

# **TURNER**

**NSQF LEVEL - 6**



**SECTOR- CAPITAL GOODS AND MANUFACTURING**

**COMPETENCY BASED CURRICULUM**  
**CRAFT INSTRUCTOR TRAINING SCHEME (CITS)**



**GOVERNMENT OF INDIA**  
Ministry of Skill Development & Entrepreneurship  
Directorate General of Training  
**CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE**  
EN-81, Sector-V, Salt Lake City, Kolkata – 700091

# TURNER

(Engineering Trade)

## SECTOR – CAPITAL GOODS AND MANUFACTURING

(Revised in 2019)

Version 1.1

### CRAFT INSTRUCTOR TRAINING SCHEME (CITS)

**NSQF LEVEL - 6**

Developed By  
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## 1. COURSEOVERVIEW

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The Craft Instructor Training Scheme is operational since inception of the Craftsmen Training Scheme. The first Craft Instructors' Training Institute was established in 1948. Subsequently, 6 more institutes namely, Central Training Institute for Instructors (now called as National Skill Training Institute (NSTI)), NSTI at Ludhiana, Kanpur, Howrah, Mumbai, Chennai and Hyderabad were established in 1960's by DGT. Since then the CITS course is successfully running in all the NSTIs across India as well as in DGT affiliated institutes viz. Institutes for Training of Trainers (IToT). This is a competency based course for instructors of one year duration. "Turner" CITS trade is applicable for Instructors of "Turner" Trade.

The main objective of Craft Instructor training programme is to enable Instructors explore different aspects of the techniques in pedagogy and transferring of hands-on skills so as to develop a pool of skilled manpower for industries, also leading to their career growth & benefiting society at large. Thus promoting a holistic learning experience where trainee acquires specialized knowledge, skills & develops attitude towards learning & contributing in vocational training ecosystem.

This course also enables the instructors to develop instructional skills for mentoring the trainees, engaging all trainees in learning process and managing effective utilization of resources. It emphasizes on the importance of collaborative learning & innovative ways of doing things. All trainees will be able to understand and interpret the course content in right perspective, so that they are engaged in & empowered by their learning experiences and above all, ensure quality delivery.

## 2. TRAINING SYSTEM

### 2.1 GENERAL

CITS courses are delivered in National Skill Training Institutes (NSTIs) & DGT affiliated institutes viz., Institutes for Training of Trainers (IToT). For detailed guidelines regarding admission on CITS, instructions issued by DGT from time to time are to be observed. Further complete admission details are made available on NIMI web portal <http://www.nimionlineadmission.in>. The course is of one-year duration. It consists of Trade Technology (Professional skills and Professional knowledge), Training Methodology and Engineering Technology/ Soft skills. After successful completion of the training programme, the trainees appear in All India Trade Test for Craft Instructor. The successful trainee is awarded NCIC certificate by DGT.

### 2.2 COURSE STRUCTURE

Table below depicts the distribution of training hours across various course elements during a period of one year:

S No.	Course Element	Notional Training Hours
1.	<b>Trade Technology</b>	
	Professional Skill (Trade Practical)	640
	Professional Knowledge (Trade Theory)	240
2.	<b>Engineering Technology</b>	
	Workshop Calculation & Science	80
	Engineering Drawing	120
3.	<b>Training Methodology</b>	
	TM Practical	320
	TM Theory	200
	<b>Total</b>	<b>1600</b>

### 2.3 PROGRESSION PATHWAYS

- Can join as an Instructor in a vocation training institute/ technical institute.
- Can join as a supervisor in Industries.

### 2.4 ASSESSMENT & CERTIFICATION

The CITS trainee will be assessed for his/her Instructional skills, knowledge and attitude towards learning throughout the course span and also at the end of the training program.

- a) The Continuous Assessment (Internal) during the period of training will be done by **Formative Assessment Method** to test competency of instructor with respect to assessment criteria set against each learning outcomes. The training institute has to maintain an individual trainee portfolio in line with assessment guidelines. The marks of internal assessment will be as per the formative assessment template provided on [www.bharatskills.gov.in](http://www.bharatskills.gov.in)
- b) The **Final Assessment** will be in the form of **Summative Assessment Method**. The All India Trade Test for awarding National Craft Instructor Certificate will be conducted by DGT as per the guidelines of DGT. The learning outcome and assessment criteria will be the basis for setting question papers for final assessment. The external examiner during final examination will also check the individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

### 2.4.1 PASS CRITERIA

Sl. No.	Subject		Marks	Internal assessment	Full Marks	Pass Marks	
						Exam	Internal assessment
1.	Trade Technology	Trade Theory	100	40	140	40	24
2.		Trade Practical	200	60	260	120	36
3.	Engineering Technology	Workshop Cal. & Sc.	50	25	75	20	15
4.		Engineering Drawing	50	25	75	20	15
5.	Training Methodology	TM Practical	200	30	230	120	18
6.		TM Theory	100	20	120	40	12
<b>Total Marks</b>			<b>700</b>	<b>200</b>	<b>900</b>	<b>360</b>	<b>120</b>

The minimum pass percent for Trade Practical, TM practical Examinations and Formative assessment is 60% & for all other subjects is 40%. 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 the assessment. While assessing, the major factors to be considered are approaches to generate solutions to specific problems by involving standard/non-standard practices.

Due consideration should also be given while assessing for teamwork, avoidance/reduction of scrap/wastage and disposal of scrap/waste as per procedure, behavioral attitude, sensitivity to the 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 of the following:

- Demonstration of Instructional Skills (Lesson Plan, Demonstration Plan)
- Record book/daily diary
- Assessment Sheet
- Progress chart
- Video Recording
- Attendance and punctuality
- Viva-voce
- Practical work done/Models
- Assignments
- Project work

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

Performance Level	Evidence
(a) Weightage in the range of 60%-75% to be allotted during assessment	
For performance in this grade, the candidate should be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of an <b>acceptable standard</b> of crafts instructorship with <b>occasional guidance</b> and engage students by demonstrating good attributes of a trainer.	<ul style="list-style-type: none"> <li>• Demonstration of <b>fairly good</b> skill to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field.</li> <li>• Average engagement of students for learning and achievement of goals while undertaking the training on specific topic.</li> <li>• A fairly good level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson.</li> <li>• Occasional support in imparting effective training.</li> </ul>
(b) Weightage in the range of 75%-90% to be allotted during assessment	
For performance in this grade, the candidate should be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of a <b>reasonable standard</b> of crafts instructorship with <b>little guidance</b> and engage students by demonstrating good attributes of a trainer.	<ul style="list-style-type: none"> <li>• Demonstration of <b>good</b> skill to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field.</li> <li>• Above average engagement of students for learning and achievement of goals while undertaking the training on specific topic.</li> <li>• A <b>good</b> level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson.</li> <li>• Little support in imparting effective training.</li> </ul>

## (c) Weightage in the range of more than 90% to be allotted during assessment

For performance in this grade, the candidate should be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of a **high standard** of crafts instructorship with **minimal or no support** and engage students by demonstrating good attributes of a trainer.

- Demonstration of **high** skill level to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field.
- Good engagement of students for learning and achievement of goals while undertaking the training on specific topic.
- A **high** level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson.
- Minimal or no support in imparting effective training.



### 3. GENERAL INFORMATION

<b>Name of the Trade</b>	<b>TURNER-CITS</b>
<b>Trade code</b>	DGT/4012
<b>NCO – 2015</b>	2356.0100, 7223.0601,7223.6002, 7223.6001
<b>NSQF Level</b>	Level-6
<b>Duration of Crafts Instructor Training</b>	One Year
<b>Unit Strength (No. Of Student)</b>	25
<b>Entry Qualification</b>	<p>Degree in appropriate branches of Mechanical Engineering from AICTE/ UGC recognized Engineering College / University.</p> <p style="text-align: center;">OR</p> <p>Diploma in appropriate branches of Mechanical Engineering from AICTE/ recognized board / Institution.</p> <p style="text-align: center;">OR</p> <p>National Trade Certificate in <b>Turner</b> or related trades.</p> <p style="text-align: center;">OR</p> <p>National Apprenticeship Certificate in <b>Turner</b> or related trades.</p>
<b>Minimum Age</b>	18 years as on first day of academic session.
<b>Space Norms</b>	240 Sq. m
<b>Power Norms</b>	30KW
<b>Instructors Qualification for</b>	
<b>1. TURNER -CITS Trade</b>	<p>B.Voc/Degree in appropriate branches of Mechanical Engineering from AICTE/UGC recognized University with two years experience in relevant field.</p> <p style="text-align: center;">OR</p> <p>03 years Diploma in appropriate branches of Mechanical Engineering from AICTE/recognized Board/ Institution or relevant Advanced Diploma (Vocational) from DGT with five years experience in relevant field.</p> <p style="text-align: center;">OR</p> <p>NTC/ NAC passed in Turner trade with seven years experience in relevant field.</p> <p><b>Essential Qualification:</b> National Craft Instructor Certificate (NCIC) in Turner trade, in any of the variants under DGT.</p>
<b>2. Workshop Calculation &amp; Science</b>	<p>B.Voc/Degree in any Engineering from AICTE/ UGC recognized Engineering College/ university with two years experience in relevant field.</p> <p style="text-align: center;">OR</p> <p>03 years Diploma in Engineering from AICTE /recognized board of technical education or relevant Advanced Diploma (Vocational) from</p>

	<p>DGT with five years' experience in the relevant field. OR NTC/ NAC in any Engineering trade with seven years experience in relevant field.</p> <p><b>Essential Qualification:</b> National Craft Instructor Certificate (NCIC) in relevant trade OR NCIC in RoDA or any of its variants under DGT.</p>					
<b>3. Engineering Drawing</b>	<p>B.Voc/Degree in Engineering from AICTE/ UGC recognized Engineering College/ university with two years experience in relevant field. OR 03 years Diploma in Engineering from AICTE /recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with five 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 seven years experience.</p> <p><b>Essential Qualification:</b> National Craft Instructor Certificate (NCIC) in relevant trade OR NCIC in RoDA / D'man (Mech /civil) or any of its variants under DGT</p>					
<b>4. Training Methodology</b>	<p>B.Voc/Degree in any discipline from AICTE/ UGC recognized College/ university with two years experience in training/ teaching field. OR Diploma in any discipline from recognized board / University with five years experience in training/teaching field. OR NTC/ NAC passed in any trade with seven years experience in training/ teaching field.</p> <p><b>Essential Qualification:</b> National Craft Instructor Certificate (NCIC) in any of the variants under DGT / B.Ed /ToT from NITTTR or equivalent.</p>					
<b>5. Minimum Age for Instructor</b>	21 Years					
<b>Distribution of training on Hourly basis: (Indicative only)</b>						
Total Hrs /week	Trade Practical	Trade Theory	Workshop Cal. & Sc.	Engg. Drawing	TM Practical	TM Theory
40 Hours	16 Hours	6 Hours	2 Hours	3 Hours	8 Hours	5 Hours

## 4. JOB ROLE

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### Brief description of Job roles:

**Manual Training Teacher/Craft Instructor;** instructs students in ITIs/Vocational Training Institutes in respective trades as per defined job role. Imparts theoretical instructions for the use of tools & equipments of related trades and related subjects. Demonstrate process and operations related to the trade in the workshop; supervises, assesses and evaluates students in their practical work. Ensures availability & proper functioning of equipment and tools in stores.

**Turner/Conventional Turning;** 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.

**CNC Operator-Turning;** removes metal from the outer diameter of a rotating cylindrical work piece. It also involves inspecting the components and continuously monitoring of the machining operations and making minor adjustments in order to ensure that the work output is to the required quality and accuracy.

**CNC Setter cum Operator-Turning;** sets up the CNC turning machine, its work holding devices, tooling, loading the machine operating programs, conducting trial runs and correcting faults, in order to ensure that the work output is produced as per specification.

### Reference NCO 2015:

- a) 2356.0100-Manual Training Teacher/ Craft Instructor
- b) 7223.0601-Turner/Conventional Turning
- c) 7223.6002 - CNC Operator-Turning
- d) 7223.6001- CNC Setter cum Operator, Turning

## 5. LEARNING OUTCOMES

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

### 5.1 TRADE TECHNOLOGY

1. Demonstrate use of turner hand Tools used for marking, hacksawing, filing and use of precision measuring instruments applying occupational safety measures at workplace.
2. Explain use of negative rake tools, power saw and surface plate for drill grinding with optimum use of resources.
3. Analyse geometrical accuracies of lathe machines and demonstrate mounting and dismounting of work piece holding devices like chuck, faceplate, driving plate etc.
4. Evaluate crankshaft turning, screw thread cutting, square and acme threading & tool grinding.
5. Suggest effective solution during boring, counter boring, grooving while turning on lathe.
6. Explain the need of non-conventional machining process used in industries.
7. Explain steel standards for parting and grinding of various shapes on lathe machine.
8. Assess turning practice by offhand, at high speed and with multi-start thread using resources economically.
9. Monitor assembling & disassembling of insert-type tools and implement balancing, truing, mounting, taper tuning and radius turning attachment on lathe machine.
10. Demonstrate gauges, belt mounting, shop floor tools and process of measuring with digital outside micrometer and dial calliper.
11. Demonstrate on SQC, CNC lathe machine, programming & simulation, use of CAM software, setting of Tools simulation and execution of program.

## 6. COURSE CONTENT

SYLLABUS FOR TURNER – CITS TRADE			
TRADE TECHNOLOGY			
Duration	Reference Learning Outcome	Professional Skill (Trade Practical)	Professional Knowledge (Trade Theory)
Practical 64 Hrs Theory 24 Hrs	Demonstrate use of turner hand Tools used for marking, hacksawing, filing and use of precision measuring instruments applying occupational safety measures at workplace.	<ol style="list-style-type: none"> <li>Occupational Safety &amp; Health Importance of housekeeping &amp; good shop floor practices.</li> <li>Health, Safety and Environment guidelines, legislations &amp; regulations as applicable. Disposal procedure of waste materials like cotton waste, metal chips/burrs etc. Basic safety introduction, Personal protective Equipments (PPE):- Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution &amp; personal safety message.</li> <li>Preventive measures for electrical accidents &amp; steps to be taken in such accidents.</li> <li>Use of Fire extinguishers. Technical English:</li> <li>Prepare different types of documentation as per industrial need by different methods of recording information.</li> <li>Basic Life support training: Be able to perform DRSABCD: D: Check for Danger R: Check for a Response</li> </ol>	<p>Introduction of First aid. Operation of electrical mains. Introduction of PPEs. Response to emergencies e.g.; power failure, fire, and system failure. <b>Soft Skills:</b> its importance and Job area after completion of training. <b>Introduction to 5S concept</b> &amp; its application. Importance of 5S implementation throughout CITS course-workplace cleaning, machine cleaning, signage, proper storage of equipment etc. <b>Importance of Technical English terms used in industry</b>-(in simple definition only) Technical forms, process charts, activity logs, in required formats of industry, estimation, cycle time, productivity reports, job cards. Basic Life support (BLS):- Basic Life Support (BLS) techniques for drowning, choking, electrocution, neck and spinal injury, including CPR (cardiopulmonary resuscitation).</p>

		<p>S: Send for help  A: Open the Airway  B: Check for normal Breathing  C: Perform CPR (Cardio Pulmonary Resuscitation)  D: Attach Defibrillator/ Monitor as soon as available.</p>	
		<p>7. Demonstrate about preventive maintenance points for the trade machines.  8. <b>Perform and monitor:</b> marking, hack sawing, filling - maintaining parallel faces, right angle. Perform machining part filling.</p>	<p>Description about the common hand tools, holding device, marking tools , cutting tools used in shop floor their specification conforming to B.I.S  <b>Hammer</b>- Introduction, types specification, material and uses.  <b>Hacksaw frame</b> - its types, blade- its specification, material, colour code and uses.  <b>Bench vice</b>- Introduction, its parts, specification, materials, Types and uses.  <b>Punch</b> - its types, materials &amp; uses.  <b>Scriber</b>- Construction&amp; uses.  Surface plate - Its necessity and uses. Files- elements, material, specification, description, types, cut, grade, shape &amp; uses.  <b>Try Square</b>- Materials, Parts, and uses.  <b>Measuring Tools</b>- Steel rule- its types, and units. Introduction about line measurement and end measurement.  Explain about the oils used for lubrication of sliding parts, Gears and Hydraulic system. Properties of said oils.</p>
		<p>9. Measurement on different measuring instruments, total reading, different types of errors and its remedies.  10. Care and maintenance</p>	<p>Precision Measuring Instruments: Calculation of least count of vernier caliper, micrometer, bevel protector, its working principle, parts and construction. Measurement of components by vernier caliper,</p>

		of different precision measuring instruments	Vernier height gauge, micrometer, and bevel protector, sine bar and slip gauges. Sources of measuring errors and its correction on measured dimensions.
		11. Perform cleaning, preventive maintenance of machines, tools, 5S practice.	Concept of general- preventive maintenance of related trade machine tools & equipment. 5S - definition, components
Practical 64 Hrs Theory 24 Hrs	Explain use of negative rake tools, power saw and surface plate for drill grinding with optimum use of resources.	12. Perform on negative rake tool. 13. Perform on non-ferrous metal.	Cutting edge geometry of turning tools-rake angle, relief angles, positive and negative rakes and their applications, cutting forces. Cutting edge geometry of drills.
		14. Perform on power saw. Perform on drill grinding.	Drilling Machine- Different types, Parts, uses & operations.
		15. Surface plate - use, installation and maintenance.	Twist drill- Nomenclature, Size, types, cutting angles, holding devices etc. Calculation of blank size for die threading.
		16. Tools grinding Perform Side Cutting tools offset turning tools 3-Parting tools.	Lathe cutting tools- Introduction, Classification tool nomenclature etc. Cutting forces, cutting power. Machine spindle capacity, 15 minutes/ 30 minutes rating of spindle, speed-power curve, spindle torque.
Practical 80 Hrs Theory 30 Hrs	Analyse geometrical accuracies of lathe machines and demonstrate mounting and dismounting of work piece holding devices like chuck, faceplate, driving plate etc.	17. Demonstrate leveling of Lathe, Alignment checking between Head stock & Tail stock of Lathe in horizontal plain and vertical plain. 18. Mounting & dismounting of Face plate, chuck, Driving plate etc.	Cutting power for various operations, maximizing cutting power utilization. Sources of measuring errors. Calibration of measuring instruments. Tools setting in correct center height-effects of rake and clearance angle.
		19. Checking geometrical accuracies of lathe. 20. Turning job between centers.	Coolant composition, preparation, health hazards. Geometrical accuracies of lathes, checking accuracies.

			Construction of reamers - cutting and holding geometries, types of materials - HSS, carbide. Deciding the bore size for reaming.
		21. Plain turning between centre with follower rest (long bar job), and setting practice to check centre axis alignment between machine spindle axis and tail stock axis.	Mounting and dismounting of Driving plate, faceplate, Steady rest and follower rest - Introduction, construction & uses. Lathe mandrel- its type & uses
		22. Taper turning practice by swiveling compound slide. 23. Taper turning practice by Tail stock offset method. 24. Checking of taper angle by bevel protector and sine bar. 25. Eccentric marking using Vernier height gauge, job holding & eccentric turning practice. 26. Practice on Lathe - Ball Turning.	Taper- Necessity, different methods of expressing taper. Different standard tapers, methods of taper turning, important elements of taper. Principle of taper turning by compound slide swiveling method, its calculation, advantages & disadvantages. Taper turning by form tool, its method of turning. Advantages & disadvantage of taper turning by form tool. Principle of taper turning by tailstock set over method. Calculation for tailstock set over method. Advantages & disadvantage of Taper turning practice by swiveling compound slide. Taper turning practice by Tail Checking of taper angle by bevel protector and sine bar. Eccentric marking using Vernier height gauge, job holding & Eccentric turning practice. Practice on Lathe - Ball Turning. Taper turning by tailstock. Set over method Taper Turning attachment- Principle. Measurement of roundness, flatness, threads, surface roughness, profiles.
Practical 64 Hrs	Evaluate crankshaft turning, screw thread	27. Perform Crankshaft turning double throws.	Lathe operation Eccentric turning- Introduction, different methods and uses.



Theory 24 Hrs	cutting, square and acme threading & tool grinding.	28. Perform Screw thread cutting metrics & B.S.W external R/H and L/H. 29. Checking of thread by using screw thread gauge.	Thread tolerance- grade, specification & application. Calculation of insert tilt angle to match helix angle in threading.
		30. Perform square threading and tool Grinding.	Square thread- Construction and uses. Calculation involved- depth, core dia., pitches, and module of Acme & Worm Thread.
		31. Perform Acme threading and tool Grinding.	Acme thread- Construction and uses. Calculation involved- depth, core dia., pitches, and module of Acme & Worm Thread.
Practical 32 Hrs  Theory 12 Hrs	Suggest effective solution during boring, counter boring, grooving while turning on lathe.	32. Perform boring, counter boring, grooving (external & internal) and radius (concave & convex) turning on lathe. 33. Plain turning practice using solid mandrel.	Influence of tool height on tool angle for lathe operation. Definition and calculation of Cutting speed, feed, depth of cut, and turning time for lathe operation.
		34. Turning performance by using index able inserts.	Introduction to latest cutting tools, materials, their properties and applications. Geometrical tolerance, tolerance stacking.
Practical 16 Hrs  Theory 06 Hrs	Explain the need of non-conventional machining process used in industries.	35. Industrial visit - for Non-conventional machining process uses in Industries.	Explain about- non - Conventional machining processes- EDM, ECM, USM etc.
Practical 32 Hrs  Theory 12 Hrs	Explain steel standards for parting and grinding of various shapes on lathe machine.	36. Demonstrate- Identification of different steel sections as per BIS. 37. Explain - for given steel standards, finding equivalent standards in various international standards.	Introduction of Engineering Materials- Importance, classification. Difference Between Metal and Non-metals. Common metals and Non-metals. Specification of steel sections as per BIS (such as square, hexagon, flat, angle, channel, round etc. Steel standards, introduction to Indian and

			international standards -BIS, DIN, EN, JIS, AISI.
		38. Perform parting off with parting tools. 39. Perform Grinding of various shape of chip breaker on tool.	Metals and Alloys- Classification of Metals. Difference Between Ferrous and Non-ferrous Metals. Properties of metals that influence machinability - hardness, toughness, tensile strength, yield strength.
Practical 48 Hrs  Theory 18 Hrs	Assess turning practice by offhand, at high speed and with multi-start thread using resources economically.	40. Form turning practice (by offhand) & Radius/ Form Turning attachment grinding of form tools.	Types of Iron Ore such as- Magnetite, Hematite, Siderite, Production of Iron. Type of Irons and alloys. Heat treatment of steels- Introduction, Definition and Objects of Heat Treatment, Heat-Treatment Processes - Annealing, Normalizing, Tempering, Hardening, Iron-Carbon diagram, martensite, austenite Machinability classification in cutting tool catalogs -P,M,K,N,S,H. Mounting form turning attachment, parts of attachment, tool materials.
		41. Assess Multi-start thread cutting (LH/RH).	Multi-start Threads- It's Function different methods, uses, difference between pitch & lead, Formulate to find out start, Pitch and lead. Gear ratio etc.
		42. Perform Turning at high speed using Tungsten carbide tools including throwaway tips/ index able inserts.	Cutting speed, feed, Machining time and depth of cut-calculation.
Practical 64 Hrs  Theory 24 Hrs	Monitor assembling & disassembling of insert-type tools and implement balancing, truing, mounting, taper tuning and radius	43. Monitor, assemble and disassemble of insert type tools.	Insert-type tools - holder construction, clamping types, for turning, boring, external grooving, internal grooving, drilling tools. Insert materials, insert shapes. Power saw- its function and uses.
		44. Perform Balancing, Truing, Mounting and Dressing of grinding	Introduction to Pedestal Grinder- its parts & applications. Selection of grinding for

	turning attachment on lathe machine.	wheel and adjustment of tool rest.	different applications and work piece materials. Dial Test Indicator applications like measurement of parallelism, concentricity.
		45. Taper turning by taper turning attachment (Taper matching).	Different types of attachments used on lathe- Introduction to Copying, Relieving, Grinding, Milling & Taper turning attachments.
		46. Perform lathe Thread cutting on non-ferrous Metal- Copper/aluminum/brass etc. 47. Advanced eccentric boring practice. 48. Practice on Boring and stepped boring (within $\pm 0.02\text{mm}$ ).	Measuring instruments such as - Screw pitch gauge, Screw thread Micrometer and Toolmaker microscope etc. Tool Maker's button- Construction & uses. Inside Micrometer- Principle, Construction, Graduation, reading, uses etc. (metric & British system).
Practical 96 Hrs Theory 36 Hrs	Demonstrate gauges, belt mounting, shop floor tools and process of measuring with digital outside micrometer and dial calliper.	49. Shop floor demonstration on limit gauges. 50. Perform using sine bar, slip gauges.	Limit Gauges- Introduction, Construction, different types and uses. Sine Bar- Introduction, constructions and uses. Slip Gauge- Introduction, types and uses. Checking taper with Sine Bar and Roller- Calculation involved.
		51. Perform belt mounting, checking, alignment.	Power Transmission- types like belt, rope, chain gear drives. Material used for belts. Types of belts drive, open belt drive, crossed belt drive. Stepped or cone pulley drive. Velocity ratio- open belt drive, Compound belt drive. Length - Open belt, cross belts.
		52. Shop floor demonstration Identification of Jig, Fixtures & their parts.	Jig and fixture- definition, different, types and uses.
		53. Demonstrate measurement with Digital outside Micrometer and dial calliper.	Digital outside Micrometer- Applications, Construction, reading. Dial Caliper- Applications, Construction and reading.

		54. V-Thread fitting.	Limit, Fit-and tolerance as per B.I.S: 919, Unilateral and bilateral system of limit, Fits-different types, symbols for holes and shafts. Holes basis & Shaft basis etc. Representation of tolerance in drawing.
		55. Shop floor demonstration on types of bearing.	Production type lathes - Capstan & turret lathe, Multi -spindle Automat etc. Capstan lathes its main parts, tools function and uses. Bearing- Introduction, construction types and uses. Comparator gauge- Introduction about Mechanical, Electrical/ Electric and optical comparator.
Practical 80 Hrs Theory 30 Hrs	Demonstrate on SQC, CNC lathe machine, programming & simulation, use of CAM software, setting of Tools simulation and execution of program.	56. An assembly job preparation combining different machining operations. 57. Practice on SQC - determine sample size, quality for a batch of actual parts of any type.	Inspection and Quality Control Inspection, Need and types of inspection. Quality control and quality assurance Meaning and need for quality control Statistical quality control Q.C. charts. Total Quality Management (TQM). Machine capability studies
		58. Identifications of different parts & different drives of CNC Lathe machine. 59. Create manual part Programming from part drawing, and simple job preparation on CNC. 60. Part - programming, and its simulation.	Introduction to N.C. & C.N.C. and its comparison Advantages of C.N.C. machine over NC machine. Constructional feature and different parts. General flow of operation of CNC machine tool. Fundamental of part programming : Axis designation , Coordinate system, Machine zero, work piece zero, reference Zero. G-Codes & M-Codes, Feed function, Spindle Speed function, Work Offset, and Tool Offset.
		61. Make the process sequence and select the appropriate tools for a sample part with	CNC turning Geometrical accuracies of machine, positioning accuracy, repeatability.

		<p>various operations.</p> <p>62. From any manufacturer's tool catalog (hard copy/soft copy from the manufacturer's web site), determine holder, insert, insert grade, chip breaker geometry, cutting parameters (cutting speed, feed rate, depth of cut) for a specified work piece material.</p> <p>63. Tool manufacturer can be any popular make like Taegutec, Sandvik, Kennametal, etc.</p>	<p>Cutting parameters - cutting speed, constant cutting speed, limiting spindle speed, feed rate, depth of cut. Productivity, cycle time, machine hour rate, Constant cutting speed in turning, Limiting spindle speed. ISO nomenclature for inserts, turning and boring tools. Insert grades, coatings, chip breaker geometry. Holder, Inserts, grade, chip breaker and cutting parameters selection from manufacturers' tool catalogs. Tool wear, Types of tool wear, tool life.</p>
		<p>64. Manual programming using contour programming commands, of a part with various operations including chamfers and radii, threading.</p> <p>65. Use canned cycles, nose radius compensation.</p> <p>66. Program part using CAM software - part with various operations including multi-start threading.</p>	<p>Threading using constant area and constant depth of cut. Multi-start threading. Tool nose radius compensation. Understanding and troubleshooting machining problems -improper chip breaking, built-up edge, poor surface finish, chatter, work hardening, profile inaccuracies. Programming using CAM software.</p>
		<p>67. Programming on computer and simulation Tool pre setting on pre setter.</p>	<p>CNC programming on lathe and tool setting. Tool pre setting</p>

SYLLABUS FOR CORE SKILLS	
1.	Workshop Calculation & Science(Common for all Engineering CITS trades) (80 Hrs)
2.	Engineering Drawing (Group I) (120Hrs)
3.	Training Methodology (Common for all CITS trades) (320Hrs + 200Hrs)

Learning outcomes, assessment criteria, syllabus and Tool List of above Core Skills subjects which is common for a group of trades, provided separately in [www.bharatskills.gov.in](http://www.bharatskills.gov.in)

## 7. ASSESSMENT CRITERIA

LEARNING OUTCOMES	ASSESSMENT CRITERIA
<b>TRADE TECHNOLOGY</b>	
<p>1. Demonstrate use of turner hand Tools used for marking, hacksawing, filing and use of precision measuring instruments applying occupational safety measures at workplace.</p>	Demonstrate Hand Tools for different turner operations.
	Demonstrate basic turner operations viz., Hacksawing, filing, drilling etc to close tolerance as per specification to make the job.
	Ensure safety procedure during above operation as per standard norms and company guidelines.
	Monitor measurements on different precision measuring instruments.
	Check for dimensional accuracy as per standard procedure.
	Instruct to avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
<p>2. Explain use of negative rake tools, power saw and surface plate for drill grinding with optimum use of resources.</p>	Explain positive & negative rakes and their applications.
	Demonstrate and Grind cutting tools.
	Demonstrate power saw and drills using surface plates.
	Demonstrate tools grinding, side cutting tools, offset turning tools.
	Explain use of parting tools.
	Instruct waste avoidance and environment friendly disposal of wastes.
<p>3. Analyse geometrical accuracies of lathe machines and demonstrate mounting and dismounting of work piece holding devices like chuck, faceplate, driving plate etc.</p>	Demonstrate cutting tool materials and accessories used on lathe machine as per the specification and their application.
	Plan for testing alignment of lathe.
	Demonstrate mounting and dismounting of lathe chuck.
	Mount and explain appropriate lathe accessories to set up a job for machining.
	Demonstrate plain turning between center and evaluate center axis alignment.
	Evaluate taper turning using swivelling compound slide.
	Check taper angel by bevel protector and sine bar.
	Analyse eccentric marking using vernier height gauge.
	Analyse accuracy/ correctness of lathe using appropriate gauge and measuring instruments.
	Check compliance with safety rules when the above operations are being performed.
<p>4. Evaluate crankshaft turning, screw thread cutting, square and acme threading &amp; tool grinding.</p>	Evaluate appropriate method to produce components with crankshaft turning.
	Monitor appropriate tools used for generating required thread form.
	Demonstrate different machining and threading (Square & acme) parameters as per requirement.

	Check accuracy/ correctness of job using appropriate gauge and measuring instruments.
	Monitor and maintain all records for further assessment.
5. Suggest effective solution during boring, counter boring, grooving while turning on lathe.	Demonstrate and monitor different boring (Plain, stepped & eccentric).
	Demonstrate and measure with instruments/ gauges as per drawing.
	Demonstrate turning operation using index able inserts.
	Check compliance with safety rules when the above operations are being performed.
6. Explain the need of non-conventional machining process used in industries.	Facilitate about the various non-conventional machining processes.
	Demonstrate non-conventional machines used in Turner job.
	Explain the process of EDM, ECM, USM etc.
7. Explain steel standards for parting and grinding of various shapes on lathe machine.	Explain Indian and international Steel standards -BIS, DIN, EN, JIS, AISI.
	Classify between various metals and alloys.
	Explain properties of metals that influence machinability.
	Demonstrate parting off and grinding of various shapes.
8. Assess turning practice by offhand, at high speed and with multi-start thread using resources economically.	Explain Machinability classification in cutting tool catalogs - P,M,K,N,S,H.
	Demonstrate and perform Multi-start thread cutting (LH/RH).
	Demonstrate turning by offhand and at high speed using Tungsten carbide.
	Monitor cutting speed, machining time and depth of cut-calculation.
	Instruct to use resources optimally to reduce unnecessary wastages.
9. Monitor assembling & disassembling of insert-type tools and implement balancing, truing, mounting, taper turning and radius turning attachment on lathe machine.	Plan, identify, assemble and disassemble all the part components as per the guide lines given in the drawing.
	Demonstrate balancing, truing, mounting and dressing of grinding wheel.
	Monitor boring and stepped boring (within +/-0.02mm).
	Mentoring and solve problems during the above operations.
10. Demonstrate gauges, belt mounting, shop floor tools and process of measuring with digital	Explain Limit Gauges and slip gauges construction, their types and uses.
	Monitor belt mounting checking alignment.
	Demonstrate jigs, fixtures and their parts used in workshop.



outside micrometer and dial calliper.	Explain V-thread fitting and shop floor demonstration on types of bearing.
	Supervise measurement with Digital outside Micrometer and dial calliper.
	Judge and Limit, Fit-and tolerance as per B.I.S: 919.
11. Demonstrate on SQC, CNC lathe machine, programming & simulation, use of CAM software, setting of Tools simulation and execution of program.	Demonstrate and execute part programme as per drawing and simulate for it's correctness with appropriate software.
	Demonstrate SQC by determining sample size and quality for a batch of actual parts of any type.
	Explain different parts & different drives of CNC lathe machine.
	Evaluate manual part programming and its simulation.
	Check the process sequence based on manufacturer's tool Catalogue.
	Demonstrate part programming using CAM software.
	Evaluate CNC programming on lathe and tool setting.
	Demonstrate and select appropriate method to produce various components.
	Check accuracy/ correctness of job using appropriate gauge and measuring instruments.

## 8. INFRASTRUCTURE

LIST OF TOOLS AND EQUIPMENT FOR TURNER – CITS TRADE			
For Batch of 25 Candidates			
S No.	Name of the Tool & Equipment	Specification	Quantity
<b>A. Hand Tools</b>			
1.	Hammer brass	200 gm with handle	13 nos.
2.	Screw Driver set	6",12",18"	05 sets
3.	Spanner double ended	6mm to 32mm.	02 sets
4.	Spanner adjustable	200mm.	05 nos.
5.	Pliers combination-	size 8"	05 nos.
6.	Fire Extinguisher		02 nos.
7.	Buckets		04 nos.
8.	Safety goggles clear glass (Good Quality)		25 nos.
9.	Oil can V2pint (pressure feed system)		13 nos.
10.	Lathe Mandrels (Different Types)		1 set
11.	Revolving Centre	MT 3	13 nos.
12.	Angle Plate with slots	200mm	02 nos.
13.	Drill Drift		13 nos.
14.	Morse Taper Plug & Ring gauge	MT 0 to MT 7	02 Set each
<b>B. INSTRUMENT AND GENERAL SHOP OUTFIT :Marking &amp; Measuring Tools</b>			
15.	Try Square	Blade size 150mm	05 nos.
16.	Universal surface gauge	250mm.	13 nos.
17.	Metric Feeler Gauge	0.04 mm to 0.30 mm	02 nos.
18.	Radius Gauge	1 to 7mm, 7.5to 15 & 15 to 22mm.	05 each
19.	Combination centre gauge		05 nos.
20.	Screw Pitch Gauge	Whitworth & Metric. (55° & 60°)	05 nos.
21.	Twist Drill angle gauge.		02 nos.
22.	Plain Ring and Plug Gauge	size- 12, 15, 16, 18, 20, 22, 24 and 25.	01 set
23.	Thread Plug Gauge	M-24 & M-30	02 sets
24.	Thread Ring gauge	M-24 and M-30	01 set
25.	Morse Taper Sleeves	No. 0-1, 1-2, 2-3, 3-4, 4-5.	05 sets
26.	Angle Gauge for tool grinding		02 nos.
27.	Slip Gauge	metric set -112	01 set
28.	Steel Rule	300mm	13 nos.
29.	Combination set	300mm	02 nos.
30.	Dial Vernier caliper	200mm, Accuracy 0.01mm	02 nos.
31.	Scriber	150mm X 3mm.	02 nos.
32.	Prick punch	100mm	05 nos.
33.	Divider spring joint	150 mm.	05 nos.
34.	Centre punch	100mm.	02 nos.
35.	Granite Surface plate	60 x 60 cm.	05 nos.

36.	Marking table (CI)	120x120 cm.	01 no.
37.	Vee Block grade A	5 mm to 60 mm with Magnetic clamp.	02 nos.
38.	Universal Vernier Caliper	200mm.	13 nos.
39.	Vernier Height gauge	with Dial-300mm, Accuracy-0.02mm	01 no
40.	Magnifying glass	Dia- 75 mm	02 nos.
41.	Outside Micrometer	0 to 25mm, Accuracy-0.01mm	05 nos.
42.	Three Point Internal Micrometer	Accuracy-.005mm	02 nos.
43.	Outside Micrometer	25 to 50mm, Accuracy 0.01mm	05 nos.
44.	Outside Micrometer	50 to 75mm, Accuracy 0.01mm	02 nos.
45.	Two Point Self Centering Bore Dial Gauge	Accuracy- .01mm	02 nos.
46.	Digital Outside Micrometer	range 0-25mm, Accuracy 0.001mm	02 nos.
47.	Inside Micrometer	25 to50mm, Accuracy 0.01mm	02 nos.
48.	Inside Micrometer	50 mm to 150 mm, Accuracy-0.01mm	02 nos.
49.	Vernier Bevel Protractor	300 mm blade.	05 nos.
50.	Outside Vernier Micrometer	0-25mm, Accuracy 0.001mm	02 nos.
51.	Outside Vernier Micrometer	25-50mm, Accuracy 0.001mm	02 nos.
52.	Digital Vernier Caliper	size 200mm, Accuracy .01mm	02 nos.
53.	Screw Thread Micrometer interchangeable with anvils		02 nos.
54.	Dial Test Indicator with Magnetic base both plunger and lever type	0.01 mm	02 nos.
55.	Sine Bar with Center distance	200 mm	02 nos.
<b>C. GENERAL SHOP OUTFIT</b>			
56.	Chisel cold	flat 20mm x150mm	02 nos.
57.	Hacksaw fixed	200mm (Pistol grip)	13 nos.
58.	File flat rough	300mm	05 nos.
59.	File flat 2 <sup>nd</sup> cut	250mm	05 nos.
60.	File flat smooth	250mm	05 nos.
61.	File half round 2 <sup>nd</sup> cut	250mm	05 nos.
62.	File half round smooth.	150 mm	05 nos.
63.	Twist Drill straight shank	1 to 12 mm, step range 1mm	02 sets
64.	Drill Chuck with key	Cap. - 12mm	05 nos.
65.	Twist Drill Taper shank	1 to 12 mm, step range 0.5mm	02 sets
66.	Tap Wrench (Adjustable)		05 nos.
67.	Die stock different size		05 nos.
68.	Tap & Die Metric set	6mm to 25mm	02 sets
69.	Reamer machine straight flute	6 to 25mm in step of 1 mm	01 set
70.	Reamer Adjustable	10 to 20mm	01 set
71.	Hand Chaser (External)	M-12 & M-16	02 sets
72.	Hand Chaser (Internal)	M-12 & M-16	02 sets

73.	Combination Drill	A-3 & A-5	05 sets
74.	Knurling tool revolving head		13 nos.
75.	Tool Holder RH & straight	3/8" square tool bit	05 nos.
76.	Parting Tool Holder		05 nos.
77.	Boring Tool holder	6mm sq. hole	05 nos.
<b>D. GENERAL MACHINERY SHOPOUTFIT</b>			
78.	(a)CNC turn Centre with minimum specification as  (b) CAM software (Master Cam)	Chuck size: 135mm, Between centre distance: 250mm, Travel in X: 100mm, Travel in Z: 200mm, No. of tool stations: 8 station turret, Spindle power: 3.7kW (continuous rating), preferably with popular control system like Fanuc/Sinumeric etc. along with motorized coolant system.	02 nos.
79.	SS and SC centre lathe (all geared) with having minimum specification as:	Centre height 150 mm and centre distance 1000 mm along with 4 jaw and 3 jaw chucks, auto feed system, safety guard, motorized coolant system and lighting arrangement.	18 nos.
80.	Lathe Tool Room SS and SC centre lathe (all geared) with having minimum specification as	Centre height 1 50 mm and centre distance 1000 mm along with 4 jaw and 3 jaw chucks, auto feed system, safety guard, motorized coolant system and lighting arrangement.	02 nos.
81.	Grinding Machine Pedestal Type D.E. with wheel guard and flanges.		02 nos.
82.	Tool Room SS and SC centre lathe (all geared) with having minimum specification as:	Centre height 150 mm and centre distance 1000 mm along with 4 jaw and 3 jaw chucks, auto feed system, safety guard, motorized coolant system and lighting arrangement.	02 nos.
83.	Drilling Machine pillar type- motorized	Up -12-mm. cap. with drill chuck & key.	01 no.
84.	Power saw machine	hydraulic type (24" blade size)	01 no.
85.	Steel Cupboard	with 8 pigeon lockers	03 nos.
86.	Work bench for fitters	with two vices of 100mm	02 nos.
87.	Steel cupboard	180x90x45cm	02 nos.
88.	Steel cupboard	120x60x45cm	02 nos.

89.	Test mandrel/test bar-	400mm	02 nos.
90.	First aid box.		01 no.
91.	Multimedia teach ware/ courseware 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)	1 set
92.	PCs with MS-Windows to run above simulation software, networked on LAN.	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	13 nos.
93.	Computer Table		13 nos.
94.	Computer Chairs		25 nos.

## ANNEXURE - I

The DGT sincerely acknowledges contributions of the Industries, State Directorates, Trade Experts, Domain Experts 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.

<b>List of Expert members participated for finalizing the course curriculum of Turner (CITS) trade</b>			
<b>S No.</b>	<b>Name &amp; Designation Sh/Mr/Ms</b>	<b>Organization</b>	<b>Remarks</b>
<b>Members of Sector Mentor council</b>			
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.	Uday Apte	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
<b>Mentor</b>			
21.	Sunil Kumar Gupta (Director)	DGET HQ, New Delhi.	Mentor
<b>Members of Core Group</b>			
22.	N. Nath. (ADT)	CSTARI, Kolkata	Co-ordinator
23.	H. Charles (TO)	NIMI, Chennai.	Member



