

# READING OF DRAWING AND ARITHMETIC

NSQF LEVEL - 6



SECTOR- EDUCATION, TRAINING & RESEARCH

**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

# READING OF DRAWING AND ARITHMETIC

**(Engineering Trade)**

**SECTOR – EDUCATION, TRAINING & RESEARCH**

**(Revised in 2019)**

**Version 1.1**

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Developed By  
Government of India  
Ministry of Skill Development and Entrepreneurship  
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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 Instructor 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 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. “Reading of Drawing and Arithmetic (RoDA)” CITS trade is applicable for Instructors of “Workshop calculation Science and Engineering Drawing” of CTS Trades.

The main objective of Craft Instructor training program 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	120
	Workshop Science	80
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 vocational 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 at the end of the year 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 Calculation	50	25	75	20	15
4.		Workshop Science	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 yearly 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 in engagement of students for learning and achievement of goals while undertaking the training on specific topic.</li> <li>• A good 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>Reading of Drawing &amp; Arithmetic-CITS</b>
<b>Trade code</b>	DGT/4001
<b>Reference NCO 2015</b>	2356.0100, 3118.0401, 3118.0402
<b>NSQF Level</b>	Level-6
<b>Duration of Craft Instructor Training</b>	One Year
<b>Unit Strength (No. Of Student)</b>	25
<b>Entry Qualification</b>	Degree in Engineering from AICTE recognized Board/University. OR Diploma in Engineering from AICTE recognized Board/ University. OR National Trade Certificate in any Engineering trade OR National Apprenticeship Certificate in any Engineering trade.
<b>Minimum Age</b>	18 years as on first day of academic session.
<b>Space Norms</b>	100 Sq. m
<b>Power Norms</b>	1 KW
<b>Instructors Qualification for</b>	
<b>1. Reading of Drawing and Arithmetic-CITS Trade</b>	B.Voc/Degree in any Engineering from AICTE/UGC recognized University with two years experience in the field of teaching/ industries. OR 03 years Diploma in any Engineering from AICTE/ recognized Board/ University or relevant Advanced Diploma (Vocational) from DGT with five years experience in the field of teaching/ industries. OR NTC/ NAC passed in any Engineering trade with seven years experience in relevant field.  <b>Essential Qualification:</b> National Craft Instructor Certificate (NCIC) in RoDA trade, in any of the variants under DGT.
<b>2. Workshop Calculation &amp; Workshop Science</b>	B.Voc/Degree in any Engineering discipline from AICTE/ UGC recognized Engineering College/ university with two years experience in relevant field. OR 03 years Diploma in any Engineering discipline from AICTE /recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with five years experience in relevant field. OR

	<p>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. 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>Distribution of training on Hourly basis: (Indicative only)</b>						
<b>Total Hrs /week</b>	<b>Trade Practical</b>	<b>Trade Theory</b>	<b>Workshop Calculation</b>	<b>Workshop Science</b>	<b>TM Practical</b>	<b>TM Theory</b>
40 Hours	16 Hours	6 Hours	3 Hours	2 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. Imparts theoretical instructions for the use of tools, mechanical drawings, blueprint reading and related subjects. Demonstrates processes and operations in the workshop; supervises, assesses and evaluates students in their practical work. Ensures availability & proper functioning of equipment & tools in stores.

**Draughtsperson, Mechanical;** prepares drawings of machines, plants, mechanical components, equipment, etc. from sketches, notes, data or sample for purposes of manufacture or repairs. Takes instructions from Mechanical Engineer and calculates dimensions as required, from available materials (notes, data etc.) or sample. Draws to scale detailed drawings, assembly drawings, showing plan, elevations, sectional views etc. according to nature of work and operations required. Prints (writes) dimensions, tolerances, material to be used and other details to give clear picture and facilitate understanding. Maintains copies of drawings and makes blue prints. May trace drawings. May design simple mechanical parts. May prepare estimates for materials and labour required. May specialize in making drawings of jigs and tools and be designated accordingly.

**Draughtsman, Mechanical;** prepares drawings of machines, plants, mechanical components, equipment, etc. from sketches, notes, data or sample for purposes of manufacture or repairs. Takes instructions from Mechanical Engineer and calculates dimensions as required, from available materials (notes, data etc.) or sample. Draws to scale detailed drawings, assembly drawings, showing plan, elevations, sectional views etc. according to nature of work and operations required. Prints (writes) dimensions, tolerances, material to be used and other details to give clear picture and facilitate understanding. Maintains copies of drawings and makes blue prints. May trace drawings. May design simple mechanical parts. May prepare estimates for materials and labour required. May specialize in making drawings of jigs and tools and be designated accordingly, selects the appropriate equipment and drawing software to use based on the type and complexity of the drawing functions to be carried out and the use of a CAD system linked bills of material, file management and associated customization of installed software including the use of macros, menus and default settings.

### Reference NCO – 2015 with respective QP/NOS:

- i) 2356.0100 - Manual Training Teacher/Craft Instructor
- ii) 3118.0401 – Draughtsperson, Mechanical
- iii) 3118.0402 - Draughtsman , Mechanical

## 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 the percentage of correctness for conventional symbols of machine parts and free hand sketch of basic hand tools as per standards and ensuring safety measures.
2. Explain the methodology for scale factor determination and dimensioning of an object in relevant drawing sheet.
3. Demonstrate construction of orthographic projection with proper dimensioning.
4. Construct two-dimensional shape of the developed surfaces of conventional solids.
5. Demonstrate the process for drawing of different fasteners and joints.
6. Explain the symbolic representation of electrical or electronic circuit along with its wiring layout and hydraulic, pneumatic and mechanical components along with mechanical joints.
7. Assess the correctness of final dimensions and graphical symbols of different surface finishes, as per Indian Standard.
8. Justify the perfection of a 2D drawing using CAD software.
9. Demonstrate drawing of machine parts by measuring with gauges & measuring instruments.
10. Illustrate assembly drawing of all types of bearings, carpentry joints, piping, machine parts etc. using conventional signs & symbols used for production drawing.
11. Demonstrate working drawing with tolerance dimension, indicating machining parameters.
12. Demonstrate basic knowledge on tools, equipment & their application in allied trade, Viz. Fitter, Turner, Electrician etc.
13. Explain the advance features of the latest version of CAD software along with advanced method for the development of two- or three-dimensional drawing with the help of it.
14. Demonstrate the method of official communication via internet.

## 6. COURSE CONTENT

SYLLABUS FOR READING OF DRAWING AND ARITHMETIC – CITS TRADE			
TRADE TECHNOLOGY			
Duration	Reference Learning Outcome	Professional Skill (Trade Practical)	Professional Knowledge (Trade Theory)
Practical 16 Hrs Theory 06 Hrs	Demonstrate the percentage of correctness for conventional symbols of machine parts and free hand sketch of basic hand tools as per standards and ensuring safety measures.	1. Conventional Representation signs and symbols of machine parts, practising free hand sketches on hand tools, simple machine parts & equipments.	Importance of trade, Environmental, occupation & safety hazards specific to the trade like electrical, computer & related shop floor hazards. Introduction to BIS & ISO & their function.
Practical 32 Hrs Theory 12 Hrs	Explain the methodology for scale factor determination and dimensioning of an object in relevant drawing sheet.	2. Construction of scales. Types of lines, Dimensioning practice on technical drawing.	Scales: Principles, types, and applications. Dimensioning: - Introduction, Importance, system of dimensioning Conversion.
		3. Geometrical drawing & Practice.	Pictorial views: types, methods of representation & function.
Practical 32 Hrs Theory 12 Hrs	Demonstrate construction of orthographic projection with proper dimensioning.	4. Construct 1 <sup>st</sup> angle projection and 3 <sup>rd</sup> angle projection methods.	Orthographic projection: General principles of projection.
		5. Exercises on sectional views on the given models /actual objects. Exercises on true shapes of different sectional views.	Sectioning: basic concept, types, importance
Practical 16 Hrs Theory 06 Hrs	Construct two-dimensional shape of the developed surfaces of conventional solids.	6. Exercises on development of surface of simple objects like cube, cone, pyramid, cylinder, prism etc.	Development of surfaces: principles, types, importance and application.
Practical 32 Hrs Theory 12 Hrs	Demonstrate the process for drawing of different fasteners and joints.	7. Drawing on fasteners-screw threads, nuts & bolts, studs and other locking devices.	Fasteners & fastening: Nut & Bolt, Keys, Cotter – types, uses, symbols & applications
		8. Drawing of butt joint and lap joint, single plate, & double plate rivet joints maintaining relation between plate thickness, rivet diameter and pitch etc.	Rivet – its types and different types of rivet joints & symbols.

Practical 112 Hrs  Theory 42 Hrs	Explain the symbolic representation of electrical or electronic circuit along with its wiring layout and hydraulic, pneumatic and mechanical components along with mechanical joints.	9. Drawing of symbols for electrical, electronics, and basic electrical, electronic circuits.	Symbols of Electrical, Electronics, and their basic application on circuits.
		10. Hydraulics & pneumatics components and Drawing of basic hydraulics & pneumatics circuits used in machine tools.	Hydraulics & pneumatics components and their basic application on circuits.
		11. Drawing of Gears: spur, bevel, helical, worm & worm wheel, rack & pinion.	Introduction to gear – its tooth profile. Types of gears and their uses. Calculation of gear data for spur, helical, worm & worm wheel, rack & pinion
		12. Drawing of welding joints, their symbols, representation of welding symbols used on drawing.	Introduction to Welding. Principle of common welding process and its defects. Types of welded joints. Types of electrodes and wires used in weld joints. Edge preparation and its use.
Practical 48 Hrs  Theory 18 Hrs	Assess the correctness of final dimensions and graphical symbols of different surface finishes, as per Indian Standard.	13. Practice on tolerance dimensioning.	Limits, fits, tolerance
		14. Indication of surface finish symbols used as per IS on working drawing.	Surface Finish: Introduction, representation, importance, symbols & applications on drawing.
Practical 32 Hrs  Theory 12 Hrs	Justify the perfection of a 2D drawing using CAD software.	15. Exercises on 2D drafting using CAD(specially AUTO-CAD) software.	Concepts of 2D Drafting using CAD (speciallyAUTO-CAD)software.
Practical 32 Hrs  Theory 12 Hrs	Demonstrate drawing of machine parts by measuring with gauges & measuring instruments.	16. Exercises with precision measuring / gauging instruments on real object and comparison with working drawing. Measurement practice for taper angle using sine bar, slip gauge, dial testindicator, and roller.	Introduction to vernier calipers, micrometer, bevel protector, sine bar, dial test indicator,slip gauge, rollers - its calculation of least countand measurement procedures. Theirprinciples,reading and precautions.
Practical 160 Hrs	Illustrate assembly drawing of all types of bearings, carpentry	17. Drawing of bearings application – bush bearing, foot step	Bearing: Different Types & symbols Applications of bearing

Theory 60 Hrs	joints, piping, machine parts etc. using conventional signs & symbols used for production drawing.	bearing, ball, roller, Tapper roller and needle bearing use on assembly.	
		18. Drawing of carpentry joints: angle, framing, broadening and lengthening joints and their different types.	Carpentry: joints, symbols Applications of joints
		19. Isometric view of pipe joints & drawing of flanged, socket and spigot joint etc. 20. Drawing on various types of shaft couplings, flanged, cone, universal and muff.	Pipe & Pipe joints – types, symbols & Applications of pipe joints
		21. Practice on detailed drawing of simple machine components.	Concept of assembly & detailed drawing; relation, importance & application.
		22. Practice on Assembly & detailed drawing of simple machine components. Different Machine Vice, Head stock, tailstock, milling arbour.	Mechanical properties of metal, Properties of steel by adding alloying element like cobalt, vanadium, magnesium, tungsten etc.
		23. Practice on Production drawing, indicating all features related to production.	Calculation and definition of Ratio, Proportion, Percentage, work, power, energy, its application in workshop.
		24. Detailed drawing of simple Jigs & Fixtures.	Jigs & Fixtures:- Introduction, types, use and advantages.
Practical 48 Hrs Theory 18 Hrs	Demonstrate working drawing with tolerance dimension, indicating machining parameters.	25. Drawing of ellipse, parabola, hyperbola, cycloid, epicycloids and hypocycloid Helix and Involute etc.	Calculation related to cutting speed, feed, r.p.m. depth of cut, machining time for drilling, turning, shaping, milling etc.
Practical 32 Hrs Theory 12 Hrs	Demonstrate basic knowledge on tools, equipment & their application in allied trade, Viz. Fitter, Turner, Electrician etc.	26. Allied Trades: - Overview Fitter, Turner, Electrician, carpenter, machinist Hand on practice related to trade work and preparation of drawings from real objects and	Allied Trades: - Overview Fitter, Turner, Electrician, carpenter, machinist Hand on practice related to trade work and preparation of drawings from real objects and

		circuits.	circuits.
Practical 32 Hrs Theory 12 Hrs	Explain the advance features of the latest version of CAD software along with advanced method for the development of two or three dimensional drawing with the help of it.	27. Practices latest version of CAD (specially AUTO-CAD) software & use of different menus and different tool bars. Drawing of Isometric and 3 Dimensions objects using CAD (specially AUTO-CAD) software.	Practices latest version of CAD (specially AUTO-CAD) software & use of different menus and different tool bars. Drawing of Isometric and 3 Dimensions objects using CAD (specially AUTO-CAD) software.
Practical 16 Hrs Theory 06 Hrs	Demonstrate the method of official communication via internet.	28. Use of Internet in accessing and sending drawing. Project work and Industrial-cum- study tour.	Use of Internet in accessing and sending drawing.

**SYLLABUS FOR CORE SKILLS**

1. Workshop Calculation & Workshop Science (120Hrs + 80 Hrs)
2. Training Methodology (TM)(Common for all CITS trades) (320 Hrs + 200 Hrs.)

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 OUTCOME	ASSESSMENT CRITERIA
<b>TRADE TECHNOLOGY (TT)</b>	
1. Demonstrate the percentage of correctness for conventional symbols of machine parts and free hand sketch of basic hand tools as per standards and ensuring safety measures.	Demonstrate the basic knowledge of Personal Protective Equipment (PPE).
	Demonstrate basic life support training method.
	Prepare various documents for industrial requirements using the methods of recording information.
	Explain health, safety and environment guidelines, legislations & regulations.
	Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner.
	Demonstrate drawing skill of all dimensions in accordance with standard specification.
2. Explain the methodology for scale factor determination and dimensioning of an object in relevant drawing sheet.	Evaluate the length of an object in drawing paper as per scale factor.
	Demonstrate necessary calculation or spacing to drawing sheet dimensions of various components / parts of drawing.
	Demonstrate creation of objects to accommodate their views in a drawing sheet without reducing the scale
	Illustrate the conventional representation of common features.
	Evaluate creation of different types of section lines as per standard practices.
	Observe safety precautions while working on drawing sheet.
3. Demonstrate construction of orthographic projection with proper dimensioning.	Illustrate convention of the dimension in required scale to drawing in drawing sheet.
	Interpret drawing requirement such as types of orthographic projection symbol.
	Evaluate drafting principal to produce drawing sheet showing elevations, plans and end views.
	Assess appropriate dimension system rule to draw the required drawing as per the standard practices.
	Check the different types of line uniformly.
	Demonstrate dimension placing system and other reference that follow the required conventions.
	Observe safety norms while working on drawing sheet.
4. Construct two-dimensional shape of the developed surfaces of conventional solids.	Explain the method of development of the surfaces of a cube & cone.
	Assess the method of development of the surfaces of a Cylinder.
	Evaluate the surface of a hexagonal pyramid cut by a plane at a certain height from its base at a certain angle.
	Evaluate the surface of an oblique cone angularly penetrated by a

	solid circular rod.
	Explain the method of development of the surface of a prism.
5. Demonstrate the process for drawing of different fasteners and joints.	Develop a neat sketch of a hexagonal nut.
	Illustrate the conventional representation of common features viz. internal thread, external thread, slotted hole, butt thread etc.
	Sketch the symbol of V butt joint and rivet joint. .
	List types of joint implemented in pipe line and show the symbols of those.
6. Explain the symbolic representation of electrical or electronic circuit along with its wiring layout and hydraulic, pneumatic and mechanical components along with mechanical joints.	Demonstrate a layout drawing for an electrical wiring.
	Demonstrate a layout diagram of piping line for water supply system of a plant indicating all necessary hydraulic equipments.
	Explain a detailed drawing of a spur gear indicating all of its numerical parameters.
	Formulate the numerical relationship between numerical parameters of a helical gear
	Demonstrate the welded spot by IS symbols in a drawing of piping layout.
7. Assess the correctness of final dimensions and graphical symbols of different surface finishes, as per Indian Standard.	Evaluate appropriate denotations for continual & details on drawing.
	Demonstrate working drawing dimension within tolerance limit, indicating the machine & surface symbol.
	Ensure that all details for preparation of drawing are available and in order.
	Assess appropriate dimension system rule to draw the required drawing of surface finish symbols as per the standard practices.
	Assess the project sheets as per drawing and maintain for future references.
	Ensure safety precautions while working on drawing sheet.
8. Justify the perfection of a 2D drawing using CAD software.	Explain brief details of CAD 2D software.
	Create simple 2D drawings through CAD.
	Explain basic commands for drawing and modification.
	Set up the command icons on two sides of the screen.
	Evaluate two dimensional geometrical figure of pre determined dimension.
	Assess all dimensions on that figure with zero precision.
	Monitor main drawing and the dimensions in two different layers.
	Check Fit of this drawing on page layout as per necessary scale.
	Make a marginal box including a title block at right bottom corner.
	Make the specified parts of the drawing bold and thick
	Differentiate the colors of several portion of the drawing.
Plot the drawing in proper size of plotting paper.	
9. Demonstrate drawing of machine parts by measuring	Assess List of basic metrological instruments for measurement.
	Evaluate measurement methodology by vernier calliper.

with gauges & measuring instruments.	Assess differentiation between internal and external micro meter.
	Analyse the final dimension of outside diameter of a circular rod.
	Evaluate use a venire height gauge.
	Assess determination of angle of inclination of an inclined plane
	Demonstrate the actual function of a bevel protector.
	Assess differentiation between the measurement method by micrometer and slide calliper.
	Check the least count of basic metrological instruments used in industries.
10. Illustrate assembly drawing of all types of bearings, carpentry joints, piping, machine parts etc. using conventional sign & symbol used for production drawing.	Demonstrate necessary calculation or spacing to drawing sheet dimensions of machine part detail & assembly drawing.
	Demonstrate drafting principal to produce drawing sheet showing sectional elevations plans and different types of views.
	Explain all types of bearing, engine parts, carpentry joints, pipe joints details & assembly drawing.
	Explain all types of simple machine components in details & assembly drawing.
	Explain all types of production features and simple jigs & fixtures in details & assembly drawing.
	Analyse table to denote the name, dimensions, materials, quantity, remarks of various parts or components as per drawing requirement.
	Demonstrate appropriate dimension system rule to draw the required drawing as per the standard practices.
	Check the drawing by different types of line use as per SP-46: 2003.
11. Demonstrate working drawing with tolerance dimension, indicating machining parameters.	Explain the factors affecting the machining parameters.
	Evaluate appropriate dimension system rule to draw the required drawing related to cutting speed, feed, r.p.m. depth of cut, machining time for drilling etc. as per the standard practices.
	Assess mathematical relationship between the parameters.
	Evaluate graphical representation between the parameters referring to the given data.
12. Demonstrate basic knowledge on tools, equipment & their application in allied trade, Viz. Fitter, Turner, Electrician etc.	Demonstrate different types of tool , equipment & functional application viz. Fitter, Turner, Electrician etc.
	Check functionality of machine.
	Identify different works and tool holding devices for functional application.
	Perform the job as per set standard limits & tolerance.
	Observe safety norms.
13. Explain the advance features of the latest version of CAD software along with advanced method for the development of two- or	Explain application of advanced CAD commands for 2D & 3D drawings.
	Generate line segment in AutoCAD importing data from Excel worksheet.
	Generate assemble of parts through 2D & 3D modelling workspace.
	Generate 3 views of 3D models.

three-dimensional drawing with the help of it.	Evaluate relevant and appropriate symbol as per drawing requirement to provide details in the drawings.
14. Demonstrate the method of official communication via internet.	Convert drawing file(dwg.) to (pdf) file and send thru e-mail as attachment.
	Manage set of drawings for digital communication.

## 8. INFRASTRUCTURE

LIST OF TOOLS AND EQUIPMENT -Reading of Drawing & Arithmetic (CITS)			
for batch of 25 candidates			
S No.	Name of the Tool & Equipment	Specification	Quantity
<b>A. TRAINEES TOOL KIT</b>			
1.	Drawing Instrument Box	With accessories.	26 sets
2.	Set square celluloid 45	250x1.5mm	26 sets
3.	Set square celluloid 60	250x1.5mm	26 sets
4.	French-curves	Set of 20 celluloid	26 sets
5.	Drawing Board	(700 x 500) IS:1444	26 sets
6.	Tee-Square	(700 mm blade) IS:1360	26 sets
7.	Mini Drafter		26 sets
<b>B. TOOLS, MEASURING INSTRUMENTS AND GENERAL SHOP OUTFIT</b>			
8.	A. Computer	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.	14 nos.
	B. Software	MS-Office latest version of operating software Auto-CADwith power pack or latest version.	14 users licenced
	C. Laser Jet printer	Latest model – Print, Copy and Scan 1200x1200dpi, 16MB	1 no.
	D. UPS		As required
9.	Chest of drawers	8 drawers	2 nos.
10.	Trainees Locker	8 drawers	3 nos.
11.	Book Self		2 nos.
12.	Steel tape	2 meters (Pull type)	1 nos.
13.	Drawing table	for A1 sheet	26 nos.
14.	Stools	(Revolving type) Adjustable height	26 nos.
15.	T.O's Table	6ftX4ft	1 no.
16.	T.O's Chair	Armed chair – Revolving	1 no.
17.	Almirah Steel	6ft. height or higher	2 nos.
18.	Computer table		14 nos.
19.	Computer chairs	Revolving	26 nos.
20.	Table for printers		1 no.
21.	D.L.P Projector	2000 LUMEN OR HIGHER	1 no.
22.	Motorised Screen forv Projector		1 no.
23.	White board	6FT. x 4FT.	1 no.
24.	Fire Fighting Equipments		As required

25.	First Aid Box		1 no.
<b>C. CLASS ROOM FURNITURE</b>			
26.	Class Room Chairs / Dual desk may also be allowed	Armless	25 /13 nos.
27.	Class Room Tables / Dual desk may also be allowed	3ft X 2ft	25 /13 nos.
28.	Chair for Trainer	(Armed) movable	01 no.
29.	Table for Trainer	(4 ½ ft X 2 ½ ft) with Drawer and cupboard	01 no.
30.	LCD / LED Projector		01 no.
31.	Multimedia Computer System	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.	01 set
32.	Computer Table		01 no.
33.	White Board	6ft X 4 ft.	01 no.
34.	LCD Projector Screen		
35.	Air Conditioner (OPTIONAL)		As required
36.	Wall Clock		01 no.
37.	Wall charts, Transparencies and DVDs related to the trade		As required
38.	Laser Printer with scanner		01 no.
39.	Steel Cupboard	With 8 pigeon lockers	3 nos.
40.	Work bench for fitters	With two vices of 100mm	2 nos.
41.	Steel cupboard	180x90x45cm	2 nos.
42.	Steel cupboard	120x60x45cm	2 nos.
43.	Multi drawer tool rack trolley	With minimum 4 drawers and 20 tool capacity	04 nos.
44.	First aid box.		1 no.

**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 expert members who had contributed immensely in this curriculum.

<b>List of Expert members participated for finalizing the course curriculum of Reading of Drawing and Arithmetic (CITS) trade.</b>			
<b>SNo.</b>	<b>Name &amp; Designation Sh/Mr/Ms</b>	<b>Organization</b>	<b>Remarks</b>
1.	Prof. NirjharDhang.(H.O.D)	Dept. of Civil Engg.IIT Kharagpur	Chairman
2.	Col. N. B. Saxena.	Construction Skill DevelopmentCouncil of India (CSDCI)	Member
3.	SatishGottipati. (M. D.)	Preca Solutions (E)	Member
4.	MeenaRaghunathan. (Director, CommunityScience.)	GMRU Foundation, Hyderabad	Member
5.	D. K. Chattopadhyay. (Training Officer.)	ATI, Kolkata. Dasnagar, Howrah	Member
6.	S. R. Vhatkar. (Training Officer.)	ATI, Kolkata. Dasnagar, Howrah	Member
7.	A. K. Naskar. (Training Officer.)	ATI, Kolkata. Dasnagar, Howrah	Member
8.	S. Chockalingam. (Training Officer.)	CTI, Chennai	Member
9.	Tapan Kr. Halder. (Training Officer.)	RDAT, Kanpur	Member
10.	Arpana Singh. (T.O.)	N.V.T.I (W) Noida	Member
11.	P. Karithashankar. (T. O.)	N.V.T.I (W) Noida	Member
12.	Simni (T. O.)	N.V.T.I (W) Noida	Member
13.	SumanKumari. (T. O.)	N.V.T.I (W) Noida	Member
14.	M.C Sharma	DGE&T (HQ)	Mentor

