale of temperature, relation between different scale of temperature, Thermometer, pyrometer, transmission of heat, conduction, convection, radiation. | Construction of Geometrical Drawing Figures: <ul style="list-style-type: none"> - Different Polygons and their values of included angles. Inscribed and Circumscribed polygons. - Conic Sections (Ellipse & Parabola) |
| 5. | Basic Electricity: Introduction, use of electricity, how electricity is produced, Types of current_ AC, DC, their comparison, voltage, resistance, their units. Conductor, insulator, Types of connections – series, parallel, electric power, Horse power, energy, unit of | Drawing of Solid figures (Cube, Cuboids, Cone, Prism, Pyramid, Frustum of Cone and Pyramid.) with dimensions. |

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| | electrical energy. | |
| 6. | <p><u>Levers and Simple Machines:</u> levers and its types.</p> <p>Simple Machines, Effort and Load, Mechanical Advantage, Velocity Ratio, Efficiency of machine, Relationship between Efficiency, velocity ratio and Mechanical Advantage.</p> | Free Hand sketch of hand tools and measuring tools used in respective trades. |
| 7. | | <p>Projections:</p> <ul style="list-style-type: none"> - Concept of axes plane and quadrant. - Orthographic projections - Method of first angle and third angle projections (definition and difference) - Symbol of 1st angle and 3rd angle projection as per IS specification. |
| 8. | | Drawing of Orthographic projection from isometric/3D view of blocks |
| 9. | | Orthographic Drawing of simple fastener (Rivet, Bolts, Nuts & Screw) |
| 10. | | Drawing details of two simple mating blocks and assembled view. |

Skill India
कौशल भारत - कुशल भारत

| Third Semester | | |
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| Duration: Six Month | | |
| S No. | Workshop Calculation and Science | Engineering Drawing |
| 1. | - Geometrical construction & theorem: division of line segment, parallel lines, similar angles, perpendicular lines, isosceles triangle and right angled triangle. | - Revision of first year topics. |
| 2. | - Area of cut-out regular surfaces: circle and segment and sector of circle. | - Machined components; concept of fillet & chamfer; surface finish symbols. |
| 3. | - Area of irregular surfaces. - Application related to shop problems. | - Screw thread, their standard forms as per BIS, external and internal thread, conventions on the features for drawing as per BIS. |
| 4. | - Volume of cut-out solids: hollow cylinders, frustum of cone, block section. - Volume of simple machine blocks. | - Free hand Sketches for bolts, nuts, screws and other screwed members. |
| 5. | - Material weight and cost problems related to trade. | - Free hand Sketching of foundation bolts and types of washers. |
| 6. | - Finding the value of unknown sides and angles of a triangle by Trigonometrical method. | - Standard rivet forms as per BIS (Six types). |
| 7. | - Finding height and distance by trigonometry. | - Riveted joints-Butt & Lap (Drawing one for each type). |
| 8. | - Application of trigonometry in shop problems. (viz. taper angle calculation). | - Orthogonal views of keys of different types |
| 9. | - Forces definition. - Compressive, tensile, shear forces and simple problems. -Stress, strain, ultimate strength, factor of safety. -Basic study of stress-strain curve for MS. | - Free hand Sketches for simple pipe, unions with simple pipe line drawings. |
| 10. | - Temperature measuring instruments. Specific heats of solids & liquids. | - Concept of preparation of assembly drawing and detailing. Preparation of simple assemblies & their details of trade related tools/job/exercises with the dimensions from the given sample or models. |
| 11. | - Thermal Conductivity, Heat loss and heat gain. | -Free hand sketch of trade related components / parts (viz., single tool post for the lathe, etc.) |
| 12. | - Average Velocity, Acceleration & Retardation. - Related problems. | - Study of assembled views of Vee-blocks with clamps. |

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| 13. | - Circular Motion: Relation between circular motion and Linear motion, Centrifugal force, Centripetal force | - Study of assembled views of shaft and pulley. |
| 14. | | - Study of assembled views of bush bearing. |
| 15. | | - Study of assembled views of a simple coupling. |
| 16. | | - Free hand Sketching of different gear wheels and nomenclature. |



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| Fourth Semester | | |
|----------------------------|---|---|
| Duration: Six Month | | |
| S No. | Workshop Calculation and Science | Engineering Drawing |
| 1. | <p><u>Graph:</u></p> <ul style="list-style-type: none"> - Read images, graphs, diagrams - bar chart, pie chart. - Graphs: abscissa and ordinates, graphs of straight line, related to two sets of varying quantities. | - Free hand Details and assembly of simple bench vice. |
| 2. | <p>Simple problem on Statistics:</p> <ul style="list-style-type: none"> - Frequency distribution table - Calculation of Mean value. - Examples on mass scale productions. -Cumulative frequency -Arithmetic mean | - Reading of drawing. Simple exercises related to missing lines, dimensions. How to make queries. |
| 3. | Acceptance of lot by sampling method (within specified limit size) with simple examples (not more than 20 samples). | <ul style="list-style-type: none"> - Simple exercises relating missing symbols. - Missing views |
| 4. | <ul style="list-style-type: none"> - Friction- co-efficient of friction, application and effects of friction in Workshop practice. <p>Centre of gravity and its practical application.</p> | - Simple exercises related to missing section. |
| 5. | <ul style="list-style-type: none"> - Magnetic substances- natural and artificial magnets. - Method of magnetization. Use of magnets. | -Free hand sketching of different types of bearings and its conventional representation. |
| 6. | <ul style="list-style-type: none"> - Electrical insulating materials. - Basic concept of earthing. | <ul style="list-style-type: none"> - Solution of NCVT test. - Simple exercises related to trade related symbols. - Basic electrical and electronic symbols |
| 7. | <ul style="list-style-type: none"> - Transmission of power by belt, pulleys & gear drive. - Calculation of Transmission of power by belt pulley and gear drive. | - Study of drawing & Estimation of materials. |
| 8. | - Heat treatment and advantages. | - Solution of NCVT test papers. |
| 9. | Concept of pressure – units of pressure, atmospheric pressure, absolute pressure, gauge pressure – gauges used for measuring pressure | |

9.2 EMPLOYABILITY SKILLS

| CORE SKILL – EMPLOYABILITY SKILL | |
|---|--|
| First Semester | |
| 1. English Literacy | Duration : 20 hrs Marks : 09 |
| Pronunciation | Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech) |
| Functional Grammar | Transformation of sentences, voice change, change of tense, Spellings. |
| Reading | Reading and understanding simple sentences about self, work and environment |
| Writing | Construction of simple sentences Writing simple English |
| Speaking/ Spoken English | Speaking with preparation on self, on family, on friends/ classmates, on known people, picture reading, gain confidence through role-playing and discussions on current happenings, job description, asking about someone's job, habitual actions. Cardinal (fundamental) numbers ordinal numbers. Taking messages, passing on messages and filling in message forms, Greeting and introductions, office hospitality, Resumes or curriculum vitae essential parts, letters of application reference to previous communication. |
| 2. IT Literacy | Duration : 20 hrs Marks : 09 |
| Basics of Computer | Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer. |
| Computer Operating System | Basics of Operating System, WINDOWS, the user interface of Windows OS, Create, Copy, Move and delete Files and Folders, Use of External memory like pen drive, CD, DVD etc., Use of Common applications. |
| Word Processing and Worksheet | Basic operating of Word Processing, Creating, opening and closing Documents, use of shortcuts, Creating and Editing of Text, Formatting the Text, Insertion & creation of Tables. Printing document. Basics of Excel worksheet, understanding basic commands, creating simple worksheets, understanding sample worksheets, use of simple formulas and functions, Printing of simple excel sheets. |
| Computer Networking | Basic of computer Networks (using real life examples), Definitions of |

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| and Internet | Local Area Network (LAN), Wide Area Network (WAN), Internet, Concept of Internet (Network of Networks), Meaning of World Wide Web (WWW), Web Browser, Web Site, Web page and Search Engines. Accessing the Internet using Web Browser, Downloading and Printing Web Pages, Opening an email account and use of email. Social media sites and its implication. Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT - ACT, types of cyber crimes. |
| 3. Communication Skills | |
| Duration: 15 hrs | |
| Marks : 07 | |
| Introduction to Communication Skills | Communication and its importance Principles of effective communication Types of communication - verbal, non-verbal, written, email, talking on phone. Non-verbal communication-characteristics, components-Para-language Body language Barriers to communication and dealing with barriers. Handling nervousness/ discomfort. |
| Listening Skills | Listening-hearing and listening, effective listening, barriers to effective listening, guidelines for effective listening. Triple- A Listening - Attitude, Attention & Adjustment. Active listening skills. |
| Motivational Training | Characteristics essential to achieving success. The power of positive attitude. Self-awareness Importance of commitment Ethics and values Ways to motivate oneself Personal Goal setting and Employability Planning. |
| Facing Interviews | Manners, Etiquettes, Dress code for an interview Do's & Don'ts for an interview. |
| Behavioral Skills | Problem Solving Confidence Building Attitude |
| Second Semester | |
| 4. Entrepreneurship Skills | |
| Duration : 15 hrs | |
| Marks : 06 | |
| Concept of | Entrepreneur - Entrepreneurship - Enterprises: Conceptual issue |

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| Entrepreneurship | Entrepreneurship vs. management, Entrepreneurial motivation. Performance & Record, Role & Function of entrepreneurs in relation to the enterprise and relation to the economy, Source of business ideas, Entrepreneurial opportunities, the process of setting up a business. |
| Project Preparation & Marketing Analysis | Qualities of a good Entrepreneur, SWOT and Risk Analysis. Concept & application of PLC, Sales & distribution Management. Difference between small scale & large scale business, Market Survey, Method of marketing, Publicity and advertisement, Marketing Mix. |
| Institution's Support | Preparation of Project. Role of various schemes and institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non-financing support agencies to familiarize with the Policies/Programmes, procedure and the available scheme. |
| Investment Procurement | Project formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment procedure - Loan procurement - Banking Processes. |
| 5. Productivity | |
| Duration : 10 hrs | |
| Marks : 05 | |
| Benefits | Personal/ Workman - Incentive, Production linked Bonus, Improvement in living standard. |
| Affecting Factors | Skills, Working Aids, Automation, Environment, Motivation – How it improves or slows down productivity. |
| Comparison with Developed Countries | Comparative productivity in developed countries (viz. Germany, Japan and Australia) in selected industries e.g. Manufacturing, Steel, Mining, Construction etc. Living standards of those countries, wages. |
| Personal Finance Management | Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and Insurance. |
| 6. Occupational Safety, Health and Environment Education | |
| Duration : 15 hrs | |
| Marks : 06 | |
| Safety & Health | Introduction to Occupational Safety and Health, importance of safety and health at workplace. |
| Occupational Hazards | Basic Hazards, Chemical Hazards, Vibroacoustic Hazards, Mechanical Hazards, Electrical Hazards, Thermal Hazards. Occupational health, Occupational hygienic, Occupational Diseases/ Disorders & its prevention. |
| Accident & Safety | Basic principles for protective equipment. |

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| | Accident Prevention techniques - control of accidents and safety measures. |
| First Aid | Care of injured & sick at the workplaces, First-Aid and Transportation of sick person. |
| Basic Provisions | Idea of basic provision legislation of India. Safety, health, welfare under legislative of India. |
| Ecosystem | Introduction to Environment. Relationship between Society and Environment, Ecosystem and Factors causing imbalance. |
| Pollution | Pollution and pollutants including liquid, gaseous, solid and hazardous waste. |
| Energy Conservation | Conservation of Energy, re-use and recycle. |
| Global Warming | Global warming, climate change and Ozone layer depletion. |
| Ground Water | Hydrological cycle, ground and surface water, Conservation and Harvesting of water. |
| Environment | Right attitude towards environment, Maintenance of in-house environment. |
| 7. Labour Welfare Legislation | |
| | Duration : 05 hrs Marks : 03 |
| Welfare Acts | Benefits guaranteed under various acts- Factories Act, Apprenticeship Act, Employees State Insurance Act (ESI), Payment Wages Act, Employees Provident Fund Act, The Workmen's Compensation Act. |
| 8. Quality Tools | |
| | Duration : 10 hrs Marks : 05 |
| Quality Consciousness | Meaning of quality, Quality characteristic. |
| Quality Circles | Definition, Advantage of small group activity, objectives of quality Circle, Roles and function of Quality Circles in Organization, Operation of Quality circle. Approaches to starting Quality Circles, Steps for continuation Quality Circles. |
| Quality Management System | Idea of ISO 9000 and BIS systems and its importance in maintaining qualities. |
| House Keeping | Purpose of House-keeping, Practice of good Housekeeping. |
| Quality Tools | Basic quality tools with a few examples. |

| LIST OF TOOLS AND EQUIPMENT | | | |
|--|--|---|-----------------|
| MACHINIST GRINDER (For batch of 12 candidates) | | | |
| S No | Name of the Tool & Equipments | Specification | Quantity |
| A. TRAINEES TOOL KIT | | | |
| 1. | Steel Rule | 150mm (graduated both English and Metric). | 16 Nos. |
| 2. | Try Square Engineer | 150mm | 16 Nos. |
| 3. | Outside Calipers (spring) | 250mm | 16 Nos. |
| 4. | Inside Calipers (spring) | 150 mm | 16 Nos. |
| 5. | Hammer Ball Peen | with handle 0.50 kg. | 16 Nos. |
| 6. | Odd leg Caliper | 150 mm | 16 Nos. |
| 7. | Scriber | 150 x 3 mm | 16 Nos. |
| 8. | Plier | 150 mm | 16 Nos. |
| 9. | Goggles | (fiber plastic cup) safety glasses (interchangeable glasses) | 16 Nos. |
| B. TOOLS, MEASURING INSTRUMENTS AND GENERAL SHOP OUTFIT | | | |
| 10. M | Hammer Copper | 0.50 kg. | 2 Nos. |
| 11. M | Hammer Engineers | Ball Peen 0.50 kg. | 2 Nos. |
| 12. M | Scribing Block | with adjustable Vertical spindle 225 mm 4 Angle Plate, adjustable (graduated in degrees) 150 x 150 x 150 mm | 2 Nos. |
| 13. M | Blocks Vee | 150 x 100 x 100 mm (fitted with clamps, hardened and ground) | 2 Pairs. |
| 14. M | Blocks Vee | (grooved and fitted with clamps) (Hardened and ground) 75 x 75 x 50 mm | 2 Pairs. |
| 15. M | Block parallel | adjustable 150 mm long, 42 mm wide, 18 mm height (hardened and ground) | 2 Pairs. |
| 16. M | Block, parallel | adjustable 100 mm long, 50 mm wide, 32 mm height (hardened and ground) | 2 pairs. |
| 17. | Calipers, Vernier | 200 mm, inside and outside (graduated in inches and millimeters_ | 1 Each |
| 18. | C-clamps | 50 mm, 100 mm and 150 mm | 2 Each |
| 19. M | Oil can | Pressure delivery _1/4 point capacity | 4 Nos. |
| 20. M | Oil can | Drip delivery (long spout) _ point | 4 Nos. |

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| | | capacity | |
| 21. | Height Gauge | (Metric and English graduated) | 1 No. |
| 22. | Combination set | (consisting of 300 mm rule centre) | 2 Nos. |
| 23. | Comparator Gauge | complete with stand and brackets. | 2 Nos. |
| 24. | Chuck, Drill | 12 mm cap. (Taper shank) | 1 No. |
| 25. | Chuck, Drill | 16 mm capacity (Taper shank) | 1 No. |
| 26. | Dial Test Indicator complete | with stand (universal type with magnetic base 1/100 mm) | 2 Nos. |
| 27. | Diamond, Wheel Dressing | (single stone mounted) | 4 Nos. |
| 28. | Files, Hand Flat, | 200 mm smooth | 8 Nos. |
| 29. | Files, Hand Flat, | 250 mm smooth | 8 Nos. |
| 30. | Files, | 150 mm Half round smooth | 8 Nos. |
| 31. | Files, | round Dead smooth 200 mm | 4 Nos. |
| 32. | Files, Triangular, | Dead smooth 200 mm and 150 mm | 2 Each |
| 33. | Files, Triangular | Dead smooth 150 mm | 4 Nos. |
| 34. A | File Flat Rough | 300 mm | 4 Nos. |
| 35. A | File Flat | 250 mm Second Cut | 4 Nos. |
| 36. A | Chisel Cold Flat | 18 mm | 4 Nos. |
| 37. A | Chisel Cold Flat | 12 mm | 4 Nos. |
| 38. | Feeler Gauge Metric Set | | 1 set |
| 39. | Gauge Radius (Inside and Outside) (Metric) | | 2 Nos. |
| 40. | Gauge, Slip (Metric) workshop grade | | 2 Sets |
| 41. | Sine Bar | 100 mm and 150mm | 1 Each |
| 42. | Gauge, Telescopic | 12 to 150 mm | 2 Sets |
| 43. | Gauge, Morse Taper, | Plug Nos. 1,2,3,4 | 1 Each |
| 44. | Gauge, Morse Taper, | Ring Nos. 1,2,3,4 | 1 Each |
| 45. | Glass, Magnifying | 250 x 25 x 75 mm dia with handle | 1 No. |
| 46. | Hacksaw frame | 200 to 300 mm adjustable | 2 Nos. |
| 47. M | Keys, Allen | 1 mm to 14 mm by 1 mm | 4 sets |
| 48. | Keys, Allen | 3 to 12 mm, by 1.5 mm | 1 Set |
| 49. | Spirit Level, Engineers | 25 mm precision | 1 No. |
| 50. | Micrometer outside | 0 to 25 mm | 3 nos. |
| 51. | Micrometer outside | 25 to 50 mm | 2 nos. |
| 52. | Micrometer outside | 50 to 75 mm | 1 no. |
| 53. | Micrometer outside | 75 to 100 mm | 1 no. |

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| 54. | Internal Micrometer | 25 to 150 mm with extension Rods. | 1 no. |
| 55. | Depth Gauge Micrometer | with extension rods to 150 mm with 70 mm Base | 1 no. |
| 56. A | Indicating Micrometer | 0.25 mm range, graduation, 01" mm graduation of dial 0.001 mm range of dial + 0.02 | 1 No. |
| 57. | Oil Stone Carborandum, | Coarse on one side and fine on the other 200 x 50 x 25 mm | 2 Nos. |
| 58. | Oil Stone Carborandum, | Coarse on one side and fine on other slip 100 x 12 mm triangular. | 2 Nos. |
| 59. | Oil Stone Carborandum, | Coarse on one side and fine on other slip 100 x 18 mm triangular | 2 Nos. |
| 60. | Try Square, Engineer's | 100 mm blade | 2 Nos. |
| 61. | Straight Edge Engineer's | 300 x 50 x 12 mm bevelled edge. | 1 No. |
| 62. | Screw Driver | 200 mm blade | 2 Nos. |
| 63. | Screw Driver | 300 mm blade | 2 Nos. |
| 64. | Spanner D.E. open jaw | 3 to 18 mm by 3 mm | 2 Sets |
| 65. | Scraper Flat | 25 x 200 mm with handle | 2 Nos. |
| 66. | Scraper Half round | 75 x 12 x 200 mm with handle | 2 Nos. |
| 67. | Scraper Triangular | 62 x 9 x 200 mm with handle | 2 Nos. |
| 68. | Tachometer | with male and female rubber attachments (upto 010,000 RPM) | 1 No. |
| 69. | Table Chuck | 75 mm Jaw Swivel Base 200 mm dia. 3 Jaw with bolting arrangement and graduated in degrees | 1 No. |
| 70. | Vices, Machine Plain | 150 Jaws x 100 mm openings | 2 Nos. |
| 71. | Vices, Machine, Swivelling Base | 150 mm x 100 mm | 2 Nos. |
| 72. | Universal Machine Vice | 100 mm for Grinding | 2 Nos. |
| 73. | Wheel Dressers, Steel Type (Huntington) (Large) | | 2 Nos. |
| 74. | Wheel Dressers, Steel (Huntington type Small) | | 3Nos. |
| 75. | Radius Truing Attachment for surface grinding machine | | 1No. |
| 76. | Radius Truing Attachment for cylindrical grinding machine. | | 1No. |
| 77. | Angle Truing Attachment for surface grinding machine. | | 1 No. |
| 78. | Demagnetizer Chuck | | 1 No. |
| 79. M | Centre Punch | 150 x 6 mm dia | 4 Nos. |
| 80. | Reamer Adjustable | 6 to 16 x 1.5 mm | 1 Set |
| 81. | Surface Plate | 60 x 60 cms. | 1 No. |
| 82. | Marking Table 90 x 60 x 90 cms | 90 x 60x 90 cms. | 1 No. |

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| 83. A | Hand Drill | 6 mm | 1 Set |
| 84. A | Taps and Dies complete set in box (Metric) | | 1 Set |
| 85. A | Taps and Dies set B.A.B.S.F.B.S.W. and American | | 1 Set |
| 86. A | Drill Twist (Straight Shank) | 1/8" to 1/2" by 1/64" | 1 Set |
| 87. A | Drill Twist (Metric) | 3 mm to 12 mm, in step of 1 mm | 1 Set |
| 88. A | Set of Sockets Morse taper | (0-1, 1-2 and 2-3) | 1 Set |
| 89. A | Drill Chuck | 0 to 12 mm Morse Taper | 1 No. |
| 90. | Combination Drill (Centering) | | 2 Nos. |
| 91. | Screw Pitch Gauge | | 2 Nos. |
| 92. | Working Benches | 340 x 120 x 75 cms with 4 bench vices, 125 mm jaw | 1 No. |
| 93. S | Fire Extinguisher | | 1 No. |
| 94. S | Fire Buckets with stand | | 4 Nos. |
| 95. | Steel lockers | with 6 drawers | 2 Nos. |
| 96. | Metal Rack | 180 x 150 x 45 cms | 1 No. |
| 97. | Desk | | 1 No. |
| 98. | Stool | | 1 No. |
| 99. | Black Board with Easel | | 1 No. |
| 100. A | Magnifying Glass with surface illuminator | | 1 No. |
| 101. A | CMTI surface finish standards (in Bakelite) | | 1 No. |
| 102. A | Adjustable Wrench | 250 mm size | 1 No. |
| 103. A | Hammer (Nylon face) | 30 mm | 4 Nos. |
| 104. A | Grease Gun | | 2 Nos. |
| 105. A | Magnetic V-Block with push button switch | | 1 Set |
| 106. A | Magnetic V-Block base | for Dial Indicator 75 x 75 x 100 mm | 2 Nos. |
| 107. A | Diamond Dresser Cluster type | | 2 Nos. |
| 108. A | Adjustable Parallel Clamps | (Hardened and ground) 100 mm long | 2 Pairs |
| 109. | Granite Stone Surface Plate | Grade A 600 x 500 x 1000 mm | 1 No. |
| 110. | Static balancing stand for grinding wheel | | 1 No. |
| 111. | Soft Board for display | 1.25 mm x 1.85 mm x 10 mm thick | 1 No. |
| 112. A | Dial Test Indicator-Lever type-long point | | 2 Nos. |
| 113. A | Magnetic Stand Flexible | type base 60 mm x 47.5 mm Magnetic Power 75 kg. ON-OFF Lever control | 2 Nos. |
| 114. A | Cutter Clearance Gauge to Suit Clearance all cutter diameters | angle 0"-30". | 1 Set |

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| 115. M | Glass Show Case | for display of jobs 450 mm x 600 x 850mm | 1 No. |
| C. DESIRABLE | | | |
| 116. | Shadeograph projector | with diascopic and epidia scopic projection, magnification 50, 100, 200, rotary screen 1 minute accuracy and centering, attachment. | 1 No. |
| D : GENERAL MACHINERY | | | |
| 117. S | SS and SC centre lathe (all geared) | with minimum specification as: centre height 150 mm and centre distance 750 mm along with 4 jaw chuck, self centering chuck, auto feed system, safety guard, motorized coolant system and lighting arrangement, set of lathe tools, lathe carriers. | 2 Nos. |
| 118. S | Pillar Drill machine | 0-12mm drill holding capacity with drill chuck & keys. | 1 No. |
| 119. S | Cylindrical External Grinding Machine | fully motorized with dressing arrangement and supplied with face plates and driving dogs, 3-jaw self centering chuck, 4- jaw independent chuck, tail stock assorted centres pump with tank and pipe fittings spanners and grease gun (each machine to be supplied with assorted grinding wheels and tool grinding machine for general purpose work with internal grinding attachment) with minimum specification as: To accommodate 750mm job with centre height 150mm. Wheel diameter x Width = 300 x 25mm. | 2 Nos. |
| 120. S | Grinding machine plain surface | wheel dia. 175 mm (or near) with reciprocating table having longitudinal table traverse 200 mm (or near) fully automatic and fitted with adjustable traverse stops, machine to be fully motorized and fitted with ace guards and pumps, tank and pump fittings and also to be supplied with magnetic chuck 250 x 112 mm. Diamond tool holder, set of spanners, grease gun, oil-can and spare grinding wheel for general purpose | 2 Nos. |

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| | | grinding. | |
| 121. S | Grinding machine plain surface | with horizontal and vertical spindle, reciprocating table having longitudinal table traverse fully motorized and supplied with set of spanners, necessary equipment, diamond tool holders for wheel sized 175 x 30 x 18 mm suitable cup wheels for vertical spindle, spare wheel proper guards and coolant pump with fittings. | 2 Nos. |
| 122. S | Tool and cutter grinding machine | 250 x 375 mm fully motorized supplied with chuck, centers tool rest, height gauge, table clamps universal vice tooth rest. Diamond dressing tool and holding attachment equipment for tool grinding and assorted grinding wheels for all tool room work (with twist drill grinding attachment). | 2 Nos. |
| 123. S | Lapping machine | with motor and chuck 132 cm dia. | 1 No. |

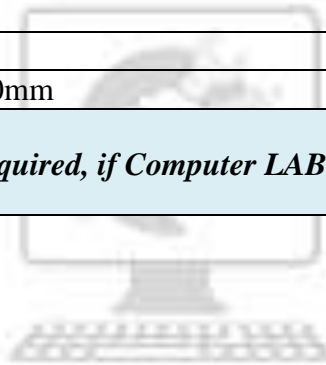
NOTE:

1. No additional items are required to be provided for the batches working in the second shift except the items under the trainees tool kit and lockers.
2. Additional number of items marked 'S' are not required to be provided for additional number of batches.
3. Items marked 'A' are to be obtained from the main store.
4. The specifications of the items in the above list have been given in metric units. The items which are available in the market nearest to the specifications as mentioned above if not available as prescribed, should be produced. Measuring instruments such as steel rules which have graduation both in English and Metric units may be produced, if possible.
5. Simple hand tools for fitting etc. such as hammers, scribing blocks, V block parallel block, angle plate Allen keys centre punch, oil cans etc. mentioned in the above list and marked 'M' may be made in the Institute as far as possible.

TOOLS & EQUIPMENTS FOR EMPLOYABILITY SKILLS

| S No. | Name of the Equipment | Quantity |
|-------|--|----------|
| 1. | Computer (PC) with latest configurations and Internet connection with standard operating system and standard word processor and worksheet software | 10 nos. |
| 2. | UPS - 500VA | 10 nos. |
| 3. | Scanner cum Printer | 1 no. |
| 4. | Computer Tables | 10 nos. |
| 5. | Computer Chairs | 20 nos. |
| 6. | LCD Projector | 1 no. |
| 7. | White Board 1200mm x 900mm | 1 no. |

Note: Above Tools & Equipments not required, if Computer LAB is available in the institute.



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FORMAT FOR INTERNAL ASSESSMENT

| Name & Address of the Assessor: | | | Year of Enrollment: | | | | | | | | | | | | |
|--|---------------------------------|------------------------|--|--------------------------------------|-------------------------|---|--------------------------|------------------------------------|-----------------------------|---------------------|------------------------|------|---------------------------------|--------------|--|
| Name & Address of ITI (Govt./Pvt.): | | | Date of Assessment: | | | | | | | | | | | | |
| Name & Address of the Industry: | | | Assessment location: Industry / ITI | | | | | | | | | | | | |
| Trade Name: | | Semester: | | Duration of the Trade/course: | | | | | | | | | | | |
| Learning Outcome: | | | | | | | | | | | | | | | |
| S No | Maximum Marks (Total 100 Marks) | | 15 | 5 | 10 | 5 | 10 | 10 | 5 | 10 | 15 | 15 | Total Internal Assessment Marks | Result (Y/N) | |
| | Candidate Name | Father's/Mother's Name | Safety Consciousness | Workplace Hygiene | Attendance/ Punctuality | Ability to Follow Manuals/ Written Instructions | Application of Knowledge | Skills to Handle Tools & Equipment | Economical Use of Materials | Speed in Doing Work | Quality in Workmanship | VIVA | | | |
| 1 | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | |