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

COMPETENCY BASED CURRICULUM

TURNER

(Duration: Two Years)

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL- 5

SECTOR –CAPITAL GOODS AND MANUFACTURING

Directorate General of Training

TURNER

(Engineering Trade)

(Revised in 2019)

Version: 1.2

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL - 5

Developed By

Ministry of Skill Development and Entrepreneurship

Directorate General of Training

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1. COURSE INFORMATION

During the two years duration a candidate is trained on subjects Professional Skill, Professional Knowledge, Engineering Drawing, Workshop Science & Calculation and Employability Skills related to job role. In addition to this a candidate is entrusted to make/do project work and Extra Curricular Activities to build up confidence. The practical skills are imparted in simple to complex manner & simultaneously theory subject is taught in the same fashion to apply cognitive knowledge while executing task. The practical part starts with basic fitting & turning and executes complex turning operation both in conventional lathe and CNC turn centre at the end of the course. The broad components covered under Professional Skill subject are as below:

FIRST YEAR: The practical part starts with basic fitting & different turning including setting of different shaped job on different chucks. The different turning operations – Plain, Facing, Drilling, Boring (counter and stepped) Grooving, Parallel turning, stepped turning, Parting, Chamfering, U-cut, Reaming, Internal recess & Knurling. The skills on grinding of different cutting tools viz., V tool, side cutting, parting and thread cutting (both LH & RH) are also imparted. During this period the testing alignment of lathe by checking different parameters viz., axial slip of main spindle, true running of head stock, parallelism of main spindle and alignment of both the centres are also covered. The observation of all safety aspects is mandatory during execution any task. The safety aspects cover components like OSH&E, PPE, Fire extinguisher, First Aid and in addition 5S being taught.

This section covers setting of different components (Form tool, Compound slide, Tail stock offset, taper turning attachment) & parameters (feed, speed, depth of cut) of lathe for taper/ angular turning of jobs. Different boring operations (plain, stepped and eccentric) are also undertaken to gain the skill in producing components involving such operations. Different thread cutting (BSW, Metric, Square, ACME, Buttress) by setting machining parameters are being taught in the practical. The use different accessories of lathe (Driving Plate, Steady rest, dog carrier and different centres) are also part of the practical training. During this period the basic maintenance and preventive maintenance of lathe and grinding machine are also covered.

SECOND YEAR: On achieving above mentioned skill sets the candidate is engaged in producing different precision of engineering component with an appropriate accuracy (±0.02mm). The machining of different irregular shaped job using different lathe accessories and also producing different utility items viz., Crank Shaft (single throw), Stub arbor, etc. are covered to enhance their competency and perform the job as per practical requirement. The machining of different components along with assembly of such components (male & female) by performing different turning activities is also covered. The accuracy achieved is of an accuracy of ± 0.02 mm outside and ±0.05mm for inside turning.

A dedicated time of 13 weeks devoted for CNC operations which involve setting both job and tools and operating the CNC turn centre to produce components as per drawing by preparing part programmes. The candidate gets enough training both on multi-media-based CNC simulated and on actual intermediate production based CNC machine. The candidate is also imparted training on process plan to produce components by performing special operation on lathe viz., worm shaft cutting and also producing different engineering components viz., drill chuck, collet chuck, screw jack, box nut etc., to develop competency in producing components which is tangible and significant in work and industry ready for executing such work as per demand.

Professional Knowledge subject is simultaneously taught in the same fashion to apply cognitive knowledge while executing task. In addition, components like cutting tools and its specification, method of brazing and soldering, calculation involving gear ratio and gearing, and tool life, lubrication and functions, jigs and fixtures, interchangeability, quality control procedure and technical English are also covered under theory part.

Total three projects need to be completed by the candidates in a group. In addition to above components the core skills components viz., Workshop calculation & science, Engineering drawing, employability skills are also covered. These core skills are essential skills which are necessary to perform the job in any given situation.

2. TRAINING SYSTEM

2.1 GENERAL

Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers range of vocational training courses catering to the need of different sectors of economy/ Labour market. The vocational training programmes are delivered under aegis of Directorate General of Training (DGT). Craftsman Training Scheme (CTS) with variantsand Apprenticeship Training Scheme (ATS) are two pioneer programmes of DGT for strengthening vocational training.

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

Candidates need broadly to demonstrate that they are able to:

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

2.2 PROGRESSION PATHWAYS:

- Can join industry as Technician and will progress further as Senior Technician, Supervisor and can rise to the level of Manager.
- Can become Entrepreneur in the related field.
- Can appear in 10+2 examination through National Institute of Open Schooling (NIOS) for acquiring higher secondary certificate and can go further for General/ Technical education.

- Can take admission in diploma course in notified branches of Engineering by lateral entry.
- Can join Apprenticeship programme in different types of industries leading to National Apprenticeship certificate (NAC).
- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming instructor in ITIs.
- Can join Advanced Diploma (Vocational) courses under DGT as applicable.

2.3 COURSE STRUCTURE:

Table below depicts the distribution of training hours across various course elements during a period of two years: -

S No.	Course Element	Notional Training Hours	
		1st Year	2nd Year
1	Professional Skill (Trade Practical)	1000	1000
2	Professional Knowledge (Trade Theory)	280	360
3	Workshop Calculation & Science	80	80
4	Engineering Drawing	80	80
5	Employability Skills	160	80
	Total	**1600**	**1600**

2.4 ASSESSMENT & CERTIFICATION

The trainee will be tested for his skill, knowledge and attitude during the period of course through formative assessment and at the end of the training programme through summative assessment as notified by the DGT from time to time.

a) The **Continuous Assessment** (Internal)during the period of training will be done by **Formative assessment method** by testing for assessment criteria listed against learning outcomes. The training institute has to maintain individual *trainee portfolio* as detailed in assessment guideline. The marks of internal assessment will be as per the formative assessment template provided on www.bharatskills.gov.in

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

2.4.1 PASS REGULATION

For the purposes of determining the overall result, weightage of 100% is applied for six months and one-year duration courses and 50% weightage is applied to each examination for two years courses. The minimum pass percent for Trade Practical and Formative assessment is 60% & for all other subjects is 33%. There will be no Grace marks.

2.4.2 ASSESSMENT GUIDELINE

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

Assessment will be evidence based comprising the following:

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

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

Performance Level	Evidence
(a) Weightage in the range of 60 -75% to be allotted during assessment	
For performance in this grade, the candidate with occasional guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of an acceptable standard of craftsmanship.	• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment • 60-70% accuracyachieved 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	
For this grade, the candidate, with little guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of a reasonable standard of craftsmanship.	• Good skill levels in the use of hand tools, machine tools and workshop equipment • 70-80% accuracyachieved 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	
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.	• High skill levels in the use of hand tools, machine tools and workshop equipment • Above 80% accuracyachieved 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.

3. JOB ROLE

Turner; Lathe 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, 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. Repeats operations if necessary. Cleans and oils machine. Demonstrate the setting &operation of CNC turning machine and produce components as per drawing by preparing part programmes. May be designated as Turner according to nature of work done. May improvise devices and make simple adjustments to machine. May recondition lathe tools.

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

May be designated as Turner according to nature of work done

Reference NCO 2015:7223.0601 – Turner

4. GENERAL INFORMATION

Name of the Trade	**TURNER**
Trade Code	DGT/1013
NCO - 2015	7223.0601
NSQF Level	Level – 5
Duration of Craftsmen Training	Two years(3200 hours)
Entry Qualification	Passed 10th class examination with Science and Mathematics or its equivalent.
Minimum Age	14 years as on first day of academic session.
Eligibility for PwD	LD, LC, DW, AA, LV, DEAF
Unit Strength (No. Of Student)	20 (There is no separate provision of supernumerary seats)
Space Norms	110 Sq.m.
Power Norms	18.5 KW
Instructors Qualification for	
1. Turner Trade	B.Voc/Degree in Mechanical Engineering from AICTE/UGC recognized Engineering College/ university with one-year experience in the relevant field. OR 3 years Diploma in Mechanical Engineering from AICTE recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field. OR NTC/NAC passed in the trade of "Turner" with three years' experience in the relevant field. **<u>Essential Qualification:</u>** Relevant National Craft Instructor Certificate (NCIC) in any of the variants under DGT. ***NOTE:- Out of two Instructors required for the unit of 2(1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications. However, both of them must possess NCIC in any of its variants.***
2. Workshop Calculation	B.Voc/Degree in Engineering from AICTE/UGC recognized

& Science	Engineering College/ university with one-year experience in the relevant field. OR 03 years Diploma in Engineering from AICTE recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field. OR NTC/ NAC in any one of the engineering trades with three years' experience. **Essential Qualification:** National Craft Instructor Certificate (NCIC) in relevant trade OR NCIC in RoDA or any of its variants under DGT
3. Engineering Drawing	B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with one-year experience in the relevant field. OR 3 years Diploma in Engineering from AICTE recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field. OR NTC/ NAC in any one of the Mechanical group (Gr-I) trades categorized under Engg. Drawing'/ D'man Mechanical / D'man Civil' with three years' experience. **Essential Qualification:** National Craft Instructor Certificate (NCIC) in relevant trade OR NCIC in RoDA / D'man (Mech /civil) or any of its variants under DGT.
4. Employability Skill	MBA/ BBA / Any Graduate/ Diploma in any discipline with Two years' experience with short term ToT Course in Employability Skills from DGT institutes. (Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above) **OR** Existing Social Studies Instructors in ITIs with short term ToT Course in Employability Skills from DGT institutes.
5. Minimum Age for Instructor	21 Years

List of Tools and Equipment	As per Annexure – I

Distribution of training on Hourly basis: (Indicative only)

Year	Total Hrs. /week	Trade Practical	Trade Theory	Workshop Cal. & Sc.	Engg. Drawing	Employability Skills
1st	40 Hours	25 Hours	7 Hours	2 Hours	2 Hours	4 Hours
2nd	40 Hours	25 Hours	9 Hours	2 Hours	2 Hours	2 Hours

5. LEARNING OUTCOME

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

5.1 LEARNING OUTCOMES (TRADE SPECIFIC)

FIRST YEAR:

1. Plan and organize the work to make job as per specification applying different types of basic fitting operations & check for dimensional accuracy following safety precautions. *[Basic Fitting Operation – Marking, Hack sawing, filing, drilling, taping etc.]*
2. Set different shaped jobs on different chuck and demonstrate conventional lathe machine operation observing standard operation practice. *[Different chucks: - 3 jaws & 4 jaws, different shaped jobs: - round, hexagonal, square]*
3. Prepare different cutting tool to produce jobs to appropriate accuracy by performing different turning operations. *[Different cutting tool – V tool, side cutting, parting, thread cutting (both LH & RH), Appropriate accuracy: - ±0.06mm, Different turning operation – Plain, facing, drilling, boring (counter & stepped), grooving, Parallel Turning, Step Turning, parting, chamfering, U -cut, Reaming, internal recess, knurling.*
4. Test the alignment of lathe by checking different parameters and adjust the tool post. *[Different parameters – Axial slip of main spindle, true running of head stock, parallelism of main spindle, alignment of both the centres.]*
5. Set different components of machine & parameters to produce taper/ angular components and ensure proper assembly of the components. *[Different component of machine: - Form tool, Compound slide, tail stock offset, taper turning attachment. Different machine parameters- Feed, speed, depth of cut.]*
6. Set the different machining parameter & tools to prepare job by performing different boring operations. *[Different machine parameter- Feed, speed & depth of cut; Different boring operation – Plain, stepped & eccentric]*
7. Set the different machining parameters to produce different threaded components applying method/ technique and test for proper assembly of the components. *[Different thread: - BSW, Metric, Square, ACME, Buttress.]*
8. Set the different machining parameter & lathe accessories to produce components applying techniques and rules and check the accuracy. *[Different machining parameters: - Speed, feed & depth of cut; Different lathe accessories: - Driving Plate, Steady rest, dog carrier and different centres.]*
9. Plan and perform basic maintenance of lathe & grinding machine and examine their functionality.

SECOND YEAR:

10. Plan & set the machine parameter to produce precision engineering component to appropriate accuracy by performing different turning operation. *[Appropriate accuracy - ±0.02mm/ (MT - 3) (proof turning); Different turning operation – Plain turning, taper turning, boring threading, knurling, grooving, chamfering etc.]*
11. Set & Produce components on irregular shaped job using different lathe accessories. *[Different Lathe accessories: - Face plate, angle plate]*
12. Plan and set the machine using lathe attachment to produce different utility component/ item as per drawing. *[Different utility component/ item – Crank shaft (single throw), stub arbour with accessories etc.]*
13. Set the machining parameters and produce & assemble components by performing different boring operations with an appropriate accuracy. *[Different boring operation – eccentric boring, stepped boring; appropriate accuracy - ±0.05mm]*
14. Calculate to set machine setting to produce different complex threaded component and check for functionality. *[Different complex threaded component- Half nut, multi start threads (BSW, Metric & Square)]*
15. Set (both job and tool) CNC turn centre and produce components as per drawing by preparing part programme.
16. Manufacture and assemble components to produce utility items by performing different operations & observing principle of interchangeability and check functionality. *[Utility item: - screw jack/ vice spindle/ Box nut, marking block, drill chuck, collet chuck etc.; different operations: - threading (Square, BSW, ACME, Metric), Thread on taper, different boring (Plain, stepped)]*
17. Make a process plan to produce components by performing special operations on lathe and check for accuracy. *[Accuracy - ±0.02mm or proof machining & ±0.05mm bore; Special operation – Worm shaft cutting (shaft) boring, threading etc.]*

6. ASSESSMENT CRITERIA

LEARNING OUTCOMES	ASSESSMENT CRITERIA
FIRST YEAR	
1. Plan and organize the work to make job as per specification applying different types of basic fitting operations & check for dimensional accuracy following safety precautions.*[Basic Fitting Operation – Marking, Hack sawing, filing, drilling, taping etc.]*	Plan & Identify tools, instruments and equipments for marking and make this available for use in a timely manner.
	Select raw material and visually inspect for defects.
	Mark as per specification applying desired mathematical calculation and observing standard procedure.
	Measure all dimensions in accordance with standard specifications and tolerances.
	Identify Hand Tools for different fitting operations and make these available for use in a timely manner.
	Prepare the job for Hacksawing, chiselling, filing, drilling, tapping, grinding.
	Perform basic fitting operations viz., Hacksawing, filing, drilling, tapping and grinding to close tolerance as per specification to make the job.
	Observe safety procedure during above operation as per standard norms and company guidelines.
	Check for dimensional accuracy as per standard procedure.
	Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
2. Set different shaped jobs on different chuck and demonstrate conventional lathe machine operation observing standard operation practice. *[Different chucks: - 3 jaws & 4 jaws, different shaped jobs: - round, hexagonal, square]*	Identify and acquaint with lathe machine operation with its components.
	Identify different work holding devices and acquaint with functional application of each device.
	Mount the appropriate work holding device and check for its functional usage to perform turning operations.
	Set the job on chuck as per shape.
	Set the lathe on appropriate speed & feed.
	Operate the lathe to demonstrate lathe operation, observing standard operating practice.
	Observe safety procedure during above operation as per standard norms and company guidelines.

3.	Prepare different cutting tool to produce jobs to appropriate accuracy by performing different turning operations. *[Different cutting tool – V tool, side cutting, parting, thread cutting (both LH & RH), Appropriate accuracy: - ±0.06mm, Different turning operation – Plain, facing, drilling, boring (counter & stepped), grooving, Parallel Turning, Step Turning, parting, chamfering, U -cut, Reaming, internal recess, knurling.*	Identify cutting tool materials used on lathe machine as per the specification and their application.
		Plan and Grind cutting tools
		Measure the tool angles with gauge and Bevel protractor as per tool signature.
		Mount the job and set machine parameter.
		Perform turning operations viz., facing, Parallel Turning, Step Turning, chamfering, grooving, U -cut, parting, drilling, boring (counter & stepped),Reaming, internal recess and knurling to make component as per specification.
		Check accuracy/ correctness of job using appropriate gauge and measuring instruments for their functional requirement.
		Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
4.	Test the alignment of lathe by checking different parameters and adjust the tool post. *[Different parameters – Axial slip of main spindle, true running of head stock, parallelism of main spindle, alignment of both the centres.]*	Plan for testing alignment of lathe
		Select appropriate items and tools for testing the alignment.
		Demonstrate possible solutions and agree tasks within the team.
		Perform testing of alignment and adjust the tool post as per instruction of machine manual/ standard testing procedure.
		Check for desired functionality.
		Record the different parameters in a standard format.
5.	Set different components of machine& parameters to produce taper/ angular components and ensure proper assembly of the components. *[Different component of machine: - Form tool, Compound slide, tail stock offset,*	Plan and select appropriate method to produce taper/ angular components.
		Evaluate angles to set up the tool and machine component for machining.
		Demonstrate possible solutions and agree tasks within the team.
		Produce taper/ angular components as per standard operating procedure.
		Check accuracy/ correctness of job using appropriate gauge and measuring instruments for their functional requirement.

	taperturning attachment. Different machine parameters- Feed, speed, depth of cut.]	Assemble the components to ascertain functionality.
6.	Set the different machining parameter & tools to prepare job by performing different boring operations. *[Different machine parameter- Feed, speed & depth of cut; Different boring operation – Plain, stepped & eccentric]*	Plan for different boring (Plain, stepped & eccentric), Select appropriate tools and counterbalance while holding the work piece as per requirement.
		Set the different machining parameters as per requirement.
		Demonstrate possible solutions within the team.
		Set job and produce component following the standard operating procedure.
		Measure with instruments/gauges as per drawing.
		Comply with safety rules when performing the above operations.
		Avoid wastage, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
7.	Set the different machining parameters to produce different threaded components applying method/ technique and test for proper assembly of the components. *[Different thread: - BSW, Metric, Square, ACME, Buttress.]*	Plan and select appropriate method to produce threaded components.
		Plan and prepare thread cutting tool in compliance to standard thread parameters.
		Produce components as per drawing.
		Check accuracy/ correctness of job using appropriate gauge and measuring instruments for their functional requirement and suit to male /female part.
		Test the proper assembly of the threaded components.
8.	Set the different machining parameter & lathe accessories to produce components applying techniques and rules and check the accuracy. *[Different machining parameters: - Speed, feed & depth of cut; Different lathe accessories: - Driving*	Identify different lathe accessories of lathe machine as per functional application.
		Mount appropriate lathe accessories to set up a job for machining.
		Observe safety/ precaution during mounting the accessories.
		Check for the alignment of accessories to machine as per standard procedure.
		Set the machining parameter and produce the component applying technique/ machine.
		Check the accuracy of the component using instruments.

	Plate, Steady rest, dog carrier and different centres.]	
9.	Plan and perform basic maintenance of lathe & grinding machine and examine their functionality.	Plan for periodic and preventive maintenance of lathe/ grinding machine.
		Select appropriate items and tools for maintenance.
		Demonstrate possible solutions and agree tasks within the team.
		Perform maintenance as per schedule of machine manual.
		Check for desired functionality.
	SECOND YEAR	
10.	Plan & set the machine parameter to produce precision engineering component to appropriate accuracy by performing different turning operation. *[Appropriate accuracy - ±0.02mm/ (MT - 3) (proof turning); Different turning operation – Plain turning, taper turning, boring threading, knurling, grooving, chamfering etc.]*	Plan and select appropriate method to produce components.
		Grind form cutting tool.
		Set the machine parameters.
		Produce components by performing different turning operations as per standard operating procedure and as per drawing.
		Check accuracy/ correctness of job using appropriate gauge and measuring instruments.
11.	Set & Produce components on irregular shaped job using different lathe accessories. *[Different Lathe accessories: - Face plate, angle plate]*	Plan and select appropriate method to produce irregular shaped components with internal taper turning.
		Work out different parameters to set up the tool for machining.
		Set the lathe accessories and mount the job.
		Produce components as per standard operating procedure by using appropriate tools.
		Check accuracy/ correctness of job using appropriate gauge and measuring instruments.
12.	Plan and set the machine using lathe attachment to produce different utility component/ item as per	Select appropriate tools and plan for turning and counterbalance while holding the work piece as per requirement.
		Comply with safety rules when performing the above operations.
		Demonstrate possible solutions within the team.

	drawing. *[Different utility component/ item – Crank shaft (single throw), stub arbour with accessories etc.]*	Set the lathe attachment as per requirement and produce component observing standard operating procedure.
		Measure with instruments/gauges as per drawing.
13.	Set the machining parameters and produce & assemble components by performing different boring operations with an appropriate accuracy. *[Different boring operation – eccentric boring, stepped boring; appropriate accuracy - ±0.05mm]*	Plan for different boring (Plain, stepped & eccentric) and counterbalance while holding the work piece as per requirement and select appropriate tools.
		Set the different machining parameters as per requirement.
		Demonstrate possible solutions within the team.
		Set job and produce component following the standard operating procedure.
		Measure with instruments/gauges as per drawing.
		Comply with safety rules when performing the above operations.
		Avoid wastage, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
14.	Calculate to set machine setting to produce different complex threaded component and check for functionality. *[Different complex threaded component- Half nut, multi start threads (BSW, Metric & Square)]*	Plan and select appropriate method to produce components with multi start threading.
		Prepare appropriate tool for generating required thread form.
		Calculate and set machine
		Mount the job and turn multi start thread (male and female).
		Check accuracy/ correctness of job using appropriate gauge and measuring instruments.
		Match the male & female component for checking for functionality
15.	Set (both job and tool) CNC turn centre and produce components as per drawing by preparing part programme.	Plan and prepare part programme as per drawing, simulate for it's correctness with appropriate software.
		Prepare tooling layout and select tools as required
		Demonstrate possible solution within the team.
		Set selected tools on to the machine
		Test/Dry run the part programme on the machine
		Set up the job and machine the component as per standard operating procedure involving parallel, step, taper, drilling, boring, radius, grooving and threading operations, etc.

	Check accuracy/ correctness of job using appropriate gauge and measuring instruments.
	Observe safety/ precaution during machining.
	Avoid wastage, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
16. Manufacture and assemble components to produce utility items by performing different operations & observing principle of interchangeability and check functionality. *[Utility item: - screw jack/ vice spindle/ Box nut, marking block, drill chuck, collet chuck etc.; different operations: - threading (Square, BSW, ACME, Metric), Thread on taper, different boring (Plain, stepped)]*	Plan and select tools and materials for the part components and make this available for use in a timely manner.
	Produce part components as per drawing
	Check for accuracy of all the part components and suitability to the higher assembly.
	Assemble all the part components as per the guidelines given in the drawing.
	Check for functionality of the screw jack, vice spindle/ Box nut, marking block, drill chuck, collet chuck etc., as per standard operating procedure.
	Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
17. Make a process plan to produce components by performing special operations on lathe and check for accuracy. *[Accuracy - ±0.02mm or proof machining & ±0.05mm bore; Special operation – Worm shaft cutting (shaft) boring, threading etc.]*	Plan and select appropriate method to produce components with worm gear cutting.
	Prepare appropriate tool for producing required worm shaft.
	Set the job and turn worm shaft, match for accurate fitting with female gauge.
	Check accuracy/ correctness of job using appropriate gauge and measuring instruments.

SYLLABUS FOR TURNER TRADE			
FIRST YEAR			
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical) With Indicative Hours**	**Professional Knowledge (Trade Theory)**
Professional Skill 175 Hrs.; Professional Knowledge 49 Hrs.	Plan and organize the work to make job as per specification applying different types of basic fitting operations & check for dimensional accuracy following safety precautions.*[Basic Fitting Operation – Marking, Hack sawing, filing, drilling, taping etc.]*	1. Importance of trade training, List of tools & Machinery used in the trade. (1 hr.) 2. Safety attitude development of the trainee by educating them to use Personal Protective Equipment (PPE). (5 hrs.) 3. First Aid Method and basic training. (2 hrs.) 4. Safe disposal of waste materials like cotton waste, metal chips/burrs etc. (2 hrs.) 5. Hazard identification and avoidance. (2 hrs.) 6. Safety signs for Danger, Warning, caution & personal safety message. (1 hr.) 7. Preventive measures for electrical accidents & steps to be taken in such accidents. (2 hrs.) 8. Use of Fire extinguishers. (7 hrs.) 9. Practice and understand precautions to be followed while working in fitting jobs.	All necessary guidance to be provided to the newcomers to become familiar with the working of Industrial Training Institute system including stores procedures. Soft Skills: its importance and Job area after completion of training. Importance of safety and general precautions observed in the in the industry/shop floor. Introduction of First aid. Operation of electrical mains. Introduction of PPEs. Response to emergencies e.g.; power failure, fire, and system failure. **Importance of housekeeping & good shop floor practices.** Introduction to 5S concept & its application. **Occupational Safety & Health**: Health, Safety and Environment guidelines, legislations & regulations as applicable. (07 Hrs.)

		(2 hrs.) 10. Safe use of tools and equipments used in the trade. (1 hr.)	
		11. Identification of tools &equipments as per desired specifications for marking & sawing (Hand tools, Fitting tools & Measuring tools) (2 hrs.) 12. Selection of material as per application Visual inspection of raw material for rusting, scaling, corrosion etc. (1 hr.) 13. Marking out lines, gripping suitably in vice jaws, hack sawing to given dimensions, sawing different types of metals of different sections. (16 hrs.) 14. Practice on hammering, marking out, chipping, chisel grinding. (6 hrs.)	Measurement, line standard and end standard, steel rule-different types, graduation and limitation. Hammer and chisel-materials, types and uses. Prick punch and scriber. (07 Hrs.)
		15. Filing practice on plain surfaces, right angle by filing. (45 hrs.) 16. Use of calipers and scale measurement. (5 hrs.)	Vice – types and uses, Files-different types of uses, cut, grade, shape, materials etc. Try square-different types, parts, material used etc. Calipers-types and uses (firm joint). (14Hrs.)
		17. Filing at right angle, marking & hack sawing. (25 hrs.)	Vee – block, scribing block, straight edge and its uses. Hacksaw-their types & uses. (07 Hrs.)
		18. Marking operation on flat & round job. (10 hrs.) 19. Drilling operation: Drill on flat, square bar and round	Center punch- materials, construction & material uses. Drill machine-different parts. Hacksaw blades- sizes, different

		bar of different material (Sensitive drill machine). (15 hrs.)	Parts. Hacksaw blades-sizes, different pitch for different materials. Nomenclature of drill. (07 Hrs.)
		20. Different threading (BSW, BSP, BA, Metric, UNC, UNF) with the help of taps and dies both external & internal (including pipes) using collet chuck. (19 hrs.) 21. Extraction of broken tap. (6 hrs.)	Surface plate its necessity and use. Tap - different types (Taper 2nd and bottoming) care while tapping. Dies different types and uses. Calculation involved to find Out drill size (Metric and Inch). (07 Hrs.)
Professional Skill 50 Hrs.; Professional Knowledge 14 Hrs.	Set different shaped jobs on different chuck and demonstrate conventional lathe machine operation observing standard operation practice. *[Different chucks: - 3 jaws & 4 jaws, different shaped jobs: - round, hexagonal, square]*	22. Identify & function of different parts of lathe. Practice on operation of lathe (dry/idle run). (20 hrs.) 23. Setting lathe on different speed and feed. (5 hrs.)	Getting to know the lathe with its main components, lever positions and various lubrication points as well. Definition of machine & machine tool and its classification. History and gradual development of lathe. (07 Hrs.)
		24. Mounting of chuck on machine spindle and unloading –3-jaw chuck & 4-jaw chuck. (15 hrs.) 25. Setting practice on round & square/ hexagonal bar. (3 hrs.) 26. Dismantling and assembling of 3 jaw and 4 jaw chucks. (7 hrs.)	Classification of lathe in Function and construction of different parts of Lathe. (07 Hrs.)
Professional Skill 250Hrs.; Professional Knowledge 70Hrs.	Prepare different cutting tool to produce jobs to appropriate accuracy by performing	27. Turning of round stock and square/hexagonal as per availability on 4-jaw independent chuck. (15hrs.) 28. Turning of round stock on 3-jaw self centering chuck.	Types of lathe drivers, merit and demerit. Description in details-head stock- cone pulley type- all geared type- construction & function. Tumbler gear set.

	different turning operations. *[Different cutting tool – V tool, side cutting, parting, thread cutting (both LH & RH), Appropriate accuracy: - ±0.06mm, Different turning operation – Plain, facing, drilling, boring (counter & stepped), grooving, Parallel Turning, Step Turning, parting, chamfering, U -cut, Reaming, internal recess, knurling.*	(10hrs.)	Reducing speed-necessary & uses. Back Gear Unit –its construction use. (07Hrs.)
		29. Grinding of R.H. and L.H., V-tool, side cutting tools, parting tool. (15 hrs.) 30. Checking of angles with angle gauge / bevel protractor. (1 hr.) 31. Grinding of "V" tools for threading of Metric 60-degree threads. (9 hrs.)	Lathe cutting tool-different types, shapes and different angles (clearances and rake), specification of lathe tools. (07 Hrs.)
		32. Facing operation to correct length (10hrs.) 33. Centre drilling and drilling operation to required size. (05hrs.) 34. Make square block by turning using 4-jaw chuck and perform drilling, boring and grooving operation. (10hrs.)	Combination drill- appropriate selection of size from chart of combination drill. Drill, chuck-its uses. Lathe accessories, chuck independent, self-centering, collet, magnetic etc., its function, construction and uses. (07Hrs.)
		35. Parallel turning, step turning, parting, grooving, chamfering practice. (48 hrs.) 36. Measurement with scale and outside caliper to ± 0.5 mm. accuracy. (2 hrs.)	Vernier caliper-its construction, principle graduation and reading, least count etc. Digital vernier caliper. Outside micrometer –different parts, principle, graduation, reading, construction. Digital micrometer. Cutting speed, feed depth of cut, calculation involved-speed feed R.P.M. etc. recommended for different materials. (14 Hrs.)
		37. Step turning within ± 0.06 mm with different shoulder, U/cut on outside diameter. (15 hrs.)	Different types of micrometer, Outside micrometer. Vernier scale graduation and reading. Sources of error with

		38. Drilling on Lathe-step drilling, drill grinding practice. (10 hrs.)	micrometer & how to avoid them. Use of digital measuring instruments. (07Hrs.)
		39. Boring practice-Plain. Counter& step, internal recessing. (20 hrs.) 40. Reaming in lathe using solid and adjustable reamer. (15 hrs.) 41. Make bore by trepanning (10 hrs.) 42. Drill grinding. (5 hrs.)	Drills-different parts, types, size etc., different cutting angles, cutting speed for different material. Boring tool. Counter - sinking and Counter boring. Letter and number drill, core drill etc. Reamers-types and uses. Lubricant and coolant-types, necessity, system of distribution, selection of coolant for different material: Handling and care. (14 Hrs.)
		43. Turning practice-between centres on mandrel (Gear blanks). (20 hrs.) 44. Fitting of dissimilar materials- M.S. in brass, aluminium, in cast iron etc. (20 hrs.) 45. Knurling practice in lathe (Diamond, straight, helical & square). (10 hrs.)	Knurling meaning, necessity, types, grade, cutting speed for knurling. Lathe mandrel- different types and their uses. Concept of interchangeability, Limit, Fit and tolerance as per BIS: 919-unilateral and bilateral system of limit, Fits- different types, symbols for holes and shafts. Hole basis & shaft basis etc. Representation of Tolerance in drawing. (14 Hrs.)
Professional Skill 25 Hrs.; Professional Knowledge 07 Hrs.	Test the alignment of lathe by checking different parameters and adjust the tool post. *[Different parameters – Axial slip of main spindle, true running of head stock, parallelism of main*	46. Checking alignment of lathe centres such as Levelling, axial slip of main spindle, true running of head stock centre, parallelism of the main spindle to saddle movement, alignment both the centres. (20 hrs.) 47. Adjustment of tool post. (3 hrs.) 48. Mounting job in between	Driving plate. Face plate & fixed & traveling steadies- construction and use. Transfer caliper-its construction and uses. Lathe centers-types and their uses. Lathe carrier- function types & uses. Mandrel – Different types and its use. Magnetic stand dial indicator, its used and care. (07 Hrs.)

	spindle, alignment of both the centres.]	centres. (2 hrs.)	
Professional Skill 75 Hrs.; Professional Knowledge 21 Hrs.	Set different components of machine & parameters to produce taper/ angular components and ensure proper assembly of the components. *[Different component of machine: - Form tool, Compound slide, tail stock offset, taper turning attachment. Different machine parameters- Feed, speed, depth of cut.]*	49. Make taper turning by form tool and compound slide swivelling. (25 hrs.)	Taper – different methods of expressing tapers, different standard tapers. Method of taper turning, important dimensions of taper. Taper turning by swiveling compound slide, its calculation. (07 Hrs.)
		50. Male and female taper turning by taper turning attachment, offsetting tail stock. (22 hrs.) 51. Matching by Prussian Blue. (2 hrs.) 52. Checking taper by bevel protector and sine bar. (1 hr.) 53. Make MT3 lathe dead centre and check with female part. (Proof machining) (25 hrs.)	Bevel protector & Vernier bevel protractor-its function & reading. Method of taper angle measurement. Sine bar-types and use. Slip gauges-types, uses and selection. (14 Hrs.)
Professional Skill 75 Hrs.; Professional Knowledge 21 Hrs.	Set the different machining parameter & tools to prepare job by performing different boring operations. *[Different machine parameter- Feed, speed & depth of cut; Different boring operation – Plain, stepped & eccentric]*	54. Turning and boring practice on CI (preferable) or steel. (23 hrs.) 55. Tip brazing on shank. (2 hrs.)	Method of brazing solder, flux used for tip tools. Basic process of soldering, welding and brazing. (07 Hrs.)
		56. Eccentric marking practice. (2 hrs.) 57. Perform eccentric turning. (18 hrs.) 58. Use of Vernier height Gauge and V-block. (1 hr.) 59. Perform eccentric boring. (18 hrs.) 60. Make a simple eccentric with dia. of 22mm and throw/offset of 5mm. (11	Vernier height gauge, function, description & uses, templates-its function and construction. Screw thread-definition, purpose &it's different elements. Driving plate and lathe carrier and their usage. Fundamentals of thread cutting on lathe. Combination set-square head. Center head, protractor head-

		hrs.)	its function construction and uses. (14 Hrs.)
Professional Skill 250Hrs.; Professional Knowledge 70Hrs.	Set the different machining parameters to produce different threaded components applying method/ technique and test for proper assembly of the components. *[Different thread: - BSW, Metric, Square, ACME, Buttress.]*	61. Screw thread cutting (B.S.W) external (including angular approach method) R/H & L/H, checking of thread by using screw thread gauge and thread plug gauge. (16hrs.) 62. Screw thread cutting (B.S.W) internal R/H & L/H, checking of thread by using screw thread gauge and thread ring gauge. (16hrs.) 63. Fitting of male & female threaded components (BSW) (4hrs.) 64. Prepare stud with nut (standard size). (14hrs.)	Different types of screw thread- their forms and elements. Application of each type of thread. Drive train. Chain gear formula calculation. Different methods of forming threads. Calculation involved in finding core dia., gear train (simple gearing) calculation. Calculations involving driver-driven, lead screw pitch and thread to be cut. (14Hrs.)
		65. Grinding of "V" tools for threading of Metric 60-degree threads and check with gauge. (3 hrs.) 66. Screw thread cutting (External) metric thread-tool grinding. (15 hrs.) 67. Screw thread (Internal) metric & threading tool grinding. (16 hrs.) 68. Fitting of male and female thread components (Metric) (2 hrs.) 69. Make hexagonal bolt and nut (metric) and assemble. (14 hrs.)	Thread chasing dial function, construction and use. Calculation involving pitch related to ISO profile. Conventional chart for different profiles, metric, B.A., With worth, pipe etc. Calculation involving gear ratios and gearing (Simple & compound gearing). Screw thread micrometer and its use. (14Hrs.)
		70. Cutting metric threads on inch lead screw and inch threads on Metric Lead Screw. (25 hrs.)	Calculation involving gear ratios metric threads cutting on inch L/S Lathe and vice-versa. (07 Hrs.)

		71. Practice of negative rake tool on non-ferrous metal and thread cutting along with fitting with ferrous metal. (25 hrs.)	Tool life, negative top rake-its application and performance with respect to positive top rake (07 Hrs.)
		72. Cutting Square thread (External) (16 hrs.) 73. Cutting Square thread (Internal). (18 hrs.) 74. Fitting of male and female Square threaded components. (2 hrs.) 75. Tool grinding for Square thread (both External & Internal). (2 hrs.) 76. Make square thread for screw jack (standard) for minimum 100mm length bar. (12 hrs.)	Calculation involving tool Thickness, core dia., pitch proportion, depth of cut etc. of sq. thread. (14 Hrs.)
		77. Acme threads cutting (male & female) & tool grinding. (08 hrs.) 78. Fitting of male and female threaded components.(7 hrs.) 79. Cut Acme thread over 25 mm dia. rod and within length of 100mm. (10 hrs.)	Calculation involved – depth, core dia., pitch proportion etc. of Acme thread. Calculation involved depth, core dia., pitch proportion, use of buttress thread. (07 Hrs.)
		80. Buttress threads cutting (male & female) & tool grinding. (13hrs.) 81. Fitting of male & female threaded components. (2 hrs.) 82. Make carpentry vice lead screw.(10hrs.)	Buttress thread cutting (male & female) & tool grinding(07Hrs.)
Professional	Set the different machining	83. Make job using different lathe accessories viz.,	Different lathe accessories, their use and care. (14 Hrs.)

Skill 50 Hrs.; Professional Knowledge 14 Hrs.	parameter & lathe accessories to produce components applying techniques and rules and check the accuracy. *[Different machining parameters: - Speed, feed & depth of cut; Different lathe accessories: - Driving Plate, Steady rest, dog carrier and different centres.]*	driving plate, steady rest, dog carrier and different centres. (30hrs.) 84. Make test mandrel (L=200mm) and counter bore at the end. (20 hrs.)	
Professional Skill 50 Hrs.; Professional Knowledge 14 Hrs.	Plan and perform basic maintenance of lathe & grinding machine and examine their functionality.	85. Balancing, mounting &dressing of grinding wheel (Pedestal). (10hrs.) 86. Periodical lubrication procedure on lathe. (20 hrs.) 87. Preventive maintenance of lathe. (20 hrs.)	Lubricant-function, types, sources of lubricant. Method of lubrication. Dial test indicator use for parallelism and concentricity etc. in respect of lathe work Grinding wheel abrasive, grit, grade, bond etc. (14 Hrs.)
In-plant training / Project work **Broad area:** a) Drill extension socket b) conical brush c) V-belt pulley d) Tail Stock Centre (MT – 3) e) Taper ring gauge f) Sprocket g) Socket spanner			

SYLLABUS FOR TURNER TRADE			
SECOND YEAR			
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical) With Indicative Hours**	**Professional Knowledge (Trade Theory)**
Professional Skill 125 Hrs.; Professional Knowledge 45Hrs.	Plan & set the machine parameter to produce precision engineering component to appropriate accuracy by performing different turning operation. *[Appropriate accuracy - ±0.02mm/ (MT - 3) (proof turning); Different turning operation – Plain turning, taper turning, boring threading, knurling, grooving, chamfering etc.]*	88. Form turning practice by hand. (8 hrs.) 89. Re-sharpening of form tools using bench grinder. (2 hrs.) 90. Tool machine handle turning by combination feed. (15 hrs.)	Form tools-function-types and uses, Template-purpose & use. Dial test indicator- construction & uses Calculation involving modified rake and clearance angles of lathe tool at above and below the center height. Subsequent effect of tool setting. Jig and fixture-definition, type and use. Chip breaker on tool-purpose and type (09 hrs.)
		91. Turn Morse taper plug (different number) and check with ring gauge / suitable MT sleeve. (25 hrs.) 92. Make revolving tail stock centre- Bush type (C-40). (Proof machining) (25 hrs.)	Cutting tool material-H.C.S., HSS, Tungsten. Carbide, Ceramic etc, - Constituents and their percentage. Tool life, quality of a cutting material. (18 hrs.)
		93. Make Morse taper sleeve and check by taper plug gauge. (25 hrs.)	Checking of taper with sin bar and roller-calculation involved (09 hrs.)
		94. Make mandrel/ plug gauge with an accuracy of ±0.02mm using tungsten carbide tools including throw-away tips. (25 hrs.)	Cutting speed, feed, turning time, depth of cut calculation, cutting speed chart (tungsten carbide tool) etc. Basic classification of tungsten carbide tips. (09 hrs.)

Professional Skill 50 Hrs.; Professional Knowledge 18 Hrs.	Set & Produce components on irregular shaped job using different lathe accessories. *[Different Lathe accessories: - Face plate, angle plate]*	95. Setting and turning operation involving face and angle plate (25 hrs.) 96. Make angle plate using face plate. (25 hrs.)	Accessories used on face plate –their uses. Angle plate-its construction & use. Balancing-its necessity. Surface finish symbols used on working blueprints- I.S. system lapping, honing etc. (18 hrs.)
Professional Skill 125 Hrs.; Professional Knowledge 45 Hrs.	Plan and set the machine using lathe attachment to produce different utility component/ item as per drawing. *[Different utility component/ item – Crank shaft (single throw), stub arbour with accessories etc.]*	97. Holding and truing of Crankshaft – single throw (Desirable). (50 hrs.)	Preventive maintenance, its necessity, frequency of lubrication. Preventive maintenance schedule., TPM (Total Productive Maintenance), EHS (Environment, health, Safety) Marking table-construction and function. Angle plate-construction, eccentricity checking. (18 hrs.)
		98. Turning of long shaft using steady rest (within 0.1 mm). (25 hrs.)	Roller and revolving steadies, Necessary, construction, uses etc. (09 hrs.)
		99. Use of attachments on lathe for different operations. (25 hrs.) 100. Turning standard stub arbor with accessories collar, tie rod, lock nut. (25 hrs.)	Different types of attachments used in lathe. Various procedures of thread measurement thread screw pitch gauge. Screw thread micrometer, microscope etc. (18 hrs.)
Professional Skill 100 Hrs.; Professional Knowledge 36 Hrs.	Set the machining parameters and produce & assemble components by performing different boring operations with an appropriate accuracy. *[Different*	101. Perform eccentric boring and make male & female eccentric fitting. (15 hrs.) 102. Position boring using tool maker's button. (10 hrs.)	Tool maker's button and its parts, construction and uses, telescopic gauge its construction and uses. (09 hrs.)
		103. Boring and stepped boring (within ± 0.05 mm) (15 hrs.) 104. Cutting of helical grooves in bearing and bushes (Oil	Inside micrometer principle, construction graduation, reading, use etc. (Metric & Inch.) (09 hrs.)

	boring operation – eccentric boring, stepped boring; appropriate accuracy - ±0.05mm]	groove) (10 hrs.)	
		105. Turning & boring of split bearing – (using boring bar and fixture)(50 hrs.)	Care for holding split bearing. Fixture and its use in turning. (18 hrs.)
Professional Skill 125 Hrs.; Professional Knowledge 45 Hrs.	Calculate to set machine setting to produce different complex threaded component and check for functionality. *[Different complex threaded component- Half nut, multi start threads (BSW, Metric & Square)]*	106. Cutting thread of 8 and 11 TPI. (25 hrs.)	Calculation involving fractional threads. Odd & even threads. (09 hrs.)
		107. Multi start thread cutting (B.S.W.) external &internal. (25 hrs.)	Multiple thread function, use, different between pitch & lead, formulate to find out start, pitch, lead. Gear ratio etc. (09 hrs.)
		108. Multi start thread cutting (Metric) (External & internal). (25 hrs.)	Indexing of start - different methods tool shape for multi-start thread. Setting of a lathe calculation for required change wheel (09 hrs.)
		109. Multi-start thread cutting, square form (Male & Female). (25 hrs.)	Calculation involving shape of tool, change wheel, core dia etc. Calculation involving shape, size pitch, core dia. Etc. (09 hrs.)
		110. Make half nut as per standard lead screw. (25 hrs.)	Helix angle, leading angle & following angles. Thread dimensions-tool shape, gear, gear calculation, pitch, depth, lead etc. (09 hrs.)
Professional Skill 250Hrs.; Professional Knowledge 90Hrs.	Set (both job and tool) CNC turn centre and produce components as per drawing by preparing part programme.	111. Personal and CNC machine Safety: Safe handling of tools, equipment and CNC machine. (2 hrs.) 112. Identify CNC machine, CNC console. (5 hrs.) 113. Demonstration of CNC lathe machine and its parts - bed, spindle motor and	CNC technology basics: Difference between CNC and conventional lathes. Advantages and disadvantages of CNC machines over conventional machines. Machine model, control system and specification.

		drive, chuck, tailstock, turret, axes motor and ball screws, guide ways, LM guides, console, control switches, coolant system, hydraulic system, chip conveyor, steady rest. (10 hrs.) 114. Working of parts explained using Multimedia based simulatorfor CNC parts shown on machine. (6 hrs.) 115. Identify machine over travel limits and emergency stop. (2 hrs.)	Axes convention of CNC machine - Machine axes identification for CNC turn centre. Importance of feedback devices for CNC control. Concept of Co-ordinate geometry, concept of machine axis. (09 hrs.)
		116. Conduct a preliminary check of the readiness of the CNC turning centre viz., cleanliness of machine, referencing – zero return, functioning of lubrication, coolant level, correct working of sub-system. (2 hrs.) 117. Identification of safety switches and interlocking of DIH modes. (1 hr.) 118. Machine starting & operating in Reference Point, JOG and Incremental Modes. (10hrs.) 119. Check CNC part programming with simple exercises and using various programming codes and words. (09hrs.) 120. Check the programme	Programming – sequence, formats, different codes and words. Co-ordinate system points and simulations. Workpiece zero points and ISO/DIN G and M codes for CNC. Different types of programming techniques of CNC machine. Describe the stock removal cycle in CNC turning for OD / ID operation. L/H and R/H tool relation on speed. Describe CNC interpolation, open and close loop control systems. Co-ordinate systems and Points. Program execution in different modes like manual, single block and auto.

		simulation on machine OR practice in simulation software in respective control system. (09hrs.) 121. Absolute and incremental programming assignments and simulations. (09hrs.) 122. Linear interpolation, and Circular interpolation assignments and simulations on software. (10hrs.)	Absolute and incremental programming. Canned cycles. Cutting parameters- cutting speed, feed rate, depth of cut, constant surface speed, limiting spindle speed, tool wear, tool life, relative effect of each cutting parameter on tool life. Selection of cutting parameters from a tool manufacturer's catalog for various operations. Process planning & sequencing, tool layout & selection and cutting parameters selection. Tool path study of machining operations Prepare various programs as per drawing. (18hrs.)
		123. Perform Work and tool setting: - Job zero/work coordinate system and tool setup and live tool setup. (15hrs.) 124. Carryout jaw adjustment according to Diameter and tooling setup on Turret. (15hrs.) 125. CNC turning centre operation in various modes: JOG, EDIT, MDI, SINGLE BLOCK, AUTO. (15hrs.) 126. Program entry. (2hrs.) 127. Set the tool offsets, entry of tool nose radius and orientation. (15hrs.) 128. Conduct work off set measurement, Tool off set measurement and entry in	Tool Nose Radius Compensation (G41/42) and its importance (TNRC). Cutting tool materials, cutting tool geometry – insert types, holder types, insert cutting edge geometry. - Describe Tooling system for turning - Setting work and tool offsets. - Describe the tooling systems for CNC TURNING Centers. - Cutting tool materials for CNC Turning and its applications - ISO nomenclature for turning tool holders, boring tool holders, indexable inserts. - Tool holders and inserts for radial grooving, face

		CNC Control. (10hrs.) 129. Make Tool nose radius and tool orientation entry in CNC control. (8hrs.) 130. Jaw removal and mounting on CNC Lathe. (8hrs.) 131. Manual Data Input (MDI) and MPG mode operations and checking of zero offsets and tool offsets. (12hrs.)	grooving, threading, drilling. (36 hrs.)
		132. Program checking in dry run, single block modes. (6 hrs.) 133. Checking finish size by over sizing through tool offsets. (9 hrs.) 134. Part program preparation, Simulation & Automatic Mode Execution for the exercise on Simple turning & Facing (step turning) (10 hrs.) 135. Part program preparation, Simulation & Automatic Mode Execution for the exercise on Turning with Radius / chamfer with TNRC. (10 hrs.) 136. Part program preparation, Simulation & Automatic Mode Execution of CNC Machine for the exercise on Blueprint programming contours with TNRC. (10 hrs.) 137. Machining parts on CNC lathe with parallel, taper, step, radius turning,	Prepare various part programs as per drawing & check using CNC simulator. Processes and Tool selection related to grooving, drilling, boring & threading. (27 hrs.)

		grooving & threading. (15 hrs.) 138. Carryout Drilling /Boring cycles in CNC Turning. (15 hrs.) *(First 60 % of the practice is on CNC machine simulator, followed by 40 % on machine.)*	
		139. Geometry Wear Correction. Geometry and wear offset correction. (10 hrs.) 140. Produce components on CNC Machine involving different turning operations viz., • Stock removal cycle OD • Drilling / boring cycles • Stock removal cycle ID • Carryout threading in different pitches. (18 hrs.) 141. Produce components by involving turning operation and part programme exercises of CNC turning viz., • Grooving and thread cutting OD • Grooving and thread cutting ID • Threading cycle OD • Sub programs with repetition • Using Sub Programs & Cycles in the Main Program. (18 hrs.)	- Describe Tapping on CNC turning. - Programming for Grooving/Threading on OD/ID in CNC Turning. - Trouble shooting in CNC lathe machine - Identify Factors affecting turned part quality/ productivity. - Parting off operation explanation. - Bar feeding system through bar feeder. - Input and Output of Data. - DNC system. Interlacing with PC. - Use of CAM Programme. (Optional) (27 hrs.)

		142. Part off: Part Prog. (4 hrs.) 143. Produce job involving profile turning, threading on taper, boring, etc. operations. (22 hrs.) 144. Demo on M/C on bar feeding system. (simulation/ video) (1 hr.) 145. DNC system setup. (Optional) 146. Run the machine on DNC mode.(Optional) 147. CAM programme execution. (Optional) 148. Data Input-Output on CNC machine. (2 hrs.)	
Professional Skill 100 Hrs.; Professional Knowledge 36 Hrs.	Manufacture and assemble components to produce utility items by performing different operations & observing principle of interchangeability and check functionality. *[Utility item: - screw jack/ vice spindle/ Box nut, marking block, drill chuck, collet chuck etc.; different operations: - threading (Square, BSW, ACME, Metric), Thread on*	149. Thread on taper surface (Vee form). (50 hrs.)	Setting of tools for taper threads-calculation of taper setting and thread depth. Heat treatment – meaning & procedure hardening, tempering, carbonizing etc. Different types of metal used in engineering application. (18 hrs.)
		150. Manufacturing & Assembly of Screw jack/vice/Box nut by performing different lathe operation. (To use earlier produce screw jack). (25 hrs.)	Interchangeability meaning, procedure for adoption, quality control procedure for quality production. (09hrs.)
		151. Prepare different types of documentation as per industrial need by different methods of recording information. (4 hrs.) 152. Turn Bevel gear blank. (21	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

	taper, different boring (Plain, stepped)]	hrs.)	time, productivity reports, job cards. (09 hrs.)
Professional Skill 125 Hrs.; Professional Knowledge 45 Hrs.	Make a process plan to produce components by performing special operations on lathe and check for accuracy. *[Accuracy - ±0.02mm or proof machining & ±0.05mm bore; Special operation – Worm shaft cutting (shaft) boring, threading etc.]*	153. Read a part drawing, make a process plan for turning operation and make arborwith clamping nut (hexagonal). (50hrs.)	Terms used in part drawings and interpretation of drawings – tolerances, geometrical symbols - cylindricity, parallelism. etc. (18 hrs.)
		154. Practice of special operations on lathes - worm gear cutting. (Shaft) (25 hrs.)	Automatic lathe-its main parts, types diff. Tools used-circular tool etc. (09 hrs.)
		155. Boring on lathe using soft jaws to make bush with collar (standard) on nonferrous metal and check with dial bore gauge to accuracy of +/- 0.05 mm. (30hrs.) 156. Make Arbor support bush. (Proof Machining) (20hrs.)	Related theory and calculation. (18 hrs.)
In-plant training/ Project work (Any Project to be done on CNC machine) a) Taper Sunk b) Socket with Split Collet c) Screw Jack d) Spindle with Hub e) Morse Taper Eccentric f) Crank Shaft with Taper Sleeve			

SYLLABUS FOR CORE SKILLS
1. Workshop Calculation & Science (Common for two years courses) (80Hrs. + 80 Hrs.)
2. Engineering Drawing (Common for Group-I (Mechanical Trade Group)) (80Hrs. + 80 Hrs.)
3. Employability Skills (Common for all CTS trades) (160Hrs. + 80 Hrs.)

Learning outcomes, assessment criteria, syllabus and Tool List of Core Skills subjects which is common for a group of trades, provided separately in www.bharatskills.gov.in

LIST OF TOOLS AND EQUIPMENT			
Turner Trade (CTS) (For batch of 20 candidates)			
S No.	**Name of the Tool & Equipment**	**Specification**	**Quantity**
A. TRAINEES TOOL KIT (For each additional unit trainees tool kit Sl. 1-10 is required additionally)			
1	Caliper outside spring joint	150 mm	(20 +1) nos.
2	Caliper inside spring joint	150 mm	(20 +1) nos.
3	Caliper odd-leg firm joint	150 mm	(20 +1) nos.
4	Steel Rule	150 mm, Graduated both in Metric and English Unit	(20 +1) nos.
5	Scriber	150mm x 3 mm	(20 +1) nos.
6	Hammer ball peen	250 gm with handle	(20 +1) nos.
7	Centre punch	100 mm	(20 +1) nos.
8	Prick punch	100 mm	(20 +1) nos.
9	Divider spring joint	150 mm	(20 +1) nos.
10	Safety goggles clear glass (Good quality)		(20 +1) nos.
B. INSTRUMENTS AND GENERAL SHOP OUTFIT			
11	Surface Plate - Granite	1000 x 1000 mm with Stand and Cover	1 no.
12	Work bench	240 x 120x 90cm high	1 no.
13	Marking table (CI)	120 x 120 cm	1 no
14	Bench vice	125 mm jaw	6 nos.
15	V-Block	150X100X100 mm with Clamp (Hardened & Ground)	1 pair each
16	Universal Surface gauge	250 mm arm	2 nos.
17	Hammer ball peen	750 gm with handle	6 nos.
18	Chisel cold flat	20 x 150 mm	6 nos.
19	Hammer copper/brass	500 gm with handle	12 nos.
20	Hacksaw fixed	200 mm (Pistol grip)	6 nos.
21	File flat	300 mm rough	6 nos.
22	File flat	250 mm 2nd cut	6 nos.
23	File flat	250 mm smooth	6 nos.
24	File half round	250 mm 2nd cut	6 nos.
25	File round	250 mm smooth	6 nos.
26	File half round	150 mm smooth	2 Sets

27	Knurling tool revolving head	(Rough, med, fine) diamond and straight	2 Sets
28	Combination set	300 mm (Complete Set)	6 nos.
29	Screwdriver	10 X 200 mm	1 set
30	Spanner double ended	6 mm to 21 mm	2 nos.
31	Spanner adjustable	200 mm	---
32	Pliers flat nose	150 mm side cutting	15 nos.
33	Caliper transfer inside	150 mm	3 nos.
34	Micrometer Outside	0 to 25 mm, Least Count 0.01 mm with NABL Accredited lab. Certificate	2 sets
35	Micrometer Outside	25 to 50 mm, Least Count 0.01 mm with NABL Accredited lab. Certificate	2 nos.
36	Micrometer Outside	50to 75 mm, Least Count 0.01 mm with NABL Accredited lab. Certificate	2 sets
37	Micrometer Inside	up to 25 mm, Least Count 0.01 mm with NABL Accredited lab. Certificate	2 nos.
38	Micrometer Inside	up to 25 to 50 mm, Least Count 0.01 mm with NABL Accredited lab. Certificate	2 nos.
39	Depth Gauge Micrometer	0 to 150 mm, Least Count 0.01 mm with NABL Accredited lab. Certificate	2 nos.
40	Vernier Caliper Outside, Inside and Depth	200 mm /8 inches with metric & inch scale (L.C. = 0.02mm) with NABL Accredited lab. Certificate	6 nos.
41	Dial Vernier Caliper with metric	200 mm, Least Count 0.05 mm with NABL Accredited lab. Certificate	6 nos.
42	Vernier Bevel Protractor	300 mm blade with NABL Accredited lab. Certificate	6 nos.
43	Vernier Micrometer	0 - 25 mm o/s LC 0.001mm with NABL Accredited lab. Certificate	2 nos.

44	Vernier Micrometer	25 - 50 mm, outside Least Count 0.001mm with NABL Accredited lab. Certificate	2 sets
45	Vernier Micrometer	0 inch to 1 inch.Outside Least Count 0.001 inch with NABL Accredited lab. Certificate	2 nos.
46	Gauge Feeler	Thickness - 0.05 mm to 0.3 mm by 0.05 **and** 0.4 mm to 1 mm by 0.1 mm - 13 leaves	1 each
47	Gauge - Radius Set	1 mm to 25 mm by 0.5 mm	6 nos.
48	Centre Gauge	com. 60°, 55° and 29°	2 sets
49	Screw Pitch Gauge	Whitworth & Metric each (0.25 to 6mm)	2 sets
50	Drill Angle Gauge		2 sets
51	Universal Dial Test Indicator - Plunger Type	Range 0 - 10 mm, Graduation 0.01 mm complete with Clamping Devices and Magnetic Stand	2 sets
52	Vernier Height Gauge	0 - 300 mm, LC = 0.02 mm with NABL Accredited lab. Certificate	1 set
53	Try Square	150 blades	4 nos.
54	Magnifying Glass	75 mm with magnifying factor 10X	4 nos.
55	Plain Ring and Plug Gauge	(12,16,20,25,30,32,36,40,45,50 mm)	1 set each
56	Wheel Dresser Hunting on-type with star cutter		1 No.
57	Wheel Dresser Diamond	(inserted-0.75 or 1 Carat)	2 nos.
58	Screw Thread micrometer interchangeable	(0-25 mm)	1 no.
59	Morse Taper Plug & Ring Gauge	No. 0 to 7 MT	1 set
60	Sine Bar with centers	200 mm	2 nos.
61	Slip Gauge metric set	(87 pieces in a Box) with workshop grade	2 nos.
62	Morse Taper	Sleeves No. 0-1, 1-2, 2-3, 3-4, 4-5.	1 set
63	Drill Drift		1 Set.

64	Twist Drill	straight shank 3 to 12 mm by 1 mm	1 No.
65	Drill Twist Set	Taper Shank - 14 mm to 20 mm by 1 mm	1 set (Box)
66	Drill Chuck	12 mm cap with key	2 Sets.
67	Tap & Die	B.A. No. 0 to 10 in a box	2 nos.
68	Tap and Die Set	Metric - 3 to 24 mm	2 Sets
69	Tap & Die	B.S.F. up to 1 inch	2 Sets.
70	Tap & Die	B.S.W. up to 1 inch	2 Sets.
71	Reamer machine	straight flute 6 to 25 mm	1 Set.
72	Reamer Adjustable	10 to 20 mm	1 set.
73	Tool Holder RH & straight for mm square tool bit		1 no.
74	Parting Tool Holder with H.S.S. blade		12 nos.
75	Tool Bits	12 X 150 mm sq. assorted shaped	15 nos.
76	Boring Tool holder	6 mm sq. tool bit	15 nos.
77	Steel Rule	300 mm with Metric and Inch	15 nos.
78	Oil Can	½ pint (pressure feed system)	06 nos.
79	Dog Carrier	25, 50 and 75 mm	12 nos.
80	Angle Plate	Adjustable - 150 X 175 X 250 mm	02 nos.
81	Spirit Level	0.05 mm / 200 mm	2 nos.
82	Tool Maker's button		1 set
83	Combination Drill / Centre Drill	A3, A4 & A5	1 set
84	Oil Stone	12 mm sq. x 100 long fine	12 nos.
85	Tap Wrench (adjustable)		09 nos.
86	Die Handle		2 nos.
87	Tool Bit assorted sizes on holder		10 nos.
88	Machine Vice - Swivel Base	100 mm	01 no.
89	Chalk Board on mobile stand		1 no.
90	Spare Grinding Wheel Ajax type for carbide tool		1 no.
91	Almirah	1980x 910 x 480 mm	2 no.
92	St. Locker with drawer (Pigeonholes)		1 no.
93	Desk		1 no.
94	Stool		4 nos.
95	Angle Gauge for tool grinding		6 nos.

96	Hand Chaser	M-12 & M-16 (External)	2 nos.
97	Hand Chaser	M-12 & M-16 (Internal)	2 nos.
98	Revolving Center (to suit Lathe tailstock)		6 nos.
99	Tool Cemented carbide assorted shaped (External) for steel turning	set of 12 nos.	1 No.
100	Thread Plug Gauge	M-20 & M-21	1 set
101	Thread Ring Gauge	M-20 & M-21	1 no.
102	Machine Chaser	M-12 TO M-21 (Std. Series) to suit on	1 set
103	Coventry Die head		2 nos.
104	Gauge Drill Grinding		1 No.
105	Magnetic Chuck	150 mm dia.(Circulartype)	1 set.
106	Lathe Mandrels (Diff. Types)		1 no.
107	Coventry Type Die Head (Self-opening)		1 no.
108	Collapsible Tap with attachment		2 nos.
109	Fire Extinguisher and buckets		2 nos. each
110	Bore dial gauge stems	12 to 35 mm, 35 to 65 mm., dial gauge indicator of 0.01 accuracy.	1 set each
C : MACHINERIES AND EQUIPMENTS			
111.	Lathe S.S. & S.C. (All geared head stock) with minimum specification as:	150 mm center height, to admit 750 mm between centers. Machine to be motorized and supplied with coolant installation, 4-jaw Independent chuck 150 mm, 3-jaw self-centering chuck 150 mm, fixed steady, traveling steady, face plate, driving plate, 4-way tool post, quick change gear box for Metric or British threads, live and dead centers with taper attachments, Motor Capacity - 5.5 KW	5 nos.

112.	Lathe S.S & S.C.(all geared type) with minimum specification as:	150 mm. Center height, 1000 mm between centers, gap bed machine to be motorized and supplied with coolant installation, 4-jaw independent chuck 250 mm , 3-jaw self-centering chuck 200 mm fixed steady, face plate, driving plate, 4-way tool post, quick change gear box for Metric/British threads, live and dead centers with taper attachments, Motor Capacity -5.5 KW	1 no.
113.	Lathe tool room S.S. & S.C. (all geared type) with minimum specification as:	150 mm center height, 1000 mm between centers. Machine to be motorized and supplied with coolant installation, 4-jaw independent chuck 250 mm, 3-jaw self-centering chuck 150 mm fixed steady, traveling steady, face plate, driving plate, 1-way tool post, draw in type collets set up to 25 mm, 0.5 mm, relieving attachments, Motor Capacity -5.5 KW	1 no.
114.	Grinding machine pedestal type	D.E. 200 mm dia. Wheel with wheel guard and vision, Motor Capacity -0.75 KW	1 no.
115.	Drill machine pillar type-motorized	up to 12 mm. Cap, Motor Capacity -0.75 KW	1 no.
116.	Power saw machine – hydraulic feed system	400 mm. Blade size, Motor Capacity -0.75 KW	1 no.
D: LIST OF ADDITIONAL MACHINES, TOOLS & EQUIPMENT FOR CNC TURN CENTRE:			
117.	CNC lathe/CNC turn Centre	[specification as per Annex-A & A (I)]	As per Annex-A & A (I)
118.	a) Simulator b) Desktop Computers	[specification as per Annex-A & A (I)]	As per Annex-A & A (I)

119.	Tool holders	[specification as per Annex-A & A (I)]	As per Annex-A & A (I)
120.	LCD projector / large screen TV		1 no.
121.	Digimatic Electronic VernierCaliper	inch and mm 8"/200 mm. LCM 0.005"/0.001 mm	2 nos.
122.	Digimatic electronic outside Micrometer	(0 to 25 mm & 25 to 50 mm) LC 0.001 mm.	1 no. each

NOTE: -

1. *No additional items are required to be provided to the batch working in the second and third shiftexcept the items under trainee's toolkit.*
2. *Institute having centralized computer lab may use the existing infrastructure to impart simulationtraining & in that case not required to procure item no. 118b.*
3. *Preferably all tools must be hardened, toughened and grounded.*
4. *Internet facility is desired to be provided in the classroom.*

Annexure – A

CNC Lab						
Space and Power Requirement						
1	Space Required (in Sq. Meter):	40 (For below 8(4+4) units) 65 (For above 8(4+4) units)				
2	Power Required (in KW):	6 (For below 4(2+2) units) 12.5(For 4(2+2) & above units)				
CNC Lab Infrastructure						
SNo.	**Name of Item**	**Category**	**Quantity**		**Unit**	**Remark**
			4 (2+2) units & Above	**Below 4 (2+2) units**		
3	CNC turn Centre [specification as per Annex-A (I)]	Machine	1	NIL	Number	**Refer Instructions**
4	Multimedia based simulator for CNC technology and interactive CNC part programming software for turning & milling with virtual machine operation and simulation using popular operation control system such as Fanuc, Siemens, etc. (Web-based or licensed based) (12 trainees + 1faculty) ***With help of this software the trainees should be able to Write, Edit, Verify & Simulate***	Software	10	10.	users	
5	Desktop Computers compatible to run simulation software with LAN facility	Machine	10	10	Number	CPU: 32/64 Bit i3/i5/i7 or latest processor, Speed: 3 GHz or Higher. RAM:-4 GB DDR-III or Higher, Wi-Fi Enabled. Network Card:

						Integrated Gigabit Ethernet, with USB Mouse, USB Keyboard and Monitor (Min. 17 Inch.) Licensed Operating System and Antivirus compatible with trade related software.
6	Printer - (Laser/ Inkjet)	Machine	1	1	Number	Optional
7	Air Conditioner	Machine	As required	As required	Number	Optional
8	UPS	Machine	As required	As required	Number	Optional

Instructions	
a)	**For units less than 4(2+2), ITI can enter into MoU with Facilitator who will provide the Training to Trainees admitted and undergoing training in above Trades.** The Facilitator should be Government ITI, Engineering/ Polytechnic College, Recognized Training Institute, Industry, Private ITI (Facilitators are arranged in descending preference order). The Facilitator should have all the above training infrastructure. (Including CNC Machines and Multimedia software for CNC). If any of the facility is not available with facilitator then the same should be provided in the ITI. The facilities of CNC should be made available to ITI trainees at the time of examination. This clause should be part of MoU to be signed. The training provider must be within the range of 15 Km or within city whichever is less.
b)	**NOTE: -** "*It is on the discretion of the ITI that it may procure CNC simulation software with extra features in addition to the specification defined against CNC simulator*".

Annexure –A (I)

Detailed specification for 2 axis CNC Lathe / Turning centre			
1	**MACHINE CAPACITY**	**Units**	**Size**
a	Swing over bed	mm	350 or higher
b	Turning diameter	mm	135 or higher
c	Distance between centres	mm	250 or higher
d	Maximum Turning Length	mm	200 or higher
e	Slant angle (bed or saddle)	degrees	30 to horizontal or higher
f	Cast Iron grade for bed and saddle		Grade 25 or equivalent
g	Machine weight net	kg	1500 or higher
2	**SPINDLE**		
a	Spindle nose		A2-4 / A2-5
b	Bore through Spindle	mm	35 or higher
c	Maximum spindle speed	RPM	4000 or higher
d	Spindle power, continuous	kW	3.7 or higher
e	Minimum spindle speed @ full power	RPM	1200 or lower
f	Type of drive		AC servo spindle motor (digital)
g	Chuck size	mm	135 or higher
h	Chuck type		3-jaw hydraulic, Hydraulic Power operated
i	Spindle bearing class		P4 class
j	Front Bearing Dia. (ID)	mm	60 or higher
3	**AXES**		
a	X - axis Travel	mm	100 or higher
b	Z - axis Travel	mm	200 or higher
c	Programmable feed rate- X & Z	mm/min	10 - 10000
d	Minimum programmable command - X & Z	mm	0.001
e	Rapid traverse - X & Z	m/min	20 or higher
f	Type of drive - X & Z		AC servo motor
g	Motor torque - Z axis	Nm	3 or higher
h	Motor torque - X axis	Nm	3 or higher with brake
i	Ball screw - Z & X axes (diameter x pitch)	mm	25 x 10 or higher
j	Ball screw finish - Z & X axes		Hardened and Ground
k	Ball screw class- Z & X axes		Pre-loaded with C3 or better
l	Guideway type - Z & X axes		Antifriction linear motion guideway
m	Guideway size - Z & X axes	mm	25 or higher
n	Guideway precision - Z & X axes		P class
4	**TURRET**		

a	Bi-Directional Tool Turret	Electromechanical/Servo/Hydraulic	
b	No. of Tools	Nos.	8 or higher
c	Tool shank size	mm	20 x 20 or higher
d	Maximum boring bar diameter	mm	25 or higher
5	**TAIL STOCK**		
a	Quill Diameter	mm	65 or higher
b	Quill Stroke	mm	70 or higher
c	Quill Taper	MT-4 or higher	
d	Quill actuation	Hydraulic	
e	Tail stock base travel manual	mm	150 or higher
f	Thrust (Adjustable)	Kgf	300 or higher
6	**COOLANT/LUBRICATION/HYDRAULIC**		
a	Coolant tank Capacity	Litres	100 or higher
b	Coolant pump motor	kW	0.37
c	Coolant pump out put	LPM	20 or higher
d	Lubrication type	Automatic centralized lubrication	
e	Lubrication tank capacity	Litres	3 or higher
f	Hydraulic pump discharge	LPM	8 or higher
g	Hydraulic tank capacity	Litres	30 or higher
h	Hydraulic system pressure maximum	Bar	30 or higher
7	**ACCURACY as per ISO 230-2**		
a	Positioning accuracy X & Z axes	mm	0.012
b	Repeatability X & Z axes	mm	± 0.007
c	Geometrical Alignment	ISO 13041-Part 1	
d	Accuracy of finish test piece	ISO 13041-Part 6	
8	**CNC SYSTEM**		
a	Control System	FANUC /Siemens	
b	System resolution	0.001 mm	
c	Motors & Drives	Compatible with CNC controllers mentioned above	
d	Tool number display	On machine operator panel	
e	Machine control panel	Feed rate, spindle speed override knob	
f	MPG (Manual pulse generator)	On machine operator panel	
g	CNC features	Graphic Simulation, Programming help, Tool Offsets, MDI,	
		Absolute/ Incremental Positioning, Pitch error compensation	
9	**POWER SOURCE**		
a	Mains supply (± 10 %)	415 V, 3 Ph., 50Hz	
b	Total connected load requirement	Approx. 15 kVA	
10	**STANDARD EQUIPMENT**		
a	Voltage Stabilizer	15 kVA	
b	Air conditioning unit for electrical	1 No.	

	cabinet		
	Backup CD for PLC Ladder Logic	1 No.	
d	Machine lighting	1 No.	
e	Levelling pads and jacking screws	4 No.	
f	Operation manual	1 No.	
g	Maintenance manual	1 No.	
h	Installation kit	1 No.	
i	Maintenance tool kit	1 No.	
j	6 rack trolley (Size 25"x22"x45") with lock	1 No.	
k	Machine guarding with safety compliance	1 No.	
11	**MAKES OF CRITICAL MACHINE TOOL COMPONENTS**		
a	Linear Motion Guideways	HIWIN/THK/PMI/STAR	
b	Ball Screws	HIWIN/THK/TSUBAKI/PMI/STAR/HMT/NSK	
c	Spindle Bearings	RHP/NSK/FAG/SKF/NRB	
d	Turret	PRAGATI/BARUFFALDI/SAUTER/DUPLOMATIC	
e	Hydraulic Chuck & Cylinder	GMT/KITAGAWA/AIRTECH/PRAGATI/ROHM	
f	Hydraulic Power Pack	YUKEN/FLUID/REXROTH	
g	Panel AC	WERNER FINLEY/RITTAL/LEXTECNOID	
h	Stabilizer	NEEL/SERVOMAX/CONSUL/FARMAX/EQUIVALENT	
i	Lubrication	CENLUBE/DROPCO/EQUIVALENT	
j	Coolant Pump	RAJAMANE/GRUNDFOS	
k	Cutting tools and holders	SANDVIK/TAEGUTEC/KENNAMETAL/SECO/ISCAR/MITSUBISHI	

12 Cutting tools & tool holders	**Quantity**		**Inserts**	**Quantity**	
	1 year	**3 years**		**1 year**	**3 years**
1. External turning holder, insert type, MWLNL	2	4	WNMG	20	40
2. External turning holder, insert type, MVJNL	2	4	VNMG	10	20
3. External turning holder, insert type, PDJNR	2	4	DNMG	10	20
4. Threading Holder - External, LH	2	4	0.5 to 2	10	30
5. Threading Holder - Internal, LH	2	4	0.5 to 2	10	30
6. Grooving Holder External, LH	2	4	3 mm	10	30
7. Grooving Holder Internal, LH	2	4	3 mm	10	30
8. Parting off Holder for insert width 2 mm, LH	2	4	2 mm	10	30
9. Boring holder SCLCL for minimum bore dia. 12 mm	2	4	WCMT	20	60
10. Boring holder SCLCL for minimum bore dia. 16 mm	2	4	CCMT	20	60
11. Internal grooving holder LH, for minimum bore dia. 12 mm.	2	4	2 mm	10	30
12. Internal threading holder LH, for minimum bore dia. 12 mm	2	4	w mm	10	30

13. Insert drill 12.7 mm	2	4	Suitable	10 sets	30 sets
14. Reducing sleeves for internal holders - Dia 12 and 16 mm	1 set	2 sets			
15. Centre drill HSS A 2.5 x 6.3	2	6			
16. Twist drill HSS straight shank, dia 6,8,10,12 mm	2 Sets	6 sets			
17. Collets suitable for the above drills	1 Set	2 sets			
18. Collet Holder	2	4			
19. Boring bar holder	3	3			

ANNEXURE-II

The DGT sincerely acknowledges contributions of the Industries, State Directorates, Trade Experts, Domain Experts, trainers of ITIs, NSTIs, faculties from universities and all others who contributed in revising the curriculum.

Special acknowledgement is extended by DGT to the following expert members who had contributed immensely in this curriculum.

List of Expert members participated for finalizing the course curriculum of Turner trade held on 12.01.17 at CSTARI, Kolkata			
S No.	**Name & Designation Shri/Mr./Ms.**	**Organization**	**Remarks**
1.	DEEPANKAR MALLICK, DDG (Trg.)	DGT, MSDE, New Delhi	Chairman
2.	H. V. SAMVATSAR, Director	CSTARI, Kolkata	Secretary (Trade Committee)
3.	NIRMALYA NATH Asst. Director of Trg.	CSTARI, Kolkata	Member cum Co-coordinator
4.	RAJENDRA PRASAD Director	DTE, Uttar Pradesh	Member
5.	R. N. BANDYOPADHAYA OSD	PaschimBanga Society for Skill Development, Kolkata	Member
6.	SUMANTA MODAK, General Manager (Works)	EVEREADY Industries Pvt. Ltd. (Representative of ***CII***)	Member
7.	S. D. SATISH CHANDRA, Manager (HR), Trg.	HAL – Koraput Division, Koraput, Odisha	Member
8.	SUMANTA CHATTERJEE Addl. General Manager	BHEL, Power Sector ER	Member
9.	P. C. BHANDARI Technical Advisor	J K Cement Ltd. Kanpur	Member
10.	SANJIT BHOWMICK Asst. General Manager	Hindalco Industries Ltd., Belur Math, Howrah	Member
11.	DEBASHIS BHATTACHARYYA, JWM,/FTI	Rifle Factory, Ishapore, Ministry of Defence, Govt. India, WB	Member
12.	SATYABADI SATAPATHY Training Officer	HAL – Koraput Division, Koraput, Odisha	Member

13.	PRABHAT SAMIR PAL Jr. Manager	GRSE Ltd., Kolkata	Member
14.	JOYDEEP PAL MAJUMDER Asst. Work Manager	Rifle Factory, Ishapore, Ministry of Defence, Govt. India, WB	Member
15.	BHABANI PROSAD MONDAL CM/FTI	Rifle Factory, Ishapore, Ministry of Defence, Govt. India, WB	Member
16.	SUNIRMAL BASU, Asst. Inspecting Officer	Railway Workshop, Kanchrapara	Member
17.	K. L. KULI Joint Director of Trg.	CSTARI, Kolkata	Member
18.	M. THAMIZHARASAN, Joint Director of Trg.	CSTARI, Kolkata	Member
19.	SANJAY KUMAR Joint Director of Trg.	CSTARI, Kolkata	Member
20.	L. K. MUKHERJEE Dy. Director of Trg.	CSTARI, Kolkata	Member
21.	U. K. MALLICK, Dy. Director	DTE&T, Odisha	Member
22.	N. R. PATTANAIK Principal	Govt. ITI Balasore, Odisha	Member
23.	DEEPAK KUMAR, SSE/Drg./C&W	Railway Workshop, Kanchrapara	Member
24.	D. W. PATNE, Secretary	Association of Non-Govt. ITI, Maharastra	Member
25.	VIVEK CHAUDHARI Principal	Ujjwal ITI Nashirabad, Dist-Jalgoan, Maharastra	Member
26.	Fr. JOSE PADAMATTAM Principal	Don Bosco Technical Institute, Park Circus	Member
27.	SWAMI GUNINDRANANDA Superintendent	R. K. Mission ShilpayatanBelurmath, Howrah	Member
28.	TAPAS SENGUPTA, Instructor	ITI Howrah Homes	Member
29.	DEBIPROSHAD SARKAR, Instructor	ITI Howrah Homes	Member
30.	G. B. KOLAPATE, Instructor	Govt. ITI Andhari, Mumbai, Maharastra	Member
31.	H. B. KOSHTI, Craft Instructor	Govt. ITI Byculla, Mumbai - 400011	Member

32.	NAGESH BALAKRISHNA NARKAR, Craft Instructor	ITI Ambernath, Thane, Maharastra	Member
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34.	SWAPAN KUMAR BHATTACHARYA, Instructor	STC/KPA, Eastern Railways, Kanchrapara	Member
35.	BIKASH CHAUDHURI, Instructor	Ramakrishna Mission Shilpayatan, Belur, Howah	Member
36.	SACHIN M. LAMSE Instructor	ITI Aundh, Pune, Maharastra	Member
37.	SOMNATH B. SAPKAL, Instructor	ITI Anudh, Pune, Maharastra	Member
38.	K. K. PANIGRAHI Instructor	Gun Shell Factory, Cossipore	Member
39.	T. K. GHOSH, Training Officer	CSTARI, Kolkata	Member
40.	R. N. MANNA, Training Officer	CSTARI, Kolkata	Member
41.	TARAKNATH GARAI Instructor	ITI Howrah Homes	Member
42.	SUDHANGSHU MUKHERJEE, Sr. Tech./Dy. CEE/KPN	Eastern Railway, Kanchrapara	Member
43.	S. N. TAMBATKAR, Craft Instructor	Govt. ITI, Adheri, Mumbai	Member

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 &Tourbo 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
21.	M. K. Verma, Sr. Manager Trg. Capability Development	SNTI, TATA Steel Ltd., Jamshedpur	Member
22.	N.K Thakur, DGM-Trg.	L&T, Construction and Mining Machinery, Kanchipuram.	Member
23.	Vijayan K T,	Volkswagen Academy, Pune	Member
Mentor			
24.	Sunil Kumar Gupta (Director)	DGET HQ, New Delhi.	Mentor
Members of Core Group			
25.	N. Nath. (ADT)	CSTARI, Kolkata	Co-ordinator
26.	H.Charles (TO)	NIMI, Chennai.	Member
27.	Sukhdev Singh (JDT)	ATI Kanpur	Team Leader
28.	Ravi Pandey (V.I)	ATI Kanpur	Member
29.	A.K. Nasakar (T.O)	ATI Kolkata	Member
30.	Samir Sarkar (T.O)	ATI Kolkata	Member

31.	J. Ram EswaraRao (T.O)	RDAT Hyderabad	Member
32.	T.G. Kadam (T.O)	ATI Mumbai	Member
33.	K. Mahendar (DDT)	ATI Chennai	Member
34.	Shrikant S Sonnavane (T.O)	ATI Mumbai	Member
35.	K. Nagasrinivas(DDT)	ATI Hyderabad	Member
36.	G.N. Eswarappa (DDT)	FTI Bangalore	Member
37.	G. Govindan, Sr. Draughtsman	ATI Chennai	Member
38.	M.N.Renukaradhya, Dy.Director/Principal Grade I.,	Govt. ITI, Tumkur Road, Banglore, Karnataka	Member
39.	B.V.Venkatesh Reddy. JTO	Govt. ITI, Tumkur Road, Banglore, Karnataka	Member
40.	N.M.Kajale, Principal,	Govt. ITI Velhe, Distt: Pune, Maharashtra	Member
41.	SubrataPolley, Instructor	ITI Howrah Homes, West Bengal	Member
42.	VINOD KUMAR.R Sr.Instructor	Govt.ITIDhanuvachapuram Trivandrum, Dist., Kerala	Member
43.	M. Anbalagan, B.E., Assistant Training Officer	Govt. ITI Coimbatore, Tamil Nadu	Member
44.	L.K.Mukherjee, DDT	CSTARI, Kolkata	Member
45.	R. N. Manna, TO	CSTARI, Kolkata	Member
Other industry representatives			
46.	VenugopalParvatikar	Skill Sonics, Bangalore	Member
47.	VenkataDasari	Skill Sonics, Bangalore	Member
48.	Srihari, D	CADEM Tech. Pvt. Ltd., Bengaluru	Member
49.	Dasarathi.G.V.	CADEM Tech. Pvt. Ltd., Bengaluru	Member
50.	L.R.S.Mani	Ohm Shakti Industries, Bengaluru	Member
51.	P. Joji, Ex-JDT	DGT, MSDE, New Delhi	Member
52.	K. Lakshmi Narayanan	Skill Development Centre, JBM Auto System Pvt. Ltd., Kancheepuram	Member

ABBREVIATIONS

CTS	Craftsmen Training Scheme
ATS	Apprenticeship Training Scheme
CITS	Craft Instructor Training Scheme
DGT	Directorate General of Training
MSDE	Ministry of Skill Development and Entrepreneurship
NTC	National Trade Certificate
NAC	National Apprenticeship Certificate
NCIC	National Craft Instructor Certificate
LD	Locomotor Disability
CP	Cerebral Palsy
MD	Multiple Disabilities
LV	Low Vision
HH	Hard of Hearing
ID	Intellectual Disabilities
LC	Leprosy Cured
SLD	Specific Learning Disabilities
DW	Dwarfism
MI	Mental Illness
AA	Acid Attack
PwD	Person with disabilities


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