



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

COMPETENCY BASED CURRICULUM

SHEET METAL WORKER

(Duration: One Year)

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL: 2.5



SECTOR – CAPITAL GOODS AND MANUFACTURING

CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE

Kolkata-700091

SHEET METAL WORKER

(Engineering Trade)

(Revised in August 2025)

Version: 3.0

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL: 2.5



Directorate General of Training

Developed By

CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE

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1. COURSE INFORMATION

During the one-year duration a candidate is trained on subjects Professional Skill, Professional Knowledge, Employability Skills related to job roles. 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 broad components covered under Professional Skill subject are as below:

The practical part starts with selecting sheet of required type, thickness (gauge) and size and marks it with scribe, square, divider, steel rule etc., according to drawing or sample. Other activities conducted at the yearly course are like shearing or bending the sheet as per sketch by machine or hand shear, forming sheet metal to required shape and size by various operations such as shearing, bending, beading, channeling, circle cutting, seaming, forming, riveting etc., performing different type of MS pipe joints by Gas welding (OAW), performing soldering, brazing operations on sheet metal etc. The course also covers performing Arc welding, Gas welding on sheet metals, performing frame work hollowing and raising on non-ferrous and ferrous sheets, bending and joining of pipes, preparing utility items with ferrous and non-ferrous sheets, performing TIG Welding, MIG Welding, Spot Welding on metal sheets, fabrication work with metal sheets, undertake repair work of mudguard, Radiators etc.

Professional Knowledge subject is simultaneously taught in the same fashion to apply cognitive knowledge while executing task. In addition, components like Physical properties of engineering materials, different types of iron, properties and uses, Heat & Temperature are also covered under theory part.

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.

2.1 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 variants and Apprenticeship Training Scheme (ATS) are two pioneer programmes of Directorate General of Training (DGT) for propagating vocational training.

Sheet Metal Worker trade under CTS is one of the popular courses delivered nationwide through network of ITIs. The course is of one year duration. It mainly consists of Domain area and Core area. The Domain area (Trade Theory & Practical) imparts professional skills and knowledge, while Core area (Employability Skills) imparts requisite core skills, knowledge and life skills. After passing out of the training program, the trainee is awarded National Trade Certificate (NTC) by DGT which is recognized worldwide.

Trainee broadly need to demonstrate that they are able to:

- Read & interpret technical parameters/document, 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 skill, knowledge, core skills & employability skills while performing jobs.
- Check the job/assembly as per drawing for functioning, identify and rectify errors in job/assembly.
- Document the technical parameters related to the task undertaken.

2.2 PROGRESSION PATHWAYS

- Can join industry as Sheet Metal Technician and will progress further as Senior Technician, Supervisor and can rise up to the level of Manager.
- Can become Entrepreneur in the related field.
- **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 one year: -

S No.	Course Element	Notional Training Hours
1	Professional Skill (Trade Practical)	840
2	Professional Knowledge (Trade Theory)	240
3	Employability Skills	120
Total		1200
4	On the Job Training (OJT)/ Group Project (if industry not available nearby)	150
5	Optional Courses (10th/ 12th class certificate along with ITI certification or add on short term courses)	240
Total Course Duration		1590

** The trainee has to undergo 150 hours of mandatory OJT (On the Job Training) at nearby industry or wherever industry not available then group project has to be done with the supervision of the trade instructor for every year.*

*** Trainees of one-year or two-year trade can also opt for optional courses of up to 240 hours in each year for obtaining 10th/ 12th class certificate from NIOS along with ITI certification, or, short term courses for extra skills/knowledge.*

2.4 ASSESSMENT & CERTIFICATION

The trainee will be tested for his/her 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.cstaricalcutta.gov.in and 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 **DGT** as per the guidelines. The pattern and marking structure is 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 percentage for Trade Practical and Formative assessment are 60% & for all other subjects is 33%.

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. Due consideration should 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 Occupational Safety, Health & Environment (OSHE) and self-learning attitude are to be considered while assessing competency.

Assessment will be evidence based comprising some of 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
- Computer based multiple choice question examination
- Practical Examination

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 for formative assessment:

Marks Allotted during Assessment	Performance Level	Evidence
Marks between 60% to 75%	For performance in this grade, the candidate should produce work which demonstrates attainment of an acceptable standard of craftsmanship with occasional guidance, and due regard for safety procedures and practices.	• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment. • 60-70% accuracy achieved while undertaking different work with those demanded by the component/job. • A fairly good level of neatness and consistency in the finish. • Occasional support in completing the project/job.
Marks above 75% to 90%	For this grade, a candidate should produce work which demonstrates attainment of a reasonable standard of craftsmanship, with little guidance, and regard for safety procedures and practices.	• Good skill levels in the use of hand tools, machine tools and workshop equipment. • 70-80% accuracy achieved while undertaking different work with those demanded by the component/job. • A good level of neatness and consistency in the finish. • Little support in completing the project/job.
Marks Above 90%	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% accuracy achieved while undertaking different work with those demanded by the component/job. • A high level of neatness and consistency in the finish. • Minimal or no support in completing the project.

Brief Description of Job Roles:

Sheet-Metal Worker; make, install and repair articles and parts of articles of sheet metal such as sheet steel, copper, tin, brass, aluminum, zinc or galvanized iron. Sheet Metal Worker, makes sheet metal articles according to drawing or sample. Studies drawing or sample and records measurements if necessary. Selects sheet of required type, thickness (gauge) and size and marks it with scribe, square, divider, foot rule etc., according to drawing or sample. Shears wherever necessary by machine or hand shears and makes it to required shape and size by bending, seaming, forming, riveting, soldering etc., using mallets, hammers, formers, sets, stakes, etc., or by various machines such as shearing, bending, beading, channeling, circle cutting. Checks work at stages during operations and does soldering, brazing, arc welding, gas welding, TIG welding & MIG welding as necessary. May undertake aluminum paneling work. May also undertake repair work. May specialize in different metal sheets such as tin, copper, brass.

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

Reference NCO-2015:

- i) 7213.0101 – Sheet Metal Worker, General/Sheet Metal Worker – Hand Tools and Manually Operated Machines.
- ii) 7213.0101 – Sheet Metal Worker, Structural
- iii) 7213.9900 - Sheet Metal Workers, Other

Reference NOS:

- i) CSC/N9520
- ii) CSC/N9634
- iii) CSC/N9635
- iv) CSC/N9522
- v) CSC/N9637
- vi) CSC/N9543
- vii) CSC/N9540
- viii) CSC/N9636
- ix) CSC/N9638
- x) CSC/N9639
- xi) CSC/N9402
- xii) CSC/N9401

4. GENERAL INFORMATION

Name of the Trade	SHEET METAL WORKER
Trade Code	DGT/1027
NCO – 2015	7213.0101, 7213.0101, 7213.9900
NOS Covered	CSC/N9520, CSC/N9634, CSC/N9635, CSC/N9522, CSC/N9637, CSC/N9543, CSC/N9540, CSC/N9636, CSC/N9638, CSC/N9639, CSC/N9402, CSC/N9401
NSQF Level	Level: 2.5
Duration of the Trade	One year
Entry Qualification	Minimum 8 th Class Passed
Minimum Age	14 years as on first day of academic session.
Eligibility for PwD	LD, LC, DW, AA, DEAF, HH
Unit Strength (No. Of Student)	20 (There is no separate provision of supernumerary seats)
Space Norms	100 sq. m.
Power Norms	18 KW
Instructors Qualification for	
1. Sheet Metal Worker Trade	B.Voc/Degree in Mechanical /Metallurgy /Production Engineering/Mechatronics from AICTE/UGC recognized Engineering College/University with one year of teaching or industry experience in the Metal field. OR 03 years Diploma in Mechanical / Metallurgy / Production Engineering/ Mechatronics from AICTE/ recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years of teaching or industry experience in the Metal field. OR NTC/ NAC passed in the trade of “Sheet Metal Worker” Trade with three years of teaching or industry experience in the Metal field. Essential Qualification: Regular/ RPL variants of National Craft Instructor Certificate (NCIC) in Sheet Metal Worker trade under DGT. <i>Out of two Instructors required for the unit of 2(1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications.</i>
2. Workshop Calculation & Science	B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with one-year of teaching or industry experience. OR

	03 years Diploma in Engineering from AICTE / recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' of teaching or industry experience. OR NTC/ NAC in any one of the engineering trades with three years' of teaching or industry experience. <u>Essential Qualification:</u> Regular / RPL variants of National Craft Instructor Certificate (NCIC) in any one of the engineering trade or RoDA.
3. Engineering Drawing	B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with one-year of teaching or industry experience. OR 03 years Diploma in Engineering from AICTE / recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' teaching or industry experience. OR NTC/ NAC in any one of the engineering/ Draughtsman group of trades with three years' of teaching or industry experience. <u>Essential Qualification:</u> Regular / RPL variants of National Craft Instructor Certificate (NCIC) in any one of the engineering trades or RoDA.
4. Employability Skill	MBA/ BBA / Any Graduate/ Diploma in any discipline with Two years' of teaching or industry experience with short term ToT Course in Employability Skills conducted by DGT institutions. (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 conducted by DGT institutions.
5. Minimum Age for Instructor	21 Years
List of Tools and Equipment	As per Annexure – I

5. LEARNING OUTCOME

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

5.1 LEARNING OUTCOMES:

Sl. No.	NOS CODE	Learning Outcome	Duration		
			Practical	Theory	Total
1	CSC/N9520	Select sheet of required type, thickness (gauge) and size and mark it with scribe, square, divider, steel rule etc., according to drawing or sample following safety precautions.	60	15	75
2	CSC/N9634	Shear and bend the sheet wherever necessary by machine or hand shear.	25	05	30
3	CSC/N9635	Form sheet metal to required shape and size by bending, seaming, forming, riveting etc., using mallets, hammers, formers, sets, stakes, etc., or by various operations such as shearing, bending, beading, channeling, circle cutting.	100	35	135
4	CSC/N9522	Perform soldering, brazing operations on sheet metal.	135	30	165
5	CSC/N9637	Make sheet metal articles according to drawing or sample following safety precaution.	112	23	135
6	CSC/N9543	Plan & work in different types of ferrous & non-ferrous sheet metals.	72	18	90
7	CSC/N9540	Perform different type of MS pipe joints by Oxy Acetylene Gas Welding (OAW) and brazing.	110	10	120
8	CSC/N9636	Perform Arc welding, Gas welding, TIG welding & MIG welding and Spot welding on sheet metals.	141	24	165
9	CSC/N9638	Perform Aluminum frame works, make ducts, cabins & panels.	25	05	30
10	CSC/N9639	Undertake repair work of any damaged sheet metal items like mudguard, Radiators etc.	60	15	75
11	CSC/N9401	Read and apply engineering drawing for different application in the field of work.		30	30
12	CSC/N9402	Demonstrate basic mathematical concept and principles to perform practical		30	30

		operations. Understand and explain basic science in the field of study.			
Employability Skills				120	120
Total			840	360	1200

6. ASSESSMENT CRITERIA

LEARNING OUTCOMES	ASSESSMENT CRITERIA
1. Selects sheet of required type, thickness (gauge) and size and mark it with scribe, square, divider, steel rule etc., according to drawing or sample following safety precautions. (NOS: CSC/N9520)	- Plan and select the type of sheet metal type & thickness as per requirement. - Prepare the pieces as per drawing. - Setting up the sheet in specific position. - Mark the sheet using scribe, steel rule divider etc. - Carry out dimensional inspection to ascertain quality.
2. Shear and bend the sheets wherever necessary by machine or hand shear. (NOS: CSC/N9634)	- Plan and select the type machine required for shearing & bending. - Prepare, set the pieces as per drawing. - Set up the pieces in specific position. - Use the machine for shearing/bending or by hand. - Carry out visual inspection correctness.
3. Form sheet metal to required shape and size by bending, seaming, forming, riveting, etc., using mallets, hammers, formers, sets, stakes, etc., or by various operations such as shearing, bending, beading, channeling, circle cutting. (NOS: CSC/N9635)	- Plan and mark on for forming operation. - Select the tools required for the bending, seaming, forming, riveting operations like mallets, hammers, formers, sets, stakes, etc. - Set the sheared plate properly on cutting table. - Perform the bending, seaming, forming, riveting operations operation maintaining proper techniques and all safety aspects. - Clean the job and inspect the cut surface for soundness of operation.
4. Performs soldering, brazing operations on sheet metal. (NOS: CSC/N9522)	- Plan and select the nozzle size, working pressure, type of flame, filler rod and flux as per requirement. - Prepare, set the pieces as per drawing. - Braze/ solder the joint adapting proper brazing/soldering technique and safety aspect. - Carry out visual inspection to ascertain quality weld joint.
5. Makes sheet metal articles according to drawing or sample following safety precaution. (NOS: CSC/N9637)	- Prepare, set the pieces as per drawing. - Selection of machine and material, marking, shearing/ bending. - Set up the pieces in specific position. - Perform the sheet metal joining operations operation maintaining proper techniques and all safety aspects. - Carry out visual inspection to ensure quality of joint.

6. Plan & work in different types of ferrous & non-ferrous sheet metals. (NOS: CSC/N9543)	• Make on ferrous and non-ferrous articles by use of power press • Perform & practice Buffing and polishing. • Angle iron bending in different angles and different radii. • Twisting the M.S. square rod and flats.
7. Perform different type of MS pipe joints by Gas welding (OAW). (NOS: CSC/N9540)	• Plan and prepare the development for a specific type of pipe joint. • Mark and cut the MS pipe as per development. • Select the size of filler rod, size of nozzle, working pressure etc. • Set and tack the pieces as per drawing. • Deposit the weld bead maintaining proper technique and safety aspects. • Inspect the welded joint visually for poor penetration, uniformity of bead and surface defects.
8. Perform Arc welding, Gas welding TIG welding, MIG welding, spot welding on sheet metals. (NOS: CSC/N9636)	• Plan and prepare the pieces for welding. • Select the type and size of filler rod and flux/electrode for welding. • Set and tack sheets as per drawing. • Deposit the weld maintaining appropriate technique and safety aspects. • Cool the welded joint by observing appropriate cooling method. Use post heating, peening etc. as per requirement. • Clean the joint and inspect the weld for its uniformity and different types of surface defects.
9. Perform Aluminium frame works, make ducts, cabins & panels. (NOS: CSC/N9638)	• Plan and select aluminium section like channels, rectangular tubes etc. specific type joint. • Mark and cut the aluminium section as per development. • Set up the pieces in specific position. • Perform the Aluminium metal joining operations operation maintaining proper techniques and all safety aspects. • Carry out visual inspection to ensure quality of joint.
10. Undertake repair work of any damaged sheet metal items like mudguard, Radiators etc. (NOS: CSC/N9639)	• Repairing of damaged sheet metal Mudguard. • Repairing of damaged sheet metal Radiators. • Testing of Sheet metal containers. • Repairing of Blocked Silencer and fuel tank. • Carry out visual inspection to ensure quality of joint.

11. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: CSC/N9402)	• Solve different mathematical problems. • Explain concept of basic science related to the field of study.
12. Read and apply engineering drawing for different application in the field of work. (NOS: CSC/N9401)	• Read & interpret the information on drawings and apply in executing practical work. • Read & analyse the specification to ascertain the material requirement, tools and assembly/maintenance parameters. • Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.

7. TRADE SYLLABUS

SYLLABUS FOR SHEET METAL WORKER TRADE			
DURATION: ONE YEAR			
Duration	Reference Learning Outcome	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
Professional Skill 60 Hrs.; Professional Knowledge 15 Hrs.	1. Select sheet of required type, thickness (gauge) and size and mark it with scribe, square, divider, steel rule etc., according to drawing or sample following safety precautions.	1. Induction training, Familiarisation with the Institute, Importance of trade in Training Machines used in the trade. 2. Introduction to safety devices used in shop floor. 3. Identification of Tools and Equipment and their uses. 4. Practice in Reading, Steel Rule, scribing of straight lines, bisecting of straight lines (on the sheet metal) using marking tools. 5. Mark and cut through the straight lines, Planishing of Sheet Metal. 6. Practice in drawing simple Geometrical shapes. 7. Practice in marking and cutting of sheets to various angles.	General discipline in the institute Elementary of First aid Importance of the sheet metal work in the industry. General safety precautions Safety precaution in sheet metal work. Metals and Non-Metals and their Characteristics, Types, Sizes and uses of Sheet Metals as per BIS. Use of reference table. Raw material information: CRCA, HRCA & MS Material Terms & definitions in sheet metal work. Marking and laying out tools and accessories Measuring Tools: steel Rule, callipers, try square, L square, Micrometre, Vernier calliper, Vernier height gauge, Combination set, screw pitch gauge, radius gauge, SWG, Bevel Protractor etc. Marking Tools: Scratch AWL, divider, Trammel point, punches etc. Cutting tools: Snips, shears, hacksaw, chisel, cutting plier, files, drills, tap & die sets etc.
Professional Skill 25Hrs.; Professional Knowledge 05Hrs.	2. Shear and bend the sheet wherever necessary by machine or hand shear.	8. Practice on cutting different types of shapes using different types of snips. 9. Tin snips (Straight cut, Right cut and Left cut) cutting off inside and outside curve, cutting off notches and cutting off profiles.	Hand tools: mallets, hammer, sheet metal hammers, groovers, riveting tools, screw drivers, wrench and spanners etc. Holding tools & accessories: vices, C clamps, stakes, stakes holder, hollow mandrel, wooden former, Jigs & fixtures, soldering bits etc.

Professional Skill 100 Hrs.;	3. Form sheet metal to required shape and size by bending, seaming, forming, riveting etc., using mallets, hammers, formers, sets, stakes, etc., or by various operations such as shearing, bending, beading, channeling, circle cutting.	10. Practice on various Sheet Metal seems like "Grooved seam, Locked Grooved seam, Pane down seam, Bottom lock seam or Corner Fold (Knocked-up seam), Corner Clip Lock, Double Bottom Lock, Clip Lock (Cap Lock), snap Joint etc. (Folded Joints) and hemming practice. 11. Forming rectangular shapes using stakes. 12. Forming Cylindrical job using various stakes such as Hollow Mandrel, Hatchet Stake; Tin Man's' Anvil stake etc. 13. Folding, Bending Sheet Metal to 90 degree using wooden mallet, 'C' clamps etc. 14. Making a radius using Wooden blocks using Hairpin Folder. 15. Making a cylindrical container with knocked- up, bottom (Bottom Locked), Grooved Joint and hemmed Top. 16. Forming frustum of Cone. 17. Making of Mug, scoop, etc. 18. Hemming (single, Double) wire edge by hand process. 19. Make a taper chute square to rectangle transition. 20. Make a taper chute square to round. 21. Making holes with solid punches, round punches as per BIS. 22. Use of hollow punches, making hole in sheet metal with help of wood block. 23. Riveting practice using various types of rivet heads. 24. Single chain riveted joint. Double chain and Zig- zag, Lap & butt riveted joints Making a dust pan (Corner and handle riveted) 25. Making a fire bucket with lap riveted joint on one side and Locked Grooved Seam on the other side.	Sheet Metal Folded Joints: Description of Sheet Metal Seam, Grooved seam, Locked Grooved seam, Pane down seam, Knocked up seam inside and outside, capstrip seam, pitsburg seam etc. Folding and joining allowances, edge stiffing, wiring allowances and false wiring, types of notches in sheet metal. Definitions of pattern Development, stretched out pattern, Master pattern (gross pattern) and templates. Development of pattern by parallel line method, radial line method. Development of surfaces: Triangulation method and geometrical construction methods. Solid and Hollow Punches. Description of hand punches as per BIS. Sizes of solid and hollow Punches and their uses. Rivets and its parts, Selection of Rivet heads. Types of Rivet and their uses. Standard sizes of Rivets and Riveting Tools. Calculation for Riveting allowances (pitch and Lap)
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		26. Bottom Hollowing and Bottom Lock Seam.	
Professional Skill 135 Hrs.;	4. Perform soldering, brazing operations on sheet metal.	27. Prepare a Lap joint. 28. Prepare Single plated butt joint. 29. Making funnel by soldering process. 30. Making oil Can by hand process by soldering. 31. Make by soldering:- • Elbow 90° equal dia. pipe. • T joint 90° equal dia. pipe. • T joint 90° unequal dia. pipe by soldering. 32. Make by soldering:- T Pipe 60° branch joint unequal dia pipe Offset T joint unequal dia. 33. Make a taper lobster back bend 90 degree from oblique cone by soldering. 34. Forming square section segmental quarter bend pipe with suitable lock and forming round section segmental quarter bend pipe. 35. Brazing copper sheet in lap joint in flat position.	Solder, Different types of solder and their composition. Types and uses of fluxes, their effect on different metal. Fastening of Sheet Metal: Self tapping screws, Clips and Connectors; Their uses, Types and Allowance of 'S' Clips, Government Clips, Drive Clips, Mailing Clips etc. Process of soft soldering, hard soldering (brazing). Heating appliances (Hand Forge, Blow Lamp) Development & laying out pattern of elbow pipe, T pipe and offset pipe in unequal diameter. Laying out pattern of 60° off-set 'T' pipe. Pattern Development of 'Y' pipe. Preparation of pickling solution. Development of T pipe, round equal and unequal. Introduction to tubes and pipes. Development and laying out of pattern of segmental quarter bend pipe. Protection-Coating, Cleaning and preparing of Sheet Metals Corrosion and anticorrosion treatment of sheet metal including sand blasting.
Professional Skill 112 Hrs.;	5. Make sheet metal articles according to drawing or sample following	36. Importance of machinery used in the trade. 37. Types of job made by the trainees in trade. 38. Introduction to machinery safety including fire fighting equipment and their uses etc.	Importance of the trade in the development of Industrial Economy of the Country. Review of Types of sheet metal Fabrication. Methods of developments.

	safety precaution.	39. Locked groove joint by aluminium sheet. 40. Single riveted lap joint by aluminium sheet. 41. Double strap single row riveted butt joint by aluminium sheet. 42. Exercise involving practical work on Aluminium Sheet, and using Pop Rivet. 43. Aluminium Windows with different extruded sections, Aluminium Soldering. 44. Making holes in sheet metal using Punching Machine. 45. Making holes in sheets with a twist drill. 46. Tri-paning with use of hand and electric drilling machine. Grinding a drill bit. 47. Practice in Drilling Holes in walls and Ceilings as applied to ducting work. 48. Use of rawl bits and rawl plug. 49. Use of fast nuts. 50. Practice on hollowing and rising on non-ferrous sheet as well as ferrous sheet. 51. Practice on removing dents of spherical or hemi-spherical articles using wheeling and raising machine. (Repairing mud guards etc.) 52. Practice on pipe bending by hand. 53. Pipe bending using Hydraulic Pipe bending' machine. 54. Development of a cone: Cylinder fitted to a cone. 55. Equal dia pipe joint with crimping and ogee beading. 56. Practice on external threading using "Die stock". 57. Practice on internal threading using taps. 58. Typical folding, Bending Practice, Making Steel-Racks, Reinforcement with angle iron. 59. Use of self tapping screws and other	Introduction to Aluminium fabrication, and its applications. Ferrous and Non-Ferrous metals. Use of Copper and Alloys. Laying out pattern of conical elbows. Pattern development of lobster back bend. Chemical and Physical properties of Aluminium. Use of Aluminium and its Alloys. Brief Description of hand punch machine. Hand and Power operated drilling Machines. Drill Bits, parts and effects of cutting angles. Angles for Drilling Sheet Metals, effect of speed, Feed Cutting Fluids, etc., on metals. Difference between drilled and punched holes. Description of swaging and beading machine, its parts, operating principles etc. Description of Fly Ball press. Operating Principles of Power Press and press brakes. Method to calculate the pressure adjustment. Clearance between Die and Punch. Introduction to "C" and "H" frame presses. Properties of stainless steel and its uses. Properties and uses of tin, lead, zinc and silver. Description and Physical properties of Muntz Metal, Gun Metal, White Metal etc. Introduction to pipe/tube bending. Brief description of Hydraulic pipe bending machine. Operating Principles etc. Description of roll forming machine types and operating principles, description of slip roll
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		fasteners. 60. Project work such as Steel Stool, Aluminium Ladder etc. 61. Metal Spinning: Making a cup or bowl shape article with aluminium sheet. 62. Construct a cylindrical medicine and food container.	forming machine and its function. Taps and dies, use of Die and Die Holder, Description of taps and tap wrench. Method to operate folding/brake folder for typical folding. Description and use of jigs and fixtures. Operating principles of spinning lathe. Description of spinning.
Professional Skill 72 Hrs.; Professional Knowledge 18 Hrs.	6. Plan & work in different types of ferrous & non-ferrous sheet metals.	63. Making of ferrous and non-ferrous articles by use of power press like blanking, piercing, punching, perforating etc. 64. Practice of Buffing and polishing. 65. Angle iron bending in different angles and different radii. 66. Twisting the M.S. square rod and flats.	Definition of Planishing and its application. Brief description of polishing machine. Various types of bobs and polishing compounds.
Professional Skill 110 Hrs.; Professional Knowledge 10 Hrs.	7. Perform different type of MS pipe joints by Oxy Acetylene Gas Welding (OAW) and brazing.	67. Setting up of Oxy-acetylene plant and types of flames. 68. Gas welding square butt joint on M.S. sheet in down hand position Fillet Tee & Lap joint on M.S sheet in down hand position. 69. Pipe butt joint in down hand position. 70. Butt joint on MS flat in down hand position by arc. 71. Fillet lap and T joint on MS flat in down hand position.	Types of oxy-acetylene flames & its uses. Types and description of flux. Types of welding blow pipes & its functions. Different process of metal joining types of weld joint & weld positions. Oxy-acetylene welding equipment's & application, Types of flame & their uses. Principle of arc welding. Types of welding machines and their uses. Advantages and disadvantages of AC/DC welding machines. Arc length and its importance Welding defects.
Professional Skill 141 Hrs.; Professional Knowledge 24 Hrs.	8. Perform Arc welding, Gas welding, TIG welding & MIG welding and Spot welding on sheet metals	72. Setting up of Arc welding plant and striking & maintaining the arc & laying short beads. 73. Fusion run with/without filler rod in flat position. 74. Square butt joint in flat position by gas.	Safety precaution in gas & arc welding Description of Oxyacetylene plant and the equipment's, accessories & tools. Various types of pipe joints. Method of metal preparation & cleaning them base metal before

		75. Resistance welding. Spot welding, seam welding. 76. Co2 welding. Deposit bead on MS sheet in flat position. 77. Lap joint, T joint and butt joint in down hand position. 78. TIG welding. Deposit bead on SS sheet in flat position. Making butt, Tee and corner joint. 79. TIG welding. Deposit bead on Aluminium sheet in flat position. 80. Making butt, Tee and corner joint. 81. MS/SS pipe butt and Y joint by TIG welding process.	welding. Gas welding defects causes & remedies. Arc welding defects causes & remedies. Principle of resistance welding. Types and applications. Welding symbols. Introduction to CO2 welding process. Welding equipment's and accessories. Advantages and application of CO2 process. TIG welding process. Advantages. Description of equipment's. Types of polarity and application. Types of Tungsten Electrodes, Filler rods, Shielding Gases. Defects, causes and remedy in TIG welding process. Latest sheet metal cutting techniques: Plasma cutting, Laser cutting, water jet cutting and punching etc.
Professional Skill 25 Hrs.; Professional Knowledge 05 Hrs.	9. Perform Aluminum frame works, make ducts, cabins & panels.	82. Making a square duct elbow with snap block. 83. Fabricate rectangular duct fittings. 84. Apply installation codes and standards to residential construction. 85. Install a rectangular duct line. 86. Make a conical hopper by soldering 87. Make models of Aluminium sliding windows and doors. 88. Partitions of mini model rooms by using aluminium channels beadings etc 89. Electrical Panel, trunk boxes and Painting.	Need for ducting. Places where ducting is employed and the working principle of a dust cyclone, Gutter and its use. False ceiling. Method of galvanizing, tinning, anodising, sherardising and Electroplating. Specification of aluminium channels angles, strips, tubes beadings, packing rubber, cardboard, glasses etc. Tools and equipment used in aluminium fabrication. Assembly & Sub assembly: Guarding assembly, Door assembly, Chassis assembly, Cabinet assembly, Power pack assembly etc. Process of painting. Spray painting. Etch primer painting, Powder coating, buffing, grinding, and sanding. Selection of different grit sizes.

Professional Skill 60 Hrs.; Professional Knowledge 15 Hrs.	10. Undertake repair work of any damaged sheet metal items like mudguard, Radiators etc.	90. Special Exercises: Repairing of any damaged sheet metal items like Mudguard and Radiators and testing of Sheet metal containers. 91. Any Special Exercises: Repairing Blocked Silencer and fuel tank.	Types of any damaged sheet metal items like Radiators and construction of Radiators, Mufflers, Estimation of work. Material handling: handling of light, medium and heavy materials. Use of cranes and types. Estimation and costing.
ENGINEERING DRAWING			
Professional Knowledge ED- 30 Hrs.	11. Read and apply engineering drawing for different application in the field of work.	Introduction to Engineering Drawing and Drawing Instruments • Conventions • Sizes and layout of drawing sheets • Title Block, its position and content • Drawing Instrument Lines-Types and applications in drawing Free hand drawing of– • Geometrical figures and blocks with dimension • Transferring measurement from the given object to the sketches. • Free hand drawing of hand tools and measuring tools. Drawing of- • Angle, Triangle, Circle, Rectangle, Square, Parallelogram, Ellipse& Parabola. • Lettering &Numbering–Single Stroke. • Development of Surfaces Dimensioning • Types of arrowhead • Leader line with text • Position of dimensioning (Unidirectional, Aligned) Symbolic representation– • Different symbols used in the Sheet Metal trade. Concept and reading of Drawing in • Concept of axes plane and quadrant • Concept of Orthographic and Isometric projections • Methodoffirstangleandthirddangleprojections(definitionanddifference) Reading of Job drawing related to Sheet Metal trade.	
WORKSHOP CALCULATION & SCIENCE			
Professional Knowledge WCS- 30 Hrs.	12. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science	Unit, Fractions Classification of unit system Fundamental and Derived units F.P.S, C.G.S, M.K.S and SI units Measurement units and conversion Factors, HCF, LCM and problems Fractions - Addition, subtraction, multiplication & division Decimal fractions - Addition, subtraction, multiplication& division Solving problems by using calculator Square root, Ratio and Proportions, Percentage Square and square root Simple problems using calculator Applications of Pythagoras theorem and related problems	

	in the field of study.	Ratio and proportion Ratio and proportion - Direct and indirect proportions Percentage Percentage - Changing percentage to decimal and fraction Material Science Types metals, types of ferrous and non-ferrous metals Physical and mechanical properties of metals Introduction of iron and cast iron Difference between iron & steel, alloy steel and carbon steel Properties and uses of rubber and insulating materials Mass, Weight, Volume and Density Mass, volume, density, weight and specific gravity, numerical related to sections L, C, O. Related problems for mass, volume, density, weight and specific gravity Heat & Temperature and Pressure Concept of heat and temperature, effects of heat, difference between heat and temperature, boiling point & melting point of different metals and non-metals Heat & Temperature - transmission of heat - Conduction, convection and radiation Co-efficient of linear expansion and related problems with assignments Concept of pressure - Units of pressure, gauge pressure and gauges used for measuring pressure Basic Electricity Introduction and uses of electricity, electric current AC, DC their comparison, voltage, resistance and their units Mensuration Area and perimeter of square, rectangle and parallelogram Area and perimeter of Triangles Area and perimeter of circle, semi-circle, circular ring, sector of circle, hexagon and ellipse Surface area and volume of solids - cube, cuboid, cylinder, sphere and hollow cylinder Finding the lateral surface area, total surface area and capacity in liters of hexagonal, conical and cylindrical shaped vessels Trigonometry Measurement of angles Trigonometrical ratios Trigonometrical tables
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SYLLABUS FOR CORE SKILLS
1. Employability Skills (Common for all CTS trades) (120 Hrs.)

Learning outcomes, assessment criteria, syllabus and Tool List of Employability Skills is provided separately in www.cstaricalcutta.gov.in / www.bharatskills.gov.in / www.dgt.gov.in.

LIST OF TOOLS AND EQUIPMENT			
SHEET METAL WORKER (For Batch of 20 Candidates)			
S No.	Name of the Tool & Equipment	Specification	Quantity
A. TRAINEES TOOLS KIT			
1.	Steel Rule	300 mm	20 +1 Nos.
2.	Try square (Metal)	200 mm	20 +1 Nos.
3.	Wing Divider	200 mm	20 +1 Nos.
4.	Centre Punch	100 mm	20 +1 Nos.
5.	Spring Dividers	150 mm	20 +1 Nos.
6.	Ordinary Wooden Mallet		20 +1 Nos.
7.	Soldering Copper Hatchet Type	0.25 kg	20 +1 Nos.
8.	Cross Peen Hammer	0.25 kg with handle	20 +1 Nos.
9.	Straight Peen Hammer	0.25 kg with handle	20 +1 Nos.
10.	Protractor with blade	150mm	20 +1 Nos.
11.	Steel tape	2 metres	20 +1 Nos.
12.	Ballpeen hammer	0.25kg with handle	20 +1 Nos.
13.	Scriber	150 mm x 3 mm (Engineer's)	20 +1 Nos.
14.	Prick punch	100mm	20 +1 Nos.
B. GENERAL SHOP OUTFIT			
15.	Steel Square	450 mm x 600 mm	4 Nos.
16.	Sheet Metal Gauge		1 No.
17.	Wheeling and raising machine		1 No.
18.	Crimping machine		1 No.
19.	Hatcher Stake		4 Nos.
20.	Stake Round and Bottom		4 Nos.
21.	Half Moon Stake		4 Nos.
22.	Funnel Stake		4 Nos.
23.	Angle Grinder	AG 4	1 No.
24.	Cordless Drill Gun	10 mm.	1 Set
25.	Steel Rule	1000mm.	2 Nos.
26.	Chisel	Bold Stud	4 Nos.
27.	Hand Lever Punch	6mm. Capacity	1 No.
28.	Hacksaw	150 mm.	4 Nos.
29.	Tap and Tap Handle	4mm	1 set
30.	Flat Nose Plier	150 mm	2 Nos.
31.	4 way bending Die	600 mm	2 Nos.
32.	Anvil Face Stake		4 Nos.
33.	Bick Iron Stake		4 Nos.
34.	Tinman's Horse		2 Nos.
35.	Hammer Peening with handle		4 Nos.
36.	Hammer Creasing with handle		4 Nos.
37.	Hammer Planishing with handle		4 Nos.

38.	Hammer Block with handle		2 Nos.
39.	Shear Tinman	300mm	8 Nos.
40.	Snip straight	300mm	8 Nos.
41.	Right cut snips	250mm	4 Nos.
42.	Left cut snips	250mm	4 Nos.
43.	Hand Shear Universal	250 mm	4 Nos.
44.	Hollow Punch set Round	3 mm Dia	2 Nos.
45.	Rivet sets snap and Dolly combined	3 mm	4 Nos.
46.	Chisel cold flat	25 mm x 250 mm.	4 Nos.
47.	Punch Letter	4 mm	1 set
48.	Punch Number	4 mm	1 set
49.	File flat	250 mm second cut	2 Nos.
50.	File flat	250 mm smooth	2 Nos.
51.	File flat	300 mm bastard	2 Nos.
52.	File half round	300 mm smooth	2 Nos.
53.	Hacksaw frame	300 mm adjustable (Tubular)	4 Nos.
54.	Hand Groover	5 mm	4 Nos.
55.	Plier. Combination	150 mm	2 Nos.
56.	Grip Wrench	200 mm	2 Nos.
57.	Ladle	150 mm Dia.	2 Nos.
58.	Blow Lamp	1 litre.	2 Nos.
59.	H.S.S. Twist Drill	3 mm, 4 mm & 6 mm each (parallel Shank)	3 Nos.
60.	Hand Drill machine	0 to 12 mm	2 Nos.
61.	Soldering Copper Hatchet type	500 gms.	8 Nos.
62.	Electric soldering iron	heavy duty 150 - 750 watt (As required)	5 Nos.
63.	Ball peen hammer	0.5kg with handle	5 Nos.
64.	Pneumatic rivet gun		2 Nos.
65.	Trammel Point	with beam 600 mm	1 No.
66.	Vernier caliper	0 mm - 150 mm	1 No
67.	Micrometer Outside	0 to 25 mm	1 No.
68.	File Rasp cut	250 mm	2 Nos.
69.	D.E. Spanner G.P. (Set of 12 spanner)	6 mm to 32 mm	2 Set
70.	Bossing Mallet		4 Nos.
71.	End tacked Mallet		4 Nos.
72.	Soft hammer (Brass, copper, Lead)		4 Nos.
73.	Steel Rule	600mm	4 Nos.
74.	Oilcan pressure feed	500ml	2 Nos.
75.	Raising hammer with handle		4 Nos.
76.	Rawl Punch holder and bits (No.8, 10, 12, 14)		2 Sets.
77.	Hollowing Hammer with handle		4 Nos.
78.	Tripaning tool	70 mm	1 No.
79.	Hand vice	50 mm	4 Nos.

80.	Tongs Flat		2 Pairs.
81.	Portable Electric drill (Single phase) -6mm		2 Nos.
82.	Pop rivet gun		2 Nos.
83.	Lazy Tong		2 Nos.
84.	Screw Driver	250 mm	2 Nos.
85.	Round File	2nd Cut 250 mm	4 Nos.
86.	Triangular File 'Smooth	250 mm	4 Nos.
87.	Square File	2nd Cut 250 mm.	4 Nos.
88.	Needle File (Swiss File)	150 mm	1 set
89.	C Clamp	150 mm	2 Nos.
C. GENERAL INSTALLATION			
90.	Bench lever shears	250 mm Blade x 3mm Capacity	1 No.
91.	Air Compressor (Pressure and displacement of air) Pneumatic Pop rivet Gun		1 No.
92.	Spray Gun(painting)	500 ml.	1 No.
93.	Combination turning up and wiring machine		1 No.
94.	Guillotine. Shearing Machine foot operated		1 No.
95.	Oxy acetylene welding plant (complete set)		1 set
96.	Circle cutting machine	300 mm dia	1 set
97.	Pillar type drilling machine	12 mm	1 No.
98.	Slip roll former	1.6. mm x 1000 mm	1 No.
99.	D.E. Grinder Pedestal motorised	200 mm	1 No.
100.	Anvil	50 kgs with Stand	1 No.
101.	Bench vice	120 mm, 150 mm	2 each
102.	Fly press Ball press No.4 single body		1 No.
103.	Power Press 2 Tons		1 No.
104.	Buffing and Polishing Machine		1 No.
105.	Nibbling Machine		1 No.
106.	Spinning Lathe		1 No.
107.	Seaming Machine		1 No.
108.	Glass cutter - Diamond point		1 No.
109.	Work Bench	1820 x 1310 x 760 mm	4 Nos.
110.	Almirah	1820 x 1210 x 450 mm	2 Nos.
111.	Metal rack	1820 x-1520 x 450 mm	2 Nos.
112.	Steel Lockers with 8 Drawers.		2 Nos.
113.	Fire extinguisher Soda Acid and foam type	Arrange all proper NOCs and equipment from Municipal/ Competent authorities.	1 each
114.	Black Board with Easel.		1 No.
115.	Portable Nibbler		2 Nos.
116.	Portable Pneumatic Shear.		2 Nos.

117.	Pipe Bending Machine (Hydraulic Type)	12 mm to 30 mm	1 No.
118.	Hand Press Brake Capacity	0.8 mm	1 No.
119.	Beading Machine with 380 mm throat clearance (with crimping rollers)		1 No.
120.	Tin smiths bench folder	600 x 1.6 mm	1 No.
121.	Gas Welding Table	1220 mm x 760 mm	1 No.
122.	Spot & Seam Welding Machine		1 No each.
123.	Arc welding Transformer/ Rectifier/Inverter 300Amps with accessories		1 set
124.	Co ₂ welding machine complete set	300Amps with CO ₂ cylinder	1 set
125.	TIG welding machine complete set	200 Amps with argon cylinder	1 set
126.	Universal cutting machine		1 No.
127.	Heavy duty Roll forming machine - pyramid type.	8 mm capacity, 4 feet, roller dia 150 mm	1 No.
128.	Hydraulic press brake	8 mm capacity, folding length 8 feet, 6 HP	1 No.
129.	LASER Cutting machine,	0.05 mm laser source, 60/80/100watts, working area 600x900 mm, maximum cutting thickness 25 mm	1 No.
130.	Plasma cutting machine	working pressure 3-4.5 bar max. Cutting thickness. 0.5 to 12 mm,	1 No.
131.	Instructors lap top pre-loaded with O.S and MS Office package	With latest configuration	1 No.
132.	LCD projector with screen/Interactive Smart Board		1 No.

D. CLASS ROOM FURNITURE FOR TRADE THEORY

133.	Instructor's table and Chair (Steel)		1 Set
134.	White magnetic board	1200mm X 900 mm	1 No.

Note: -

1. All the tools and equipment are to be procured as per BIS specification.

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.

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ABBREVIATIONS	
CTS	Craftsmen Training Scheme
ATS	Apprenticeship Training Scheme
CITS	Crafts 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

