



COMPETENCY-BASED CURRICULUM

FOR THE TRADE OF

MACHINIST (GRINDER)

UNDER

CRAFTSMAN TRAINING SCHEME (CTS)

IN SEMESTER PATTERN

Government of India
Ministry of Skill Development and Entrepreneurship

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1. INTRODUCTION

India is one of the youngest nations in the world. Our youth are our strength. However, a challenge facing the country is that of skilling our youth as per the demands of the industry. Recognizing the need for quickly coordinating the skill development and entrepreneurship efforts of all concerned stakeholders, the Government of India created the Ministry of Skill Development and Entrepreneurship on 9th November, 2014. To create further convergence between the Vocational Training System through Industrial Training Institutes (ITIs) and the new skill initiatives of the Government, the Training and Apprenticeship Training divisions from the Directorate General of Employment and Training (DGET) under the Ministry of Labour and Employment stand transferred to the Ministry of Skill Development and Entrepreneurship (MSDE) with effect from 16th April, 2015. This move brings over 11000 ITIs and scores of other institutions, and the Apprenticeship and Training divisions, under the Ministry.

The Ministry of Skill Development and Entrepreneurship is an apex organization for the development and coordination of the vocational training including Women's Vocational Training in our country. The Ministry conducts the vocational training programmes through the Craftsmen Training Scheme (CTS), Apprenticeship Training Scheme (ATS), Modular Employable Scheme (MES) under the Skill Development Initiative (SDI) Scheme, and Craftsmen Instructor Training Scheme (CITS) to cater the needs of different segments of the Labour market. The National Council for Vocational Training (NCVT) acts as a central agency to advise Government of India in framing the training policy and coordinating vocational training throughout India. The day-to-day administration of the ITIs rests with the State Governments/ Union Territories.

- Training courses under the CTS is being offered through a network of more than 11000 Government and Private Industrial Training Institutes (ITIs) located all over the country with a total seating capacity of more than 16 Lakhs with an objective to provide skilled workforce to the industry in 126 trades. Skill development courses exclusively for women are also being offered under CTS and other schemes through Government and Private ITIs and Regional Vocational Training Institutes (RVTIs) for Women.
- The Apprentices Act, 1961 was enacted with the objective of regulating the program of apprenticeship training in the industry by utilizing the facilities available within for imparting on-the-job training. The Act makes it obligatory for employers in specified industries to engage apprentices in designated trades to impart on the job training for school leavers, and ITI passed outs to develop skilled manpower for the industry.
- The Ministry is implementing the Employable Scheme (MES) under the Skill Development Initiative Scheme to provide vocational training to people to develop skilled manpower for the industry through a network of Vocational Training Providers (VTPs) located across the country.

Central Staff Training and Research Institute (CSTARI), Kolkata is the nodal institute for the development/revision of curricula under all vocational training schemes of the Ministry. National Instructional Media Institute (NIMI), Chennai is to make available instructional material in various trades for the use of trainees and trainers to ensure overall improvement in the standard of institutional training under the CTS and ATS schemes. The institute is actively involved in the development, production and dissemination of instructional media Packages (IMPs) comprising of books on Trade Theory, Trade Practical, Test/Assignment, and Instructor's Guide.

The National Skills Qualification Framework (NSQF), published in the Gazette of India on 27th December, 2013, is a national framework that aims to integrate general and vocational streams of education and training. The main goal of the NSQF is to focus on competency-based qualifications, which in turn facilitate and enhance transparency, both within and between general and vocational streams. The National Skill Development Agency (NSDA) under the Ministry is responsible for anchoring and implementation of the Framework, by bringing together the key stakeholders through the National Skill Qualifications Committee (NSQC).

The competency-based framework organizes qualifications into ten levels, with the entry level being 1, and the highest level being 10. Each level of the NSQF is described by a statement of learning outcomes in five domains, known as level descriptors. These five domains are (1) Process, (2) Professional knowledge, (3) Professional skill, (4) core skill, and (5) Responsibility. The paradigm shift from learning focused on inputs to an outcome/competency-based education would help in the Recognition of Prior Learning (RPL), and simultaneously enable the alignment of the Indian qualifications with international ones. Government funding is expected to be on a preferential basis for NSQF compliant courses. The NSQF notification provides a Qualification Register, which is the official national database of all qualifications aligned to NSQF levels. Through this Register, learners can expect access to all NSQF compliant qualifications.

The Ministry has set up Mentor Councils to focus on courses under NCVT in various sectors with representation from thought leaders among different stakeholders viz., industries, innovative entrepreneurs who have proved to be game-changers, academic/professional institutions, and champion ITIs for each of the sectors. The Mentor Council for each sector reviews curriculum, admission criteria, course duration, and requirement of trainers and assessment/evaluation systems for the sector on a continuous basis and make recommendations regarding the same. Sector-wise Core Groups are formed to plan and prepare the documentation for the competency-based curricula for the courses under each sector.

2. GENERAL INFORMATION

1	Qualification	MACHINIST (GRINDER)
2	N.C.O./NOS Code No.	7224.10, 7224.20 , 7224.30, 7224.45, 8211.5
3	NSQF Level	Level 4
4	Duration of the course/qualification	Two Years (Four semesters each of six month duration).
5	Entry Qualification	Passed 10 th Class with science and mathematics under 10+2 system of education or its equivalent
6	Trainees per unit	12 (Supernumeraries/Ex-Trainee allowed: 4)

Note:

- i) Out of the two Instructors required for a unit of 2(1+1), one must have Degree/Diploma, and other must have NTC/NAC qualifications, in the relevant field.
- ii) Qualification of the Instructor for WCS and ED must be as per the training manual.

Distribution of notional training hours of the training per week:

Total hours /week	Trade practical	Trade theory	Workshop Cal. &Sc.	Engg. Drawing	Employability skills	Extra-curricular activity
40 Hours	25 Hours	6 Hours	2 Hours	3 Hours	2 Hours	2 Hours

3. COURSE STRUCTURE

Name of the Qualification: **MACHINIST (GRINDER)**

Total duration of the course: 24 Months

Training duration details:

Course Elements	Hourly Distribution
Professional Skills	2200 hrs
Professional Knowledge	530 hrs
Workshop Calculation & Science	180 hrs
Engineering Drawing	265 hrs
Employability Skills	110 hrs
Extra Curricular Activities	180 hrs
In-plant Training/Project Work	240 hrs
Admission & Examination	160 hrs
Total	3865 hrs

4. JOB ROLES

4.1 Brief description

Grinder, 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 specialise in grinding a particular type of tool and be designated accordingly. May check ground tool or cutter by shadow projector to ensure accurate finish.

Grinder Operator makes metal articles to required specifications using lathe and cutting tools. Studies drawings and other specifications of parts to be made. Selects metal, holds it in chuck, jig or fixture on lathe as required, centres it by manipulating chuck jaws or otherwise using dial indicator or marking block and securely tightens it in position. Selects correct cutting tool, grinds it if necessary and holds it tight in tool post at correct height. Sets feed and speed and starts machine. Manipulates hand wheels or starts automatic controls to guide cutting tool into or along metal. Controls flow of coolant (cutting lubricant) on edge of tool. Arranges gears in machine to obtain required pitch for screw cutting. Calculates tapers and sets machine for taper turning, controls lathe during operation by means of hand wheels and levers and frequently checks progress of cutting with measuring instruments such as calipers and rule, micrometers, etc. Stops machine, removes completed part and checks it further with instruments to ensure accuracy.

4.2 NOS & QP/NCO Mapping:

1. **NCO-2004:** 7224.10
2. **NCO-2004:** 7224.30
3. **NCO-2004:** 7224.40
4. **NCO-2004:** 7224.45
5. **NCO-2004:** 8211.55

NOS: -

1. **CSC/ Q 0109 (Conventional Surface Grinding Machine)**
2. **CSC/ Q 0302 (Grinder Handtools Handheld Power Tools)**
3. **CSC/ Q 0117 (CNC Operator - Grinding Machine Centre)**
4. **CSC/ Q 0110 (Operator- Conventional Turning)**
5. **CSC/ Q 0304 (Fitter Mechanical Assembly)**
6. **CSC/ N 1335**
7. **CSC/N 1336**

5. NSQF LEVEL COMPLIANCE

The Broad Learning outcomes of **MACHINIST (GRINDER)** trade under CTS matches with the Level descriptor at Level 4.

The NSQF [level 4] descriptor is given below:

LEVEL	Process required	Professional knowledge	Professional skill	Core skill	Responsibility
Level 4	work in familiar, predictable, routine, situation of clear choice	factual knowledge of field of knowledge or study	recall and demonstrate practical skill, routine and repetitive in narrow range of application, using appropriate rule and tool, using quality concepts	language to communicate written or oral, with required clarity, skill to basic Arithmetic and algebraic principles, basic understanding of social political and natural environment	Responsibility for own work and learning.

6. GENERAL TRAINING PLAN, EXAMINATION & PASS REGULATION

General Training Plan

The knowledge and skill components as stated in the section for 'learning outcomes' are to be imparted in accordance with the instructions in respect of the content and time structure.

Assessment

The assessment for the semester-based qualification is carried out by conducting formative assessments, and end-of-semester examinations, as per the guidelines given in the Curriculum. The internal assessments for theory subjects and practical are conducted for evaluating the knowledge and skill acquired by trainees and the behavioural transformation of the trainees as per the learning outcomes. Theory examinations are conducted in Trade Theory, Workshop Calculation & Science, Engineering Drawing and Employability Skills. Trade practical examinations are conducted by the respective State Governments. The details of the examination and assessment standard are in a latter section. NCVT prepares the question papers for the Trade practical. Candidates are to demonstrate that they can:

1. Read & interpret technical parameters/documentation, plan and organize work processes, and identify necessary materials and tools,
2. Perform a task/job with due consideration to safety rules, accident prevention regulations and environmental protection stipulations,
3. Apply Professional Knowledge, Core Skills, and Employability Skills while performing the task/job.
4. Check the task/job as per the drawing for proper functioning, and identify and rectify errors in the job, if any.
5. Document the technical parameters related to the task/job.

Pass regulation

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

7. LEARNING OUTCOMES

The following are minimum broad learning outcomes after completion of the MACHINIST (GRINDER) course of 02-year duration:

A. GENERIC OUTCOMES

1. Recognize & comply safe working practices, environment regulation and housekeeping.
2. Work in a team, understand and practice soft skills, technical English to communicate with required clarity.
3. Demonstrate knowledge of concept and principles of basic arithmetic, algebraic, trigonometric, statistics, co-ordinate system and apply knowledge of specific area to perform practical operations.
4. Understand and explain basic science in the field of study including basic electrical, and hydraulics & pneumatics.
5. Read and apply engineering drawing for different application in the field of work.
6. Understand and explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.
7. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.
8. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.
9. Understand and apply basic computer working, basic operating system, simulate part programme using simulation software and uses internet services to get accustomed & take benefit of IT developments in the industry.

B. SPECIFIC OUTCOME

SEMESTER - I

10. Perform marking out the components for chipping, filing, drilling, counter boring, countersinking, reaming, tapping fitting and allied operations with clear choice of procedures.
11. Plan and organize the work for different types of fitting operations and check for work result.
12. Set and produce the job with general tolerance on surface grinder.
13. Demonstrate practical skills in aligning/truing the work pieces and set of cutting tools for performing different turning operations (plain, step, taper turning, boring, v-thread cutting) and check for accuracy without any assistance.

SEMESTER - II

14. Perform wheel checking, balancing, mounting, dressing, truing and setup automatic movement of table for cylindrical grinder and surface grinder.

15. Setup and produce long cylindrical parallel job, taper job, eccentric job, using cylindrical grinder and check for accuracy without any assistance.
16. Perform the grinding of different types of metals such as cast iron, bronze, aluminium, carbide tip and different class of steel by dry and wet grinding method.
17. Perform preventive maintenance of grinding machines.

SEMESTER - III

18. Setup and produce V- block, cube, parallel bar snap gauge, ring gauge, plug gauge, taper pin to close tolerances and check for accuracy without any assistance.
19. Perform thin plate grinding using coolant to close limits.
20. Perform slot grinding on surface grinding machine to close limit and check for accuracy without any assistance.
21. Understand, explain the constructional features and working principles of internal cylindrical grinder perform different types of bore grinding and check for accuracy.
22. Understand, explain the constructional features and working principles of tool and cutter grinder, set and sharpen the plain/slot/side and face milling cutter and check for accuracy.

SEMESTER - IV

23. Set and sharpen the slitting saw, spiral milling cutter, end mill cutter, angular milling cutter, tap, reamer drill, and check for accuracy.
24. Perform form grinding viz. Angular, concave, convex using cylindrical and surface grinder.
25. Perform steep taper, morse taper, lathe centre grinding up to close limit and check for accuracy.
26. Grind different precession components viz. dowel pin, sinebar, slip gauges.

NOTE: Learning outcomes are reflection of total competencies of a trainee. Each learning outcome may include multiple assessment components. However assessment will be carried out as per assessable outcome and assessment criteria.

8. ASSESSABLE OUTCOMES WITH ASSESSMENT CRITERIA

Note:

1. The training shall be conducted as per the syllabus.
2. The trainee shall demonstrate the competencies that are defined below in the assessable outcomes highlighted below.
3. The trainee shall be assessed for his/her achievement levels in all the assessable outcomes on the basis of the formative assessment, Theory & Practical examinations, observation, and viva-voce.
4. The trainee shall be assessed for his/her achievement levels in all the assessable outcomes of the Employability Skills, Workshop Calculation & Science, and Engineering Drawing, on the basis of Theory Examinations, and for his/her ability to apply the concepts in Practical.
5. The assessable outcomes and assessment criteria will serve as a set of guidelines for Trainers, Paper setters, Moderators, and Assessors.

Assessable outcomes along with assessment criteria to be achieved after each semester and completion of qualification:

Generic assessable outcomes:

ASSESSABLE OUTCOMES	ASSESSMENT CRITERIA
1. Recognize & comply 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 and according to site policy.
	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 off dangerous 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 of 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 Productive 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 & contribute to the avoidance of instances of environmental pollution.
	1.13 Deploy environmental protection legislation & regulations
	1.14 Take opportunities to use energy and materials in an environmentally friendly manner
	1.15 Avoid waste and dispose waste as per procedure
	1.16 Recognize different components of 5S and apply the same in the working environment.
2. Work in a team, understand and practice soft skills, technical English to communicate with required clarity.	2.1 Obtain sources of information and recognize information.
	2.2 Use and draw up technical drawings and documents.
	2.3 Use documents and technical regulations and occupationally related provisions.
	2.4 Conduct appropriate and target oriented discussions with higher authority and within the team.
	2.5 Present facts and circumstances, possible solutions & use English special terminology.
	2.6 Resolve disputes within the team
	2.7 Conduct written communication.
3. Demonstrate knowledge of concept and principles of basic arithmetic, algebraic, trigonometric, statistics and apply knowledge of specific area to perform practical operations.	3.1 Semester examination to test basic skills on arithmetic, algebra, trigonometry and statistics.
	3.2 Their applications will also be assessed during execution of assessable outcome and also tested during theory and practical examination.
4. Understand and explain basic science in the field of study including basic electrical, and hydraulics & pneumatics.	4.1 Semester examination to test basic skills on science in the field of study including basic electrical and hydraulics & pneumatics.
	4.2 Their applications will also be assessed during execution of assessable outcome and also tested during theory and practical examination.
5. Read and apply engineering drawing for different application in the field of work.	5.1 Semester examination to test basic skills on engineering drawing.
	5.2 Their applications will also be assessed during execution of assessable outcome and also tested during theory and practical examination.
6. Understand and explain the concept in productivity,	6.1 Semester examination to test the concept in productivity, quality tools and labour welfare legislation.

<p>quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.</p>	<p>6.2 Their applications will also be assessed during execution of assessable outcome.</p>
<p>7. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.</p>	<p>7.1 Semester examination to test knowledge on energy conservation, global warming and pollution. 7.2 Their applications will also be assessed during execution of assessable outcome.</p>
<p>8. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.</p>	<p>8.1 Semester examination to test knowledge on personnel finance, entrepreneurship. 8.2 Their applications will also be assessed during execution of assessable outcome.</p>
<p>9. Understand and apply basic computer working, basic operating system and uses internet services to get accustomed & take benefit of IT developments in the industry.</p>	<p>9.1 Semester examination to test knowledge on basic computer working, basic operating system and uses internet services. 9.2 Their applications will also be assessed during execution of assessable outcome.</p>

**SPECIFIC ASSESSABLE OUTCOME:
Semester-I**

ASSESSABLE OUTCOME	ASSESSMENT CRITERIA
10. Perform marking out the components for filing, drilling, fitting and allied operations with clear choice of procedures.	10.1 Identify tools and equipment's for measuring and use of these tools.
	10.2 Select raw material and visual inspect for defects.
	10.3 Identify basic hand tools for filing, drilling, fitting operations and use this tools.
	10.4 Mark according to drawing.
	10.5 Follow relevant legislation, industry guidelines and enterprises policies / procedures.
	10.6 Check all dimensions in accordance with specifications.
11. Plan and organize the work for different types of fitting operations and check for work result.	11.1 Plan and select tools and equipment's for fitting operation.
	11.2 Mark according to drawing by using marking tools on flat and round surfaces.
	11.3 File the job using different methods and perform in accordance with standard specifications and tolerances.
	11.4 Drill on flat and round surfaces.
	11.5 Identify & use hand tools for threading (internal and external) with dies and taps.
	11.6 Measure all dimensions in accordance with standard specifications and tolerances.
12. Set and produce the job with general tolerance on surface grinder.	12.1 Explain the constructional features, working principles and safety aspect of surface grinder.
	12.2 Explain functional application of different levers, stoppers, adjustment etc.
	12.3 Identify different lubrication points of surface grinder.
	12.4 Identify lubricants and their usage for application in surface 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 surface 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.
13. Demonstrate practical skills in aligning/truing the work pieces and set of cutting tools for performing different turning operations (plain, step, taper turning, boring, v-thread cutting) and check for accuracy without any assistance.	13.1 Select appropriate tools and equipment and operate the machine to produce components as per required dimension.
	13.2 Measure all dimensions to check for accuracy with respect to the drawing
	13.3 Solve problem by applying basic methods, tools, materials and information during machining.
	13.4 Avoid waste and dispose waste as per procedure.

Semester-II

14. Perform wheel checking, balancing, mounting, dressing, truing and setup automatic movement of table for cylindrical grinder and surface grinder.	14.1 Acquaintance of basic working principles and safety aspect of grinding wheel mounting, balancing ,dressing and truing of grinding wheel.
	14.2 Explain functional application of different levers, stoppers, adjustment etc for cylindrical and surface grinder.
	14.3 Identify different lubrication points of cylindrical and surface grinder.
	14.4 Identify lubricants and their usage for application in cylindrical and surface grinder as for machine manual.
	14.5 Identify different grinding wheel mounting devices and acquaint with functional application of each device.
	14.6 Mount the grinding wheel with required alignment and check for its functional usage to perform cylindrical and surface grinding operations.
	14.7 Solve problem by applying basic methods and information during setting.
	14.8 Observe safety procedure during mounting as per standard norms.
15. Setup and produce long cylindrical parallel job, taper job, eccentric job, using cylindrical grinder and check for accuracy without any assistance.	15.1 Select appropriate tools and equipment and operate the machine to procedure components as per required dimension.
	15.2 Solve problem by applying basic methods, tools, materials and information during machining.
	15.3 Avoid waste and dispose waste as per procedure.
16. Perform the grinding of different types of metals such as cast iron, bronze, aluminium, carbide tip and different class of steel by dry and wet grinding method.	16.1 Identify different work material and select the grinding wheel.
	16.2 Observe heat generated in grinding for different types of metal.
	16.3 Select appropriate coolant for different types of metal grinding. Observe safety procedure during dry and wet grinding.
	16.4 Solve problem by applying desired mathematical skill, basic methods, select speed, feed, depth of cut and organize information during setting.
17. Perform preventive maintenance of grinding machines.	17.1 Ascertain for the aligning / parallelism of grinding machines.
	17.2 Plan work for lubrication schedule, simple estimation.
	17.3 Observe mechanism, driving system of grinding machines and set properly if required.

Semester-III

18. Setup and produce V-block, cube, parallel bar snap gauge, ring gauge, plug gauge, taper pin to close tolerances and check for accuracy without any assistance.	18.1 Plan and select appropriate method to produce various components with the help of surface grinder and cylindrical grinder.
	18.2 Select the appropriate grinding wheel and work holding devices.
	18.3 Apply desired mathematical skills, collect and organize information to work out the machining parameters.
	18.4 Produce components as per drawing.
	18.5 Check accuracy/ correctness of job using appropriate gauge and measuring instruments for their functional requirement and suit to male /female part.
19. Perform thin plate grinding using coolant to close limits.	19.1 Plan work in compliance with standard safety norms.
	19.2 Work out and apply cutting parameters as per requirement of thin plate grinding operations and holding the thin work piece for grinding.
	19.3 Produce thin components as per standard operating procedure by using appropriate grinding wheel.
	19.4 Check accuracy/ correctness of job using appropriate gauge and measuring instruments.
20. Perform slot grinding on surface grinding machine to close limit and check for accuracy without any assistance.	20.1 Plan and select appropriate method to grind the slot as per drawing.
	20.2 Select appropriate grinding wheel, equipment and machine to produce the slot in work piece as per drawing and make these available for use in a timely manner.
	20.3 Set the job on grinding machine and grind the slot as per specification/drawing following Standard operating practice.
	20.4 Check the dimension of slot by precession instrument.
	20.5 Observe safety precautions during operation.
	20.6 Check for desired performance.
21. Understand, explain the constructional features and working principles of internal cylindrical grinder perform different types of bore grinding and check for accuracy.	21.1 Plan and select appropriate method to produce components.
	21.2 Demonstrate possible solutions within the team 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.
	21.3 Set up and produce component with bore as per standard operating procedure of internal cylindrical grinding.
	21.4 Measure the dimensions with instruments/gauges as per drawing.
	21.5 Comply with safety rules when performing the above operations.

22. Understand, explain the constructional features and working principles of tool and cutter grinder, set and sharpen the plain/slot/side and face milling cutter and check for accuracy.	22.1 Plan and select appropriate method to sharpen the plain/slot/side and face milling cutter.
	22.2 Set up milling cutter and sharpen the milling cutter as per standard operating procedure of the machine.
	22.3 Measure the dimensions with instruments/gauges.
	22.4 Comply with safety rules when performing the above operations.

Semester-IV

23. Set and sharpen the slitting saw, spiral milling cutter, end mill cutter, angular milling cutter, tap, reamer drill, and check for accuracy.	23.1 Plan and select appropriate method to sharpen the slitting saw, spiral milling cutter, end mill cutter, angular milling cutter, tap, reamer drill.
	23.2 Dress the grinding wheel and set up milling cutter.
	23.3 Work out and apply indexing parameters as per different components to be sharpened.
	23.4 Set and sharpen the milling cutter as per standard operating procedure and comply with safety rules when performing the above operations.
	23.5 Solve problems during operation by selecting and applying basic methods, tools, materials and collect and organize information for quality output.
	23.6 Measure with instruments/gauges as per drawing and check functionality of milling cutter.
	23.7 Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
24. Perform form grinding viz. Angular, concave, convex using cylindrical and surface grinder.	24.1 Plan and select appropriate method to perform form grinding viz. Angular, concave, convex using cylindrical and surface grinder.
	24.2 Work out and apply form grinding standard methods to make form grinding wheel as per different components to be ground and Comply with safety rules when performing the above operations.
	24.3 Set up and produce component as per standard operating procedure for form grinding.
	24.4 Solve problems during operation by selecting and applying basic methods, tools, materials and information and using quality concept.
	24.5 Comply with safety rules when performing the above operations.
	24.6 Measure with instruments/gauges as per drawing and check functionality of the components.
	24.7 Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.

25. Perform steep taper, morse taper, lathe centre grinding up to close limit and check for accuracy.	25.1 Plan and select appropriate method to perform steep taper, morse taper, lathe centre grinding.
	25.2 Set up and produce component as per standard operating procedure of steep taper grinding.
	25.3 Comply with safety rules when performing the above operations.
	25.4 Solve problems during operation by selecting and applying basic methods, tools, materials and information and using quality concept.
	25.5 Apply mathematical skill, knowledge of facts, principles, processes and general concepts in the field of steep taper grinding.
	25.6 Measure with instruments/gauges as per drawing and check functionality of component.
26 Grind different precession components viz. dowel pin, sinebar, slip gauges.	26.1 Plan and select appropriate method to perform the precession components viz. dowel pin, sinebar, slip gauges.
	26.2 Set and produce the precession components as per drawing.
	26.3 Solve problems during operation by selecting and applying basic methods, tools, materials and information and using quality concept.
	26.4 Assemble the part components as per the guide lines given in the drawing.
	26.5 Check for accuracy of the precession components and suitability of the assembly.
	26.6 Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
	26.7 Observe safety/ precaution during machining.

9. SYLLABUS CONTENT WITH TIME STRUCTURE

SYLLABUS FOR THE TRADE OF MACHINIST (GRINDER)

9.1 Syllabus Content for Professional Skill & Knowledge

First Semester (Semester Code No. **MCG -01**)

Duration: Six Months

Learning Objectives (1st Semester)

1. Observe safety and know the use of personal protection and fire safety equipments
2. Read simple blue prints and accordingly mark and punch with suitable hand tools
3. Cut with hacksaw to dimensions on different sections of metal
4. File and finish the parts to required shape and size
5. Perform drilling, reaming, tapping, in Bench Fitting jobs
6. Measure using Vernier calipers, to precise dimension
7. Chip slots & oils grooves (Straight).
8. Measure and check dimensions using Vernier caliper and Micrometers
9. Perform facing and plain turning operation on a lathe
10. Turn tapered surface by compound slide method.
11. Re-sharpen of plain turning tool on pedestal grinding machine
12. Bore, cut 'v' threads, knurl and parting off operations on a lathe

Detailed Syllabus:

WK NO.	TRADE PRACTICAL	TRADE THEORY	ENGINEERING DRAWING	WORKSHOP CALCULATION & SCIENCE
1.	Importance of trade training, List of tools & Machinery used in the trade. Health & Safety: Introduction to safety equipments and their uses. Introduction of first aid, operation of Electrical mains. Occupational Safety & Health Importance of housekeeping & good shop floor practices. Health, Safety and	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. 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.	Engineering Drawing-- introduction to Engg. Drawing and its importance.	Introduction to Iron and Steel. Differences in Iron & steel.

	<p>Environment guidelines, legislations & regulations as applicable. Disposal procedure of waste materials like cotton waste, metal chips/burrs etc. Basic safety introduction,</p> <p>Personal protective Equipments(PPE):-</p> <p>Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message.</p> <p>Preventive measures for electrical accidents & steps to be taken in such accidents.</p> <p>Use of Fire extinguishers</p>			
2 - 3	<p>Identification of tools & equipments as per desired specifications for marking & sawing(Hand tools , Fitting tools & Measuring tools)</p> <p>Selection of material as per application Visual inspection of raw material for rusting, scaling, corrosion etc., Marking out lines, gripping suitably in vice jaws, hacksawing to given dimensions, sawing different types of metals of different sections.</p> <p>Practical on marking, punching and rough grinding on pedestal grinder.</p>	<p>-Description of hand tools, Safety precautions, care and maintenance and material from which they are made.</p> <p>-Ferrous and nonferrous metal and their identification by different methods.</p> <p>Application and use of pedestal grinder.</p>	<p>-do-</p> <p>Use of drawing instruments – Drawing of straight, inclined and curved lines.</p>	<p>Introduction to Property and uses of C.I. and wrought Iron. Iron and steel properties and uses.</p> <p>Properties and uses of plain carbon steel and alloy steel.</p>
4.	Grinding of Chisels,	Theory of Semi precision	Exercise on linear	Properties and uses of

	Hack sawing, Measuring different types of jobs by steel rule caliper etc.	instruments.	and angular measurements.	non ferrous metals and alloys Fraction and decimal -conversion fraction decimal and vice-versa.
5.	Drilling, reaming, tapping and threading with dies and use of coolants.	Relation between drill & tap sizes, care of taps and dies and their correct use. Types, properties and selection of coolants and lubricants.	Types of lines their meaning & application as per BIS SP: 46-2003.	Properties and uses of copper, zinc, lead, tin, aluminum.
6.	Drilling different sizes of holes by hand and machine. Use of screw drivers, spanners, pliers etc. simple fitting.	Brief description of drilling machine use and care.	Simple conventional symbols for material and parts as per BIS SP: 46-2003. Geometrical construction of rectangles, square, circles.	Composition, properties and uses of brass, bronze, solder, bearing material, timber, rubber etc.
7.	Filing practice, simple fitting.	Heat treatment of metals, its importance, various methods of heat treatment such as hardening, tempering, normalizing, annealing etc.	Simple conventional symbols for material and parts as per BIS SP: 46-2003. Geometrical construction of rectangles, square, circles.	Composition, properties and uses of brass, bronze, solder, bearing material, timber, rubber etc.
8.	Centre lathe and parts, setting of jobs and tools grinding of lathe tools of various angles.	Brief description of a Centre lathe, its use.	Geometrical construction of polygon and ellipse, parabola & hyperbola.	System of units, British, metric and SI units for length, area, volume capacity, weight, time, angle, their conversions. Effect of alloying elements in the properties of C.I. & steel.
9.	Parallel turning, taper turning and boring. Using compound rest and TT attachment.	Lathe tools and their uses taper and its types and problems on taper. Taper turning methods and	Geometrical construction of involutes, oval, and helix.	Unit of temperature for & related problems. Standard & absolute temp.

		calculations. i.e. Form tool, TT attachment, Compound rest etc.		
10.	Simple screw cutting (External and Internal)	Method of screw cutting simple calculation. Tap size drill size & vice versa.	Free hand sketching of straight lines, rectangles, circles, square, polygons, ellipse.	Mass, volume, density, weight, sp. Gravity & specific weight. S.I. M.K.S. and F.P.S. units of force, weight etc. their conversion to related problems.
11.	Simple plain turning	Thread and its element types.	-do-	-do-
12.	Safety rule on shop floor maintenance and control of grinding machines oiling cleaning etc.	Introduction to Grinding trade and machine safety precautions according to IS: 1991-1962.	Standard printing style for letters and numbers as per BIS : SP: 46-2003 using stencils	Inertia, rest and motion, velocity and acceleration.
13.	Measurement of different types of job by steel rule, caliper etc. Taper by angular protractor.	General measuring tools (used in grinding shop) their description, use care and maintenance.	Free hand sketching of simple geometrical solids, cube, cone, prism, cylinder, sphere, pyramids.	Types of forces, its units and Weight calculation.
14.	Setting grinding wheel on wheel flange, truing and balancing of wheels. Dressing of grinding wheel	General dressing tools used in grinding section such as wheel, diamond dresser, steel type dresser, abrasive dresser and nonferrous dresser.	Scales- Types & its use.	Revision & Test Power and roots Factor, Power base exponents number. Multiplication and division of power and root of a number. Square root of number and problems
15.	Checking measuring various types of jobs using micrometers, Vernier caliper, Vernier Height gauge etc. Grinding practice on cylindrical grinding machine.	Precision instruments English and metric micrometer, vernier caliper, dial test indicator etc. their description and uses.	Revision & Test Construction of diagonal scale.	Heat & temperature, thermometric scales, their conversions.
16.	Grinding practice on surface and cylindrical	Principle and value of grinding in finishing	Simple dimensioning	Work energy and power, their units and applied

	grinding machine (Grinding should be performed both on soft and hardened materials). Checking dimension by Vernier height gauge.	process, various types of grinding wheels their construction and characteristic glazed and loaded wheels.	technique, size and location, dimensions of parts, holes angles, taper, screw etc. as per BIS SP: 46-2003.	problems.
17.	Grinding practice on surface and cylindrical grinding machine. Grinding parallel block and plain mandrel to size.	-do-	Transferring measurements for linear, angular, circular dimensions from the given object to the related free hand sketches using different measuring instruments.	----do-----
18.	Rough and finish grinding of surface and cylindrical job according to drawings. Include diamond and CBN	Different types of abrasive, manufacture of grinding wheels, their grades.	Pictorial drawings, isometric drawings of simple geometrical solids.	Percentage, changing percentage to decimal and fraction and vice versa. Applied problems.
19	Demonstration on selection of grinding wheels for grinding different metals, selection of suitable wheel to obtain rough and IS: 1249- 1958.	Factors effecting selection of wheels, identification of wheel, marking system of grinding wheels IS: 551-1966.	Pictorial drawings, isometric drawings of simple geometrical solids.	Percentage, changing percentage to decimal and fraction and vice versa. Applied problems.
20	Grinding different metals with suitable grinding wheels.	Grit and different types of bonds, such as vitrified, resinoid, rubber etc. Different types of metals and electroplated bond.	Oblique/orthographic projection of simple geometrical solids	Problem on percentage related to trade.
21.	Externals and internal grinding operation, changing the wheel speed, obtain recommended wheel and controlling depth.	Grinding wheel speed, surface speed per minute conversion of peripheral speed to r.p.m. Depth of cut and range at usefulness.	Orthographic drawings: Application of both the first angle and third angle. Isometric drawing of simple machined &	-do- Different types of loads, stress, strain, modulus of elasticity. Ultimate strength, different types of stress, factor of safety, examples.

			casting blocks.	
22.	Grinding sockets, morse taper and checking depth by depth gauge micrometer. Grinding External sleeve.	Depth micrometer and vernier caliper. Common types of surface grinding machine, plain surface, rotary surface, horizontal and vertical surface grinder etc. Method of grinding tapers.	Free hand sketches of trade related hand tools and measuring tools.	Ratio & proportion- Ratio, finding forms ratio proportions, direct proportion and indirect proportion. Application of ratio and proportion & related problems.
23 - 24	Revision			
25	Examination			

Second Semester (Semester Code No MCG – 02)

Duration: Six Months

Learning Objectives (2nd Semester)

Achievements: On completion of Semester-II, the trainee shall be able to:

1. Setup cylindrical grinder for automatic movements for parallel grinding
2. Test and mount wheels sleeves, truing and rebalancing for grinding parallel mandrel.
3. Perform Wheel balancing and dressing for grinding long bar using steady rest.
4. Grinding different types of jobs using machine chuck, face angle plate collets.
5. Align table for parallel grinding or taper grinding (by swiveling machine table)
6. Grind eccentric job and different types of jobs using jigs and fixtures angle plates.
7. Setup Tool & cutter grinder for sharpening / grinding tools and cutters
8. Grind to sharpen plain/slot/side and face milling cutter.
9. Grind to sharpen drills reamers and taps.
10. Grind different classes of metals such as cast iron brass, bronze, aluminium, carbide tip and different classes of steel (by Dry and wet grinding)
11. Setup surface grinder for automatic movements for grinding
12. Grind jobs by using face plate angle plate

Detailed Syllabus:

WK NO.	TRADE PRACTICAL	TRADE THEORY	ENGINEERING DRAWING	WORKSHOP CALCULATION & SCIENCE
1.	Introduction Training- Revision of previous works. Machine setting for automatic movements and parallel grinding on cylindrical grinder.	Introduction Training- Revision of previous works. Common types of grinding machines. Plain cylindrical external and internal cylindrical grinder and universal grinder.	Simple sketches of trade related hand tools & measuring instruments	Simple machines-principle, velocity ratio, mechanical advantage, efficiency, related problems.

2.	Testing and mounting wheels sleeves, truing and rebalancing and grinding parallel mandrel.	Test for alignment and checking, balancing at wheel, dressing different types of wheel, dressers, their description and uses.	Introduction to Orthographic Views And its advantages.	-do-
3.	Wheel balance and dressing grinding long bar using steady rest.	Test for alignment and checking, balancing of wheel, dressing different types of wheel, dressers their description and uses.	Orthographic drawings, application of both the first angle and third angle. Method of representing the drawings for simple and complex machine parts, exercises with dimensions.	Algebraic symbols, fundamental algebra operations, sign and symbols used in algebra, coefficient terms, and unlike terms.
4.	Grinding different types of jobs using machine chuck, face angle plate collets.	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.	----do----	Algebraic addition, subtraction, multiplication and division.
5.	Table alignment with the help of test bar and dial test indicator parallel grinding and taper grinding (by swiveling machine table)	External grinding operational steps in external grinding of a job and precautions to be taken.	Standard method of sectioning as per BIS: SP: 46-2003. Exercises for different sectional views on the given orthographic drawing of machine part, castings etc. Orthographic drawings in first angle projection	Simple machines like winch pulley and compounding axle etc.
6.	Grinding of eccentric job and different types of jobs using jigs and fixtures angle plates.	Holding devices such as jig and fixture angle plates 'V' blocks etc. their description and uses.	Orthographic drawings in the first angle projection	Calculation of tap hole sizes for internal threads and blank size for cutting external threads.
7.	Grinding of job by using face plate angle plate etc.	Internal grinding operational steps in internal grinding of a	Orthographic drawings in the third angle	-----do-----

		job precautions to be taken.	projection	
8.	Grinding of plain/slot milling cutter.	Milling cutters and its nomenclature.	-do-	Factors and equations: Algebraic formula and solving simple equations.
9.	- do -	Grinding of bushes and cylinders steps and precautions to be taken.	--do--	Factors and different types of factorization (LCM, HCF).
10.	Grinding bushes on mandrel within the close tolerance limits.	Rough and finish grinding limit fit and tolerances as per ISI: 919-1963. Basic size and its deviation, position of tolerances as per ISI: 919-1963. Basic size and its deviation, position of tolerance zones with respect of zero line. Fits different types clearance, interference and transition. Interchangeable system. Letter symbols for holes and shaft and fundamental deviation hole basis and shaft basis system.	Standard method of sectioning as per BIS. SP: 46-2003. Exercises for different sectional views on the given orthographic drawing of machine parts, casting etc	Equations simple simultaneous equation.
11.	Dry and wet grinding of different classes of metals such as cast iron , barzed carbide tip and different classes of steel.	Heat generated in grinding dry and wet grinding use of coolant, their composition and selection. Characteristic of coolant.	-do-	Simple simultaneous equation.
12.	Grinding square block angle plate and angular block.	Grinding a square job grinding angular surface taker grinding by stane land taper and angle protractor.	Conversion of isometric, oblique drawings to orthographic drawings and vice-versa. Related problems such as 'V' block oriented by various machining	Application, construction and solution of problems by equation.

			operations etc.	
13.	Grinding practice on drills reamers and taps.	Methods of grinding of drills reamers and taps.	-----do---	Atmospheric pressure, pressure gauge, gauge pressure and absolute pressure and their units.
14.	Grinding slitting saw and side and face milling cutter.	Methods of grinding of milling cutters such as slitting saws, side and face milling cutter etc.	-----do---	-do-
15.	Checking tapered or angular jobs with help of sine bar, Dial gauge.	Use of snap gauges, sine bar and slip gauges their description and uses. Polishing, lapping powder and emery clothes lapping flat surface.	Method of representing the drawings for simple and complex machine blocks given for exercises with dimensions.	Simple problems on multiplication, division, power and root using calculator.
16.	Grinding milling cutter with straight flutes	Tools and cutter grinder their description, working principles, operations care and maintenance.	Reading of production drawing including machining symbol, GD&T	Power and exponent. Laws of exponent.
17.	Grinding milling cutter with helical flutes	Special types of grinding machines and centreless grinders. Their description, working principles, operations, care and maintenance.	Surface development of simple geometrical solids like cube, rectangular block, cone, pyramid, cylinder, prism etc.	Relation between specific gravity and density simple experimental determination.
18.	Grinding internal bore of cylindrical job and use of telescopic gauge.	Grinding defects vibration, chattering, glazing and loading their causes and remedies.	-----do---	Geometry: Fundamental geometrical definition-angles and properties of angles, triangles, and properties of triangles.
19.	-Do-	Grinding different defects and remedies on its.	Interpretation of solids and conventional	Pythagoras theorem, properties of similar triangles.

			application of intersectional curves on drawing. Solution of NCVT test paper (preliminary) Revision.	Revision.
20.	Grinding carbide tipped tools and gauges (rough and finish grinding using disc and diamond wheels)	Applications of diamond wheel in grinding and grinding of tipped tools.	Interpretation of solids and conventional application of intersectional curves on drawing. Solution of NCVT test paper (preliminary) Revision.	Pythagoras theorem, properties of similar triangles. Revision.
21.	Making simple utility jobs with surface and cylindrical grinders. Preventive maintenance of grinding machines.	Preventive maintenance and its necessity. Mode of frequency of lubrication. Preparation of Maintenance schedule, simple estimation, use of hand book and reference table.	Sketches for bolts, nuts, screws and other screwed members.	Definition and units of torque. Pythagoras theorem, properties of similar triangles. Revision.
22-23	In-plant training / Project work (work in a team)			
24	Revision			
25	Examination			

Third Semester (Semester Code No. (MCG – 03))

Duration: Six Month

Learning Objectives (3rd Semester)

Achievements: On completion of Semester-III, the trainee shall be able to:

1. Grind plain flat surfaces of Vee block
2. Grind Cylindrical bore grinding
3. Perform Wheels dressing for rough and finishing grinding a cube to close limit.
4. Grind cylindrical shoulder on cylinder-grinding machine to close limit h7.
5. Grind slots on surface grinding machines to close limit H7.

6. Identify different faults while grinding-Cracks, blow holes and chatter.
7. Grind Snap gauge, ring gauge, plug gauge grinding in close limit.
8. Grind long cylindrical job using steady rest to close limit h6.
9. Grind thin plates using coolants to close limits h6.
10. Grind parallel and taper pins using chuck and collets-h6.

Detailed Syllabus:

WK NO.	TRADE PRACTICAL	TRADE THEORY	ENGINEERING DRAWING	WORKSHOP CALCULATION & SCIENCE
1.	Cylindrical and surfaces grinding practice (Maintaining parallelism) on both soft and hard metals.	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.	Revision of first year topics.	Revision of 1 st year course.
2.	Practice on tools and cutter grinding machine. Machine manipulation and control Mounting jobs on mandrel. Mounting of wheel and guards sharpening of lathe tools and drill on pedestal grinder etc.	Tool and cutter grinding machine-parts and accessories, description use, care and maintenance, pedestal grinder and bench grinder-their description and uses.	Machined components and surface finish symbols.	Heat and temperature, thermometric scales their conversions.
3.	Grinding practice on plain flat surface with close tolerances	Dial test indicators marking block, height gauge and surface plate their description.	Screw thread, their standard forms as per BIS, external and internal thread, conventions on the features for drawing as per BIS.	Rectangle, square, Rhombus, parallelogram and their properties.
4.	Grinding practice on angular surface like V block	Principle of vernier caliper, protractors, micrometers (O/S, I/S and depth) and other	Sketches for bolts, nuts, screws and other screwed members.	Circle and properties circle: regular polygons. Application of geometrical

		instruments having vernier graduations. Combination sets-their use care and maintenance.		to shop problems.
5.	Parallel block grinding on surface grinding machine within close limits. Plane cylindrical grinding practice to close limit with accuracy of h7.	Bonding materials their kinds description and uses. Grade and structure at grinding wheels. Brief about I.S.O. 9000. Importance of Quality.	Sketching of foundation bolts and types of washers.	Forces definition. Compressive, tensile, shear forces and simple problems.
6.	Cylindrical bore grinding practice. Setting and turning of jobs on chucks and face plates.	Wheel marking system selection of wheels. Specification and types (shapes & size) of grinding wheels, diamond wheels and their uses.	Standard rivet forms as per BIS.	-do-
7.	Balancing and mounting of grinding wheel Rt. angle grinding practice on surface grinding machine.	Mounting of grinding wheels, grinding wheels, collets and mandrels, balancing of grinding wheels by different methods.	Riveted joints-Butt & Lap.	Temperature measuring instruments. Specific heats of solids & liquids, quantity of heat.
8.	Wheels dressing for rough and finishing grinding. Grinding a cube to close limit.	Types of dresses-steel type, abrasive Diamond tool and rotary dresses abrasive bricks and sticks their description, use, care and maintenance.	Sketches of keys, cotter and pin joints.	Heat loss and heat gain, with simple problems.
9.	Shoulder grinding practice on cylinder-grinding machine to close limit h7.	Dressing and truing of grinding wheels advantage of balancing, inspections and care of grinding wheels. Wheel storage.	-do-	Mensuration: Plain figures-triangles, square, rectangle, parallelogram.
10.	Slot grinding practice on surface grinding machines to close limits H7. Finding of different faults while grinding-Cracks, blow holes, chatters.	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	Sketches for simple pipe, unions with simple pipe line drawings.	Mensuration : Plain figures-segment and sector of circle, ellipse, fillets. Plain figures. Trapezium, regular polygons, circle, hollow circles.

		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.		
11.	Snap gauge grinding practice in close limit.	Gauges-feeler, taper gauge radius, plug, ring snap (fixed and adjustable) and slip their description use care and maintenance.	---do---	Mensuration: Solid figures: Prism, cylinder, pyramid, cone. Solid figures: frustum of a cone, sphere, spherical segment.
12.	Grinding practice on cylindrical taper using standards ring gauges.	Inside micrometer depth gauge, special types of micrometers, universal dial test indicator their construction and function.	Concept of preparation of assembly drawing and detailing. Simple assemblies & their details of trade related tools/job/exercises with the dimensions from the given sample or models.	Material weight and cost problems related to trade.
13.	Grinding practice of ring gauge using plug gauge.	Special type of grinding machine centreless, thread crankshaft etc. their description, use care and maintenance.	Single Tool post for the lathe with washer and screw	Trigonometry: trigonometric ratios, use of trigonometric table.
14.	Grinding long cylindrical using steady rest to close limit h6.	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	Details and assembly of Vee-blocks with clamps.	Area of triangle by trigonometry.

15.	Grinding thin plates using coolants to close limits h6.	Principle types of grinding fluids importance of uniform temperature, selection and use at grinding fluids, method of supplying grinding fluids.	Details and assembly of Vee-blocks with clamps.	Finding height and distance by trigonometry.
16.	Grinding practice on parallel and taper pins using chuck and collets-h6.	Types of holding devices methods of holding work, type of centres - holding work between centres types of chucks and holding process in chucks.	Details of assembly of shaft and pulley. Industrial visit.	Application of trigonometry in shop problems. Industrial visit.
17.	Selection of grinding wheel and grinding practice on rectangular bar of non-ferrous metals.	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.	Details of assembly of shaft and pulley.	Application of trigonometry in shop problems
18.	Grinding practice on machine centre to close limit h6 or H6.	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.	Details of assembly of bush bearing.	-do-
19.	Facing and Chamfering practice.	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.	Details of assembly bush bearing.	-do-

20.	Step grinding practice on surface grinding machine to close limit h6 or H6.	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.	Details of assembly of a simple coupling.	Levers-definition, types and principles of levers.
21.	V-block grinding practice.	Process of grinding angular surfaces. Grinding slots and grooves. Grinding "V" blocks. Recommended wheel speeds for surface grinding machines.	Sketching of different gear wheels and nomenclature.	Mechanical Advantage, velocity ratio and mechanical efficiency
22 - 23	In-plant training / Project work (work in a team)			
24	Revision			
25	Examination			

Fourth Semester (Semester Code No. **MCG - 04**)

Duration: Six Month

Learning Objectives (4th Semester)

Achievements: On completion of Semester-IV, the trainee shall be able to:

1. Grind Angular forms grinding practice.
2. Grind Compound or double taper on cylindrical grinder.
3. Grind Steep taper, grinding practice on lathe centre.
4. Grind Morse taper-plug and metric tapers.
5. Set up for Taper grinding using sine bar D.T.I. and gauge blocks to close limit h6.
6. Grind internal step grinding to close limit on ring gauge, to close limit-H6.
7. Grind to sharpen single angle cutter by using work head.
8. Grind cylindrical slot to close limit h5.
9. Sharpen tools, drills, scrapers and chisels.
10. Grind Form, radius, angle on concave & convex cutter.

11. Sharpen Spiral milling cutter, end mill cutter and taps
12. Perform Lapping on flat surface and cylindrical surface
13. Finish by buffing process to very close limit h5.
14. Check and evaluate the finished component for Quality of surface finish

Detailed Syllabus:

WK NO.	TRADE PRACTICAL	TRADE THEORY	ENGINEERING DRAWING	WORKSHOP SCIENCE & CALCULATION
1	Introduction to CNC machine operation like Jog, Reference Edit, MDI ,Auto Mode Prog. Call & Entry, Simulation, Tool off-set & Tool changing /Orientation.	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.	Details and assembly of simple hand – vice.	Centre of gravity, simple experimental determination, stable, unstable & neutral equilibrium, simple explanation
2	Angular from grinding practice.	Cylindrical-types of cylindrical grinding operation traverse method, plunge cut method and form grinding method. Alignment of head stock and tail stock.	---do---	---do---
3	Grinding cylindrical steps with shoulder and chamfer.	Method of plain cylindrical surface grinding step-grinding and shoulder and face grinding.	Blue print Reading. Simple exercises related to missing lines.	Friction- co-efficient of friction. Simple problem related to friction.
4	Compound or double taper grinding practice on cylindrical grinder.	Method of grinding external and angle (simple) taper and steep. Taper double compound taper.	---do---	Magnetic substances- natural and artificial magnets.
5.	Steep taper, grinding practice on lathe centre.	Use of universal head for angular grinding. Measuring and checking of taper and angles. Use of taper plug and ring gauges.	Simple exercises relating missing symbols. Missing views	Method of magnetisation. Use of magnets.
6.	Morse taper-plug grinding metric tapers.	Taper and angle checking by using protractors,	Simple exercises relating to missing	Electricity & its uses. Electric current-positive

		micrometer and rollers.	symbols. Missing views	& negative terminals.
7.	Taper grinding using sine bar D.T.I. and gauge blocks to close limit h6.	Use of sine bar and gauge block-taper checking by sine bar gauge block D.T.I. micrometer and rollers. Other out of round surfaces. Holding work with fixed steady rest.	Simple exercises related to missing section.	Use of fuses and switches, conductors and insulators.
8.	Prepare different types of documentation as per industrial need by different methods of recording information	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	Simple exercises related to missing section.	Simple electric circuits, simple calculations.
9.	Grinding Taper up to close limit H6.Grinding lathe centre.	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	-do-	Ohm's Law. Simple calculation, electrical insulating materials.
10.	Internal step grinding to close limit, ring gauge, grinding to close limit-H6. Grinding of single angle cutter.	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	---do---	Transmission of power by belt, pulleys & gear drive. Calculation of Transmission of power by belt pulley and gear drive.

		grinding threads and thread calculation.		
11.	Cylindrical slot grinding to close limit h5.	Thread grinding method of holding jobs method of grinding threads and thread calculation.	Sketching of different types of bearings and its conventional representation.	-do-
12.	Grinding of angular cutter by using work head.	Various types of thread grinding wheels and their selection. Types of dressers and process of process of dressing selection of coolants and their use.	----do---	Read images, graphs, diagrams –bar chart, pie chart Graphs: abscissa and ordinates, graphs of straight line, related to two sets of varying quantities.
13.	Lapping practice on flat surface. Lapping practice on cylindrical surface and buffing practice to close limits h5.	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	Solution of NCVT test. Basic electrical and electronic symbols	-do-
14.	Sharpening tools and drills, sharpening scrapers and chisels.	Grinding boring tools shaping tools, slotting tools, tools planning and drills, grinding of scrapers, chisels and carbide tipped tools. Selection of wheels fluids etc. and methods of grinding.	Study of drawing & Estimation of materials.	Stress, strain, Hooks law, ultimate strength, factor of safety definitions and problems on them.
15.	Grinding of spiral path.	Grinding defects and their corrections, inaccurate work out of round, out of parallel taper on and irregular marks spiral scratches, discoloured burnt surface etc.	Solution of NCVT test papers.	-do- Mechanical properties of metals. Heat treatment and advantages.
16.	Form grinding radius angle, Grinding of	Grinding defects and their correction.	Solution of NCVT	-do- Mechanical properties

	concave & convex cutter.	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.	test papers.	of metals. Heat treatment and advantages.
17.	Slitting saw sharpening practice using tooth rest.	Cutter grinding necessity of sharpening. General method of sharpening milling cutters-clearance angles. Use of setting gauges. Sharpening methods of plain or key way cutters	Solution of NCVT test papers.	Basic Electronic: Introduction to wiring symbols, units, resistor, capacitor and inductor.
18.	Side and face milling cutter sharpening practice.	Method of indexing direction of wheel rotation, wheel dressing. Types of cutter grinding wheels and their selection. Types of tooth rests and their location. Grinding peripheral teeth on a side and face milling cutter use of indexing attachment.	Revision	Solution of NCVT test papers.
19.	Spiral milling cutter sharpening practice.	Calculation of clearance angle. Setting for cup wheels and straight wheels. Recommended clearance angles for different materials to be cut primary and secondary clearance width of lands.	Revision	Solution of NCVT test papers.
20.	Sharpening end mill cutter.	Sharpening of helical milling cutter using linear and angular setting methods. Sharpening shell end mill and angular cutters	Revision	----do---
21.	Sharpening tap	Grinding flutes of form cutters, grinding taps, reamers, similar types of cutting tools, use of	Revision	----do---

		universal attachment. Hones and honing- Type of honing stones-their description and use. Amount and rate of stock removal. Adjustment for elementary honing condition, honing tolerances.		
22- 23	In-plant training / Project work (work in a team)			
24	Revision			
25	Examination			

9.2 SYLLABUS CONTENT OF CORE SKILLS

First Semester(Semester Code No. MCG - 01)

Duration: Six Month

Learning Objectives (1st Semester)

1. Demonstrate basic arithmetic to derive value of unknown quantity / variable.
2. Understand & apply engineering material, their classification, properties and applications in the day to day technical application.
3. Explain & apply speed, velocity, work, power & energy for application in field of work.
4. Understand & explain importance of engineering drawing, drawing instruments, their standard & uses.
5. Draw lines, geometrical figures, free hand sketches.
6. Understand and apply sizes & layout of drawing sheet, method of presentation of engineering drawing & symbolic representation as per BIS standards

Sl. No.	Professional Knowledge	Professional Knowledge & Skills
	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

		<ul style="list-style-type: none"> - Rectangle, Square, Rhombus, Parallelogram. - Circle and its elements.
5.	Percentage: Introduction, Simple calculation. Changing percentage to decimal and fraction and vice-versa.	Lettering and Numbering as per BIS SP46-2003: <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 (Semester Code No MCG - 02)

Duration: Six Months

Learning Objectives (2nd Semester)

1. Demonstrate basic algebraic, mensuration, trigonometric facts and formulas to derive value of unknown quantity / variable.
2. Apply the factual knowledge of basic heat & temperature, basic electricity for day to day practical application.
3. Explain & apply principles of simple machine & levers for mechanical advantage, efficiency for practical application.
4. Draw & practice dimensioning, construction of solid figures and projections as per IS specifications.

Sl. No.	Professional Knowledge	Professional Knowledge & Skills
	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.	<p>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 electrical energy.</p>	<p>Drawing of Solid figures (Cube, Cuboids, Cone, Prism, Pyramid, Frustum of Cone and Pyramid.) with dimensions.</p>
6.	<p>Levers and Simple Machines: 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>	<p>Free Hand sketch of hand tools and measuring tools used in respective trades.</p>
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.		<p>Drawing of Orthographic projection from isometric/3D view of blocks</p>
9.		<p>Orthographic Drawing of simple fastener (Rivet, Bolts, Nuts & Screw)</p>
10.		<p>Drawing details of two simple mating blocks and assembled view.</p>

Third Semester (Semester Code No MCG - 03)

Duration: Six Months

Learning Objectives (3rd Semester)

1. Demonstrate & apply calculation of area of cut-out regular & irregular surfaces, Volume of geometrical shapes and their cut section in related shop floor problems.
2. Calculate value of unknown sides and angles of geometrical shapes by trigonometrical methods and apply in shop floor problems.
3. Understand & apply concept of forces, stress & strain, factor of safety for practical application.
4. Factual knowledge of thermal conductivity, temperature measuring instruments, average velocity and circular motion for day to day application.
5. Understanding drawing of machined components & related symbols for use in manufacturing purpose.
6. Draw free hand sketches for fasteners, hand tools and components.
7. Prepare simple assembly drawings & their details.

Sl. No.	Professional Knowledge	Professional Knowledge & Skills
	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.	<ul style="list-style-type: none"> - Forces definition. - Compressive, tensile, shear forces and simple problems. -Stress, strain, ultimate strength, factor of safety. -Basic study of stress-strain curve for MS. 	<ul style="list-style-type: none"> - Free hand Sketches for simple pipe, unions with simple pipe line drawings.
10.	<ul style="list-style-type: none"> - Temperature measuring instruments. Specific heats of solids & liquids. 	<ul style="list-style-type: none"> - 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.	<ul style="list-style-type: none"> - Thermal Conductivity, Heat loss and heat gain. 	<ul style="list-style-type: none"> -Free hand sketch of trade related components / parts (viz., single tool post for the lathe, etc.)
12.	<ul style="list-style-type: none"> - Average Velocity, Acceleration & Retardation. - Related problems. 	<ul style="list-style-type: none"> - Study of assembled views of Vee-blocks with clamps.
13.	<ul style="list-style-type: none"> - Circular Motion: Relation between circular motion and Linear motion, Centrifugal force, Centripetal force 	<ul style="list-style-type: none"> - Study of assembled views of shaft and pulley.
14.		<ul style="list-style-type: none"> - Study of assembled views of bush bearing.
15.		<ul style="list-style-type: none"> - Study of assembled views of a simple coupling.
16.		<ul style="list-style-type: none"> - Free hand Sketching of different gear wheels and nomenclature.

Fourth Semester (Semester Code No. MCN - 04)

Duration: Six Months

Learning Objectives (4th Semester)

1. Read & interpret different types graphs.
2. Solve simple statistical problem and apply sampling method for inspection purpose.
3. Factual knowledge of friction, magnetism and their application and affects.
4. Understand the application of electrical insulating materials & concept of earthing.
5. Understand & apply transmission of power, heat treatment & their advantages.
6. Factual knowledge of pressure, its units and measuring system and understand basic concept of pneumatics & hydraulic system.
7. Draw free hand sketches of bench vice and bearing.
8. Understand & identify missing lines, symbols & views.
9. Estimate material required as per drawing.

Sl. No.	Professional Knowledge	Professional Knowledge & Skills
	Workshop Calculation and Science	Engineering Drawing
1.	Graph: - 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.	Simple problem on Statistics: - 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).	- Simple exercises relating missing symbols. - Missing views
4.	- Friction- co-efficient of friction, application and effects of friction in Workshop practice. Centre of gravity and its practical application.	- Simple exercises related to missing section.
5.	- Magnetic substances- natural and artificial magnets. - Method of magnetization. Use of	-Free hand sketching of different types of bearings and its conventional representation.

	magnets.	
6.	- Electrical insulating materials. - Basic concept of earthing.	- Free hand sketching of different gear wheels and nomenclature/ Simple duct (for RAC). Free hand sketch of Reciprocating compressor – open type (for RAC)
7.	- Transmission of power by belt, pulleys & gear drive. - Calculation of Transmission of power by belt pulley and gear drive.	- Solution of NCVT test. - Simple exercises related to trade related symbols. - Basic electrical and electronic symbols
8.	- Heat treatment and advantages.	- Study of drawing & Estimation of materials.
9.	Concept of pressure – units of pressure, atmospheric pressure, absolute pressure, gauge pressure – gauges used for measuring pressure	- Solution of NCVT test papers.
10.	Introduction to pneumatics & hydraulics systems.	

10. SYLLABUS CONTENT OF EMPLOYABILITY SKILLS

General Information

Name of the subject	: EMPLOYABILITY SKILLS
Applicability	: CTS- Mandatory for all trades ATS- Mandatory for fresher only
Hours of Instruction	110 Hrs.
Examination	: The examination shall be held at the end of semesters.
Instructor Qualification	<ul style="list-style-type: none"> • 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 ITIs and • Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above or • Existing Social Studies Instructors duly trained in Employability Skills from DGET institutes
Instructor	<ul style="list-style-type: none"> • One full-time instructor is required for 1000 seats and above • For seats less than 1000, the instructor may be out sourced/ hired on contract basis.

Semester-wise Distribution of Topics (Employability Skill)

Course Duration	Topics		Examination
	Semester 1	Semester 2	
01 Year (Two semesters)	1. English Literacy 2. I.T. Literacy 3. Communication Skills	1. Entrepreneurship Skills 2. Productivity 3. Occupational Safety , Health, and Environment Education 4. Labour Welfare 5. Legislation 6. Quality Tools	Final examination at the end of second semester

Syllabus Content for Employability Skills

Semester 1

Learning Objectives (1st semester)

1. Read, write and communicate in English language for day to day work.
2. Communicate in written and oral and with required clarity ensuring that the information communicated is clear, concise and accurate.
3. Understand and apply basic computer working, basic operating system and uses internet services to get accustomed & take benefit of IT developments in the industry.

1. English Literacy	
Hours of Instruction: 20 Hrs.	
Marks Allotted: 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, picture reading gain confidence through role-playing and discussions on current happening job description, asking about someone's job habitual actions. Cardinal (fundamental) numbers ordinal numbers. Taking messages, passing messages on and filling in message forms Greeting and introductions office hospitality, Resumes or curriculum vita essential parts, letters of application reference to previous communication.
2. I.T. Literacy	
Hours of Instruction: 20 Hrs.	
Marks Allotted: 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 and INTERNET	<p>Basic of computer Networks (using real life examples), Definitions of 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.</p>
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3. Communication Skills

Hour of Instruction: 15 Hrs.Marks Allotted: 07

Topic	Contents
Introduction to Communication Skills	Communication and its importance
	Principles of Effective communication
	Types of communication – verbal, nonverbal, written, email, talking on phone.
	Nonverbal 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

Learning Objectives (2nd Semester)

LEARNING OBJECTIVES OF 2ND SEMESTER

1. Knowledge of business activities, ability to interact with consumers for development of businesses.
2. Understand and apply productivity, its benefits and factors affecting the productivity.
3. Follow and maintain procedures to achieve a safe working environment in line with occupational health, safety, environment regulations and Labour welfare legislation and requirements.
4. Understand and apply quality concepts as per ISO and BIS system and its importance.
5. Recognize different components of 5S and apply the same in the working environment.

4. Entrepreneurship skill Hour of Instruction: 15 Hrs.Marks Allotted: 06	
Topic	Content
Business & Consumer:	Types of business in different trades and the importance of skill, Understanding the consumer, market through consumer behavior, market survey, Methods of Marketing, publicity and advertisement
Self-Employment:	Need and scope for self-employment, Qualities of a good Entrepreneur (values attitude, motive, etc.), SWOT and Risk Analysis
Govt Institutions :	Role of various Schemes and Institutes for self-employment i.e. DIC, SIDBI, MSME, NSIC, Financial institutions and banks
Initiation Formalities :	Project Formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment Procedure - Loan Procurement - Agencies - banking Process
5. Productivity Hour of Instruction: 10 Hrs.Marks Allotted: 05	
Productivity	Definition, Necessity, Meaning of GDP.
Benefits	Personal / Workman – Incentive, Production linked Bonus, Improvement in living standard. Industry Nation.
Affecting Factors	Skills, Working Aids, Automation, Environment, Motivation How improves or slows down.
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 & Environment Hour of Instruction: 15 Hrs.Marks Allotted: 06	
Safety & Health :	Introduction to Occupational Safety and Health and its importance at workplace
Occupational Hazards :	Occupational health, Occupational hygiene, Occupational Diseases/ Disorders & its prevention
Accident & safety :	Accident prevention techniques- control of accidents and safety measures
First Aid :	Care of injured & Sick at the workplaces, First-aid & Transportation of sick person
Basic Provisions :	Idea of basic provisions of safety, health, welfare under legislation of India
7.Labour Welfare Legislation Hour of Instruction: 05 Hrs.Marks Allotted: 03	
Labour Welfare Legislation	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 Hour of Instruction: 10 Hrs.Marks Allotted: 05	
Quality Consciousness :	Meaning of quality, Quality Characteristic
Quality Circles :	Definition, Advantage of small group activity, objectives of Quality Circle, Roles and Functions 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 Housekeeping, Practice of good Housekeeping.5S Principles of Housekeeping: SEIRI – Segregation, SEITON – Arrangement, SEISO – Cleaning, SEIKETSU – maintenance of Standards, SHITSUKE - Discipline

11. INFRASTRUCTURE

1. Instructors' Qualification	Degree in Mechanical Engineering from recognized Engineering College /university with one year experience in the relevant field. OR Diploma in Mechanical Engineering from recognized board of technical education with two years' experience in the relevant field. OR 10th Class Pass + NTC/NAC in the Trade of "Machinist Grinder" With 3 years post-qualification experience in the relevant field.
Desirable qualification	Preference will be given to a candidate with CIC (Craft Instructor Certificate) in Machinist Grinder Trade.
3. Space Norms	102 Sq. m
4. Power Norms	23.4 KW
5. Tools, Equipment & General Machinery	(As per Annexure II)

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Note:

- 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.
- ii) Instructor qualification for WCS and E.D, as per the training manual.
- iii) The list of Tools, Equipment& General Machinery listed in Annexure – II is for a particular trade (MACHINIST GRINDER) comprising of four semesters and not for a single semester.

12. ASSESSMENT STANDARD

11.1ASSESSMENT GUIDELINES:

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 the assessment. Due consideration shall be given while assessing for teamwork, avoidance/reduction of scrap/wastage and disposal of scarp/wastage as per procedure, behavioral attitude, sensitive to environment and regularity in training. The sensitivity towards OSHE and self-learning attitude shall be considered while assessing competency.

Assessment shall be evidence based comprising the following:

- 1) Job carried out in labs/workshop
- 2) Record book/ daily diary
- 3) Answer sheet for assessment
- 4) Viva-voce
- 5) Progress Chart
- 6) Attendance and punctuality
- 7) Assignment
- 8) Project work

Evidence of internal assessment should be preserved for an appropriate period of time for audit and verification by examination body.

The following marking pattern to be adopted while assessing:

a) Weightage in the range of 60-75% to be allotted during assessment under following performance level:

For performance in this grade, the candidate with occasional guidance and showing due regard for safety procedures and practices, has produced work that demonstrates attainment of an acceptable standard of craftsmanship. In this work there is evidence of:

- 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 above75%- 90% to be allotted during assessment under following performance level:

For this grade, the candidate, with little guidance and showing due regard for safety procedures and practices, has produced work that demonstrates attainment of a reasonable standard of craftsmanship. In this work there is evidence of:

- Good skill levels in the use of hand tools, machine tools, and workshop equipment
- 70-80% tolerance dimension achieved while undertaking different work with those demanded by the component/job.
- 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 under following performance level:

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. In this work there is evidence of:

- 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.

12.2. INTERNAL ASSESSMENT (FORMATIVE ASSESSMENT)

Comp. No.	ASSESSABLE OUTCOME	INTERNAL ASSESSMENT Marks
GENERIC		
1.	Recognize & comply safe working practices, environment regulation and housekeeping.	
2.	Work in a team, understand and practice soft skills, technical English to communicate with required clarity.	
3.	Demonstrate knowledge of concept and principles of basic arithmetic, algebraic, trigonometric, statistics, co-ordinate system and apply knowledge of specific area to perform practical operations.	
4.	Understand and explain basic science in the field of study including basic electrical, and hydraulics & pneumatics.	
5.	Read and apply engineering drawing for different application in the field of work.	
6.	Understand and explain the concepts of productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.	
7.	Explain energy conservation, global warming, and pollution and contribute in the day to day work by optimally using available resources.	
8.	Explain personnel finance, entrepreneurship, and manage/organize related task in the day to day work for personal & societal growth.	
9.	Understand and apply basic computer working, basic operating system, and uses internet services to get accustomed & take benefit of IT developments in the industry.	
SPECIFIC		
10.	Perform marking out the components for chipping, filing, drilling, counter boring, countersinking, reaming, tapping fitting and allied operations with clear choice of procedures.	
11.	Plan and organize the work for different types of fitting operations and check for work result.	
12.	Set and produce the job with general tolerance on surface grinder.	
13.	Demonstrate practical skills in aligning/truing the work pieces and set of cutting tools for performing different turning operations (plain, step, taper turning, boring, v-thread cutting)	

	and check for accuracy without any assistance.	
	Sub-Total of Internal assessment for Semester- I	100
14.	Perform wheel checking, balancing, mounting, dressing, truing and setup automatic movement of table for cylindrical grinder and surface grinder.	
15.	Setup and produce long cylindrical parallel job, taper job, eccentric job, using cylindrical grinder and check for accuracy without any assistance.	
16.	Perform the grinding of different types of metals such as cast iron, bronze, aluminium, carbide tip and different class of steel by dry and wet grinding method.	
17.	Perform preventive maintenance of grinding machines.	
	Sub-Total of Internal assessment for Semester- II	100
18.	Setup and produce V- block, cube, parallel bar snap gauge, ring gauge, plug gauge, taper pin to close tolerances and check for accuracy without any assistance.	
19.	Perform thin plate grinding using coolant to close limits.	
20.	Perform slot grinding on surface grinding machine to close limit and check for accuracy without any assistance.	
21.	Understand, explain the constructional features and working principles of internal cylindrical grinder perform different types of bore grinding and check for accuracy.	
22.	Understand, explain the constructional features and working principles of tool and cutter grinder, set and sharpen the plain/slot/side and face milling cutter and check for accuracy.	
	Sub-Total of Internal assessment for Semester- III	100
23.	Set and sharpen the slitting saw, spiral milling cutter, end mill cutter, angular milling cutter, tap, reamer drill, and check for accuracy.	
24.	Perform form grinding viz. Angular, concave, convex using cylindrical and surface grinder.	
25.	Perform steep taper, morse taper, lathe centre grinding up to close limit and check for accuracy.	
26.	Grind different precession components viz. dowel pin, sinebar, slip gauges.	
	Sub-Total of Internal Assessment for Semester- IV	100
	Total of Internal Assessment	400

Note: The generic outcome to be assessed along with the specific outcome.

12.3 FINAL ASSESSMENT- All India Trade TEST (SUMMATIVE ASSESSMENT)

- There shall be a single objective type Examination paper for the subjects Engineering Drawing and Workshop Calculation & Science.
- There shall be a single objective type Examination paper for the subjects Trade Theory and Employability Skills.
- The two objective type Examination papers as mentioned above shall be conducted by National Council for Vocational Training (NCVT), whereas examination for the subject Trade Practical shall be conducted by the State Governments. NCVT shall supply the Question Paper for the subject Trade Practical.

MARKING PATTERN		
Sl. No.	Subject for the trade test	Maximum marks for the each subject
	Practical	300
	Trade Theory	200
	Employability Skills	Objective type Written Test of 200 marks (Trade Theory 150 Marks & Employability Skills 50 marks)
	Workshop Calculation and Science.	100
	Engineering Drawing	Objective Type Written test of 100 marks (Engineering Drawing 50 marks & Workshop Calculation and Science 50 marks)
	Internal assessment	100
TOTAL:		700

12. LIST OF TRADE COMMITTEE MEMBERS

Sl. No.	Name & Designation Sh/Mr./Ms.	Organization	Mentor Council Designation
Members of Sector Mentor council			
1.	A. D. Shahane, Vice-President, (Corporate Trg.)	Larsen & Turbo Ltd., Mumbai:400001	Chairman
2.	Dr. P.K.Jain, Professor	IIT, Roorkee, Roorkee- 247667, Uttarakhand	Member
3.	N. Ramakrishnan, Professor	IIT Gandhinagar, Gujarat- 382424	Member
4.	Dr. P.V.Rao, Professor	IIT Delhi, New Delhi-110016	Member
5.	Dr. Debdas Roy, Asstt. Professor	NIFFT, Hatia, Ranchi- 834003, Jharkhand	Member
6.	Dr. Anil Kumar Singh, Professor	NIFFT, Hatia, Ranchi- 834003, Jharkhand	Member
7.	Dr. P.P.Bandyopadhyay Professor	IIT Kharagpur, Kharagpur- 721302, West Bengal	Member
8.	Dr. P.K.Ray, Professor	IIT Kharagpur, Kharagpur- 721302, West Bengal	Member
9.	S. S. Maity, MD	Central Tool Room & Training Centre (CTTC), Bhubaneswar	Member
10.	Dr. Ramesh Babu N, Professor	IIT Madras, Chennai	Member
11.	R.K. Sridharan, Manager/HRDC	Bharat Heavy Electricals Ltd, Ranipet, Tamil Nadu	Member
12.	N. Krishna Murthy Principal Scientific Officer	CQA(Heavy Vehicles), DGQA, Chennai, Tamil Nadu	Member
13.	Sunil Khodke Training Manager	Bobst India Pvt. Ltd., Pune	Member
14.	Ajay Dhuri	TATA Motors, Pune	Member
15.	UdayApte	TATA Motors, Pune	Member
16.	H B Jagadeesh, Sr. Manager	HMT, Bengaluru	Member
17.	K Venugopal Director & COO	NTTF, Peenya, Bengaluru	Member
18.	B.A.Damahe, Principal L&T Institute of Technology	L&T Institute of Technology, Mumbai	Member
19.	Lakshmanan. R Senior Manager	BOSCH Ltd., Bengaluru	Member
20.	R C Agnihotri Principal	Indo- Swiss Training Centre Chandigarh, 160030	Member

Mentor			
21.	Sunil Kumar Gupta (Director)	DGET HQ, New Delhi.	Mentor
Members of Core Group			
22.	N. Nath. (ADT)	CSTARI, Kolkata	Co-ordinator
23.	H.Charles (TO)	NIMI, Chennai.	Member
24.	Sukhdev Singh (JDT)	ATI Kanpur	Team Leader
25.	Ravi Pandey (V.I)	ATI Kanpur	Member
26.	A.K. Nasakar (T.O)	ATI Kolkata	Member
27.	Samir Sarkar (T.O)	ATI Kolkata	Member
28.	J. Ram Eswara Rao (T.O)	RDAT Hyderabad	Member
29.	T.G. Kadam (T.O)	ATI Mumbai	Member
30.	K. Mahendar (DDT)	ATI Chennai	Member
31.	Shrikant S Sonnavane (T.O)	ATI Mumbai	Member
32.	K. Nagasrinivas(DDT)	ATI Hyderabad	Member
33.	G.N. Eswarappa (DDT)	FTI Bangalore	Member
34.	G. Govindan, Sr. Draughtsman	ATI Chennai	Member
35.	M.N.Renukaradhya, Dy.Director/Principal Grade I,	Govt. ITI, Tumkur Road, Banglore, Karnataka	Member
36.	B.V.Venkatesh Reddy. JTO	Govt. ITI, Tumkur Road, Banglore, Karnataka	Member
37.	N.M.Kajale, Principal,	Govt. ITI Velhe, Distt: Pune, Maharashtra	Member
38.	SubrataPolley, Instructor	ITI Howrah Homes, West Bengal	Member
39.	VINOD KUMAR.R Sr.Instructor	Govt.ITIDhanuvachapuram Trivandrum, Dist., Kerala	Member
40.	M. Anbalagan, B.E., Assistant Training Officer	Govt. ITI Coimbatore, Tamil Nadu	Member
41.	K. Lakshmi Narayanan, T.O.	DET, Tamil Nadu	Member
42.	R. N. Manna, TO	CSTARI, Kolkata	Member
Other industry representatives			
43.	VenugopalParvatikar	Skill Sonics, Bangalore	Member
44.	VenkataDasari	Skill Sonics, Bangalore	Member
45.	Srihari, D	CADEM Tech. Pvt. Ltd., Bengaluru	Member
46.	Dasarathi.G.V.	CADEM Tech. Pvt. Ltd., Bengaluru	Member
47.	L.R.S.Mani	Ohm Shakti Industries, Bengaluru	Member

TRADE: MACHINIST (GRINDER)**14. LIST OF TOOLS & EQUIPMENTS FOR 12 TRAINEES+4****A : TRAINEES TOOL KIT:**

Sr. No.	Description	Quantity
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, INSTRUMENTS, AND GENERAL SHOP OUT FITS

Sr. No.	Description	Quantity
M 1.	Hammer Copper 0.50 kg.	2 Nos.
M 2.	Hammer Engineers, Ball Peen 0.50 kg.	2 Nos.
M 3.	Scribing Block with adjustable Vertical spindle 225 mm 4 Angle Plate, adjustable (graduated in degrees) 150 x 150 x 150 mm	2 Nos.
M 4.	Blocks Vee 150 x 100 x 100 mm (fitted with clamps, hardened and ground)	2 Pairs.
M 5.	Blocks Vee (grooved and fitted with clamps) (Hardened and ground) 75 x 75 x 50 mm	2 Pairs.
M 6.	Block parallel, adjustable 150 mm long, 42 mm wide, 18 mm height (hardened and ground)	2 Pairs.
M 7.	Block, parallel, adjustable 100 mm long, 50 mm wide, 32 mm height (hardened and ground)	2 pairs.
8.	Calipers, Vernier 200 mm, inside and outside (graduated in inches and millimeters)	1 Each
9.	Calipers, Vernier, outside 300 mm (graduated in inches and millimeters)	4 Nos.
10.	C-clamps 50 mm, 100 mm and 150 mm	2 Each
M 11.	Oil can, Pressure delivery $\frac{1}{4}$ point capacity	4 Nos.
M12.	Oil can Drip delivery (long spout) $\frac{1}{4}$ point capacity	4 Nos.
13.	Height Gauge (Metric and English graduated)	1 No.
14.	Combination set (consisting of 300 mm rule centre)	2 Nos.
15.	Comparator Gauge, complete with stand and brackets.	2 Nos.
16.	Chuck, Drill 12 mm cap. (Taper shank)	1 No.
17.	Chuck, Drill 16 mm capacity (Taper shank)	1 No.
18.	Dial Test Indicator complete with stand (universal type with magnetic base 1/100 mm)	2 Nos.

19.	Diamond, Wheel Dressing (single stone mounted)	4 Nos.
20	Files, Hand Flat, 200 mm smooth	8 Nos.
21.	Files, Hand Flat, 250 mm smooth	8 Nos.
22.	Files, 150 mm Half round smooth	8 Nos.
23.	Files, round Dead smooth 200 mm	4 Nos.
24.	Files, Triangular, Dead smooth 200 mm and 150 mm	2 Each
25.	Files, Triangular Dead smooth 150 mm	4 Nos.
A 26.	File Flat Rough 300 mm	4 Nos.
A 27.	File Flat 250 mm Second Cut	4 Nos.
A 28.	Chisel Cold Flat 18 mm	4 Nos.
A 29.	Chisel Cold Flat 12 mm	4 Nos.
30.	Feeler Gauge Metric Set	1 set
31.	Gauge Radius (Inside and Outside) (Metric)	2 Nos.
32.	Gauge, Slip (Metric) workshop grade	2 Sets
33	Sine Bar 100 mm and 150mm	1 Each
34.	Gauge, Telescopic 12 to 150 mm	2 Sets
35.	Gauge, Morse Taper, Plug Nos. 1,2,3,4	1 Each
36.	Gauge, Morse Taper, Ring Nos. 1,2,3,4	1 Each
37.	Glass, Magnifying 250 x 25 x 75 mm dia with handle	1 No.
38.	Hacksaw frame 200 to 300 mm adjustable	2 Nos.
M 39.	Keys, Allen 1 mm to 14 mm by 1 mm	4 sets
40.	Keys, Allen 3 to 12 mm, by 1.5 mm	1 Set
41.	Spirit Level, Engineers 25 mm precision	1 No.
42.	Micrometer outside 0 to 25 mm	3 nos.
43.	Micrometer outside 25 to 50 mm	2 nos.
44.	Micrometer outside 50 to 75 mm	1 no.
45.	Micrometer outside 75 to 100 mm	1 no.
46.	Internal Micrometer 25 to 150 mm with extension Rods.	1 no.
47.	Depth Gauge Micrometer with extension rods to 150 mm with 70 mm Base	1 no.
A 48.	Indicating Micrometer 0.25 mm range, graduation, 01" mm graduation of dial 0.001 mm range of dial + 0.02	1 No.
49	Oil Stone Carborandum, Coarse on one side and fine on the other 200 x 50 x 25 mm	2 Nos.
50	Oil Stone Carborandum, Coarse on one side and fine on other slip 100 x 12 mm triangular.	2 Nos.
51	Oil Stone Carborandum, Coarse on one side and fine on other slip 100 x 18 mm triangular	2 Nos.
52.	Try Square, Engineer's 100 mm blade	2 Nos.
53.	Straight Edge Engineer's 300 x 50 x 12 mm bevelled edge.	1 No.
54.	Screw Driver 200 mm blade	2 Nos.
55.	Screw Driver 300 mm blade	2 Nos.
56	Spanner D.E. open jaw 3 to 18 mm by 3 mm	2 Sets
57	Scraper Flat 25 x 200 mm with handle	2 Nos.
58	Scraper Half round 75 x 12 x 200 mm with handle	2 Nos.
59	Scraper Triangular 62 x 9 x 200 mm with handle	2 Nos.
60	Techometer with male and female rubber attachments (upto 0-10,000	1 No.

	RPM)	
61.	Table Chuck 75 mm Jaw Swivel Base 200 mm dia. 3 Jaw with bolting arrangement and graduated in degrees	1 No.
62.	Vices, Machine Plain 150 Jaws x 100 mm openings	2 Nos.
63.	Vices, Machine, Swivelling Base 150 mm x 100 mm	2 Nos.
64.	Universal Machine Vice 100 mm for Grinding	2 Nos.
65.	Wheel Dressers, Steel Type (Huntington) (Large)	2 Nos.
66.	Wheel Dressers, Steel (Huntington type Small)	3Nos.
67.	Radius Truing Attachment for surface grinding machine	1No.
68.	Radius Truing Attachment for cylindrical grinding machine.	1No.
69.	Angle Truing Attachment for surface grinding machine.	1 No.
70.	Demagnetizer Chuck	1 No.
M 71.	Centre Punch 150 x 6 mm dia	4 Nos.
72.	Reamer Adjustable 6 to 16 x 1.5 mm	1 Set
73.	Surface Plate 60 x 60 cms	1 No.
74.	Marking Table 90 x 60 x 90 cms	1 No.
A 75.	Hand Drill 6 mm	1 Set
A 76.	Taps and Dies complete set in box (Metric)	1 Set
A 77.	Taps and Dies set B.A.B.S.F.B.S.W. and American	1 Set
A 78.	Drill Twist (Straight Shank) 1/8" to 1/2" by 1/64"	1 Set
A 79.	Drill Twist (Metric) 3 mm to 12 mm, in step of 1 mm	1 Set
A 80.	Set of Sockets Morse taper (0-1, 1-2 and 2-3)	1 Set
A 81.	Drill Chuck 0 to 12 mm Morse Taper	1 No.
82.	Combination Drill (Centering)	2 Nos.
83.	Screw Pitch Gauge	2 Nos.
84.	Working Benches 340 x 120 x 75 cms with 4 bench vices, 125 mm jaw	1 No.
S 85.	Fire Extinguisher	1 No.
S 86.	Fire Buckets with stand	4 Nos.
87.	Steel lockers with 6 drawers	2 Nos.
88.	Metal Rack 180 x 150 x 45 cms	1 No.
89.	Desk	1 No.
90.	Stool	1 No.
91.	Black Board with Easel	1 No.
A 92.	Magnifying Glass with surface illuminator	1 No.
A 93.	CMTI surface finish standards (in Bakelite)	1 No.
A 94.	Adjustable Wrench 250 mm size	1 No.
A 95.	Hammer (Nylon face) 30 mm	4 Nos.
A 96.	Grease Gun	2 Nos.
A 97.	Magnetic V-Block with push button switch	1 Set
A 98.	Magnetic V-Block base for Dial Indicator 75 x 75 x 100 mm	2 Nos.
A 99.	Diamond Dresser Cluster type	2 Nos.
A 100.	Adjustable Parallel Clamps (Hardened and ground) 100 mm long	2 Pairs
101.	Granite Stone Surface Plate Grade A 600 x 500 x 1000 mm	1 No.
102.	Static balancing stand for grinding wheel	1 No.
103.	Soft Board for display 1.25 mm x 1.85 mm x 10 mm thick	1 No.
A 104.	Dial Test Indicator-Lever type-long point	2 Nos.
A 105.	Magnetic Stand Flexible type base 60 mm x 47.5 mm Magnetic Power	2 Nos.

	75 kg. ON-OFF Lever control	
A 106.	Cutter Clearance Gauge to Suit Clearance all cutter diameters angle 0"-30".	1 Set
M 107.	Glass Show Case for display of jobs 450 mm x 600 x 850mm	1 No.
Desirable:-		
1.	Shadeograph projector with diascopic and epidia scopic projection, magnification 50, 100, 200, rotary screen 1 minute accuracy and centering, attachment.	1 No.

C: GENERAL MACHINERY

Sr. No.	Description of Machinery	Quantity
S 1.	Lathe 75 cm between centers x 180 cm centre height 4 jaw independent chuck, self centering chuck set of lathe tools, lathe carriers etc. complete.	2 Nos.
S 2.	Drilling machine pillar 0-12 capacity	1 No.
S 3.	Grinding machine external cylindrical fully motorized and supplied with face plates and driving dogs, 3-jaw self centering chuck 4- jaw independent chuck tail stock assorted centers, stud pumps tank all guards 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)	2 Nos.
S 4.	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 steps, 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 grinding.	2 Nos.
S 5.	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.
S 6.	Tool and cutter grinding machine of size 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.
S 7.	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.

D : ADDITIONAL LIST OF TOOLS AND EQUIPMENTS REQUIRED FOR 3RD AND 4TH SEMESTERS

(For a batch of 15 trainees)

Sr. No.	Description	Quantity
1.	2.	3.
GENERAL MACHINERY		
1.	Grinding machine universal, machine to be motorized and supplied with assorted arbors spindles for internal work, 3-jaw self centering chuck, 4-jaw independent chuck face plate driving dogs, tail stock and centers, machine to be completed with all guards, sud and driving dogs, 3-jaw self centering chuck pump and tank, pipe fittings, diamond tool holder fixtures, radius dressing attachment and with spanners (internal and external) and general purpose grinding cylindrical magnetic chuck (permanent) 2,000 mm dia.	2 Nos.
2.	Small type hand honing machine with motors sand and bracket and with sets of different types of honing stones and other accessories.	1 nos.
3.	Lathe machine with taper turning attachment 4-jaw chuck and 3-jaw chuck.	1 nos.

GUIDELINES FOR INSTRUCTORS AND PAPER SETTERS

1. All questions of theory paper for the trade will be in objective type format.
2. Due care to be taken for proper & inclusive delivery among the batch. Some of the following method of delivery may be adopted:
 - a. Lecture
 - b. Lesson
 - c. Demonstration
 - d. Practice
 - e. Group discussion
 - f. Discussion with peer group
 - g. Project work
 - h. Industrial visit
3. Maximum utilization of latest form of training viz., audio visual aids, integration of IT, etc. May be adopted.
4. The total hours to be devoted against each topic may be decided with due diligence to safety & with prioritizing transfer of required skills.
5. Questions may be set based on following instructions:-

Sl. No.	Question on different aspect	Weightage in %age	Key Words may be like
1	Information received	25	What, Who, When
2	Knowledge	50	Define, Identify, Recall, State, Write, List & Name
3	Understanding	15	Describe, Distinguish, Explain, Interpret & Summarize
4	Application	10	Apply, Compare, Demonstrate, Examine, Solve & Use

6. Due weightage to be given to all the topics under the syllabus while setting the question paper.