

SYLLABUSFOR  
**Sheet Metal Worker**  
UNDER

CRAFTSMEN TRAINING SCHEME  
&  
APPRENTICESHIP TRAINING SCHEME

As approved by  
GOVERNMENT OF INDIA

In consultation with  
THE NATIONAL COUNCIL FOR  
VOCATIONAL TRAINING  
&  
CENTRAL APPRENTICESHIP COUNCIL

Issued by  
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## General Information

1. Name of the Trade : Sheet Metal Work
2. N.C.O Code No. : 837.10
3. Duration of Craftsmen Training : One year
4. Duration of Apprenticeship : Three year including one year basic Training
5. Entry Qualification : Passed in 10<sup>th</sup> class Examination under 10 + 2 system of education or its equivalent
6. Rebate of Ex-craftsmen Trainees : Full
7. Ratio of Apprentice to Workers : 1 : 7

**TRADE : SHEET METAL WORKER  
REVISION OF SYLLABUS-SUGGESTIONS**

**TRADE PRACTICAL  
Induction Training**

**Week No.**

1. Familiarization with the institute. Importance of machinery used in the trade. Type of work done by the trainees in the Institute-types of job made by the trainees in the trade-Introduction to safety including fire fighting equipment and their uses etc. Use of protective safety devices and its use in the shop floor.  
Identification of Tools and Equipments.  
Introduction and use of marking tools. Practice in Reading, Steel Rule, Scribing of straight lines, bisecting of straight lines(on the sheet metal) using marking tools.
2. Plaiting of Sheet Metal and Practice in drawing simple geometrical shapes. Practice in cutting sheet metal to these shapes. Practice in cutting and marking of sheets to various angles.
3. Practice on cutting with different types of snips. Tin snips(Straight cut, Right cut and left cut) cutting off inside and outside curve, cutting off notches and cutting profiles.
4. Practice on Sheet Metal Seams.  
Grooved seam, Locked Groove seam, Pane down seam, Bottom down seam or corner Fold(Knocked-up seam), Corner Clip Lock, Double Bottom Lock, Clip Lock(cap Lock), Snap Joint etc. (Folded Joints)
5. ASSESSMENT TEST  
Development on parallel line method and forming rectangular shapes using stakes. Forming cylindrical job using various stakes such as Hollow mandrel, Hatchet Stake, Tin Man's Avil etc..
6. Folding/Bending sheet Metal to 90 degrees using wooden mallet 'C' clamps etc. making a radius using Wooden Blocks using Hairpin folder.
7. Preparation of soft solder sticks, preparation of fluxes. Practice soft soldering on lap joints, sunklap joints and platted butt joints. Making round cylinder with soldered lap joint and sweating practice.
8. Making a cylindrical container with knocked-up bottom(Bottom Lock), Grooved joint and Hemmed Top.
9. Making holes with solid punches, Round punches as per ISI and use of Hollow punches for making holes in Sheet Metal with the help of grained block of wood. Making 'Chimney' for kerosene cooker.

11. Making holes in Sheet Metal using Punching Machine. Making holes in Sheet Metal with a twice drill. Thru-panning with use of hand and electric drilling machine. Grinding a drill bit.
12. Riveting practice using various types of river heads. Sing chain riveted joint. Double chain zig zag riveted

### **PROGRESS TEST**

#### ACHIEVEMENT

Able to:

Use various hand tools.

- (a) Mark off, cut various sheet Metals and make joints.
- (b) Soldering and Brazing.
- (c) Bend sheet Metal with hand13 tools.
- (d) Make simple container Hemmed Top and Locked Bottom.
- (e) Do simple riveting.
13. Making a dust pan. Corner and handle reverted. Making a fire bucket with lap riveted joint on one side and Locked Grooved Seam on the other side. Bottom Hollowing and Bottom Lock Seam.
14. Exercise involving practical work on Aluminum Sheet, and using pop Rivet. Aluminum Windows with different extrude sections, Aluminum Soldering
15. Practice in Drilling Holes in walls and Ceilings as applied to ducting work. Use of rawl bits and rawl plug.
16. Practice on hollowing and rising on non-ferrous sheet as well as ferrous sheet.
17. Practice on removing dents of spherical or hemi-spherical articles using wheeling and raising machine. (Repairing mud guards etc.)
18. Making rectangular articles with false wired edge.  
Wiring practice on straight edge.  
Wring practice on curved edge.
19. Fitting flange to circular pipe by using cramped joint in the body and fixing flange joint by Brazing.
20. Making various types of locks and joints as applied to ducting work, joining elbows. Use of Pittsburgh joint and fixing body stiffeners such as angle bar, Channel bar flanged, flats etc. (Ducting)
21. Forming square section segmental quarter bend pipe with suitable lock and forming Round section Segmental Quarter bend pipe.
22. Practice on cutting cylinder obliquely. To make 90° 'L' pieces of equal diameter and join at the s right angle.
23. To make a 90° 'T' piece with equal diameter pipe.  
To make a 60° 'T' piece with equal diameter pipe.  
To make a 90° 'T' piece with equal diameter pipe.
24. Practice on pipe bending by hand. Pipe bending using Hydraulic pipe bending machine.
25. Making a MUG with wired edge, Side and bottom locked grooved and knocked-up joint with hemmed edge handle riveted.
26. HALF YEARLY TEST
27. Making a 60° Off set 'T' piece (Round) and two way piece equal angle.
28. Forming frustum of Cone.
29. (a) To make taper chute square to square.

- (b) To make a taper chute and flat back.
- 30. Forming on Elbow between round conical. Lobster back bends.
- 31. ALLIED TRADE TRAINING  
Welding: Simple tacking by gas welding on ferrous Metal Sheets.
- 32. Practice in gas Welding butt joints on Ferrous Metal.  
Practice in welding on Non-ferrous Sheet Metals, Spot welding Practice.
- 33. Welding Practice on Sheet Metal making pipes.
- 34. Prepare a tapered tray with welded corners. Brazing copper and Brass articles. Silver soldering of copper pipes.
- 35. Make a 90° elbow with black iron sheet welded joint. A lobster back bend with welded joint.
- 36. Arc welding practice, Fusion welding.

### PROGRESS TEST

#### ACHIEVEMENT

##### Able to:

- a) Make irregular shape.
- b) Fit more than piece of piece of pipe to an outlet.
- c) Make shapes in Frustum of Cone, Lobster back bend etc.
- d) Do simple gas welding and brazing as applied to normal sheet metal works.
- e) Make various shapes of different metals and alloys and joint by gas welding.
- f) Do fusion welding, Spot welding, Arc welding etc.
- 37. ALLIED TRADE TRAINING: (FITTING)  
Swing by Hacksaw, Chipping, Cross Filing and Draw Filing
- 38. Practice on external threading using 'Die Stock'.  
Practice on internal threading using taps.
- 39. ALLIED TRADE TRAINING : (FORGER AND HEAT TREATER)  
Simple smithy operations, Such as drawing out, punching, different and riveting. (Making a 'Tong')
- 40. Angle iron bending in different angles and different radii. Twisting the square rod and twisting the Flat.
- 41. Project work such as Steel stool, Aluminum Ladder etc.
- 42. Making a copper article by use of power press and also making brass and stainless steel articles.  
Practice or Buffing and polishing.
- 43. Internet ration to a cone : Cylinder fitted to a cone. Equal dia pipe joint with crimping and Ogee beading.
- 44. A dust cyclone with round inlet. Making gutters of different shapes.
- 45. Making a twisted square tapered chute. making a rectangular to round hood.
- 46. A rectangular bell mouth with twin outlets.
- 47. Metal Spinning : Making a cylindrical-Medicine Container of Aluminium Sheet.
- 48. Typical folding, bending Practice, Making Steel Racks, Reinforcement with angle iron.  
reinforcement with angle iron.
- 49. Electrical Panel Fabrication and Painting.

50. Project Work-Group of Trainees.  
 51. Any Special Exercises : repairing Mudguard, Radiators and Blocked Silencer.  
 52. FINAL TEST.

## **TRADE : SHEET METAL WORKER**

### **REVISION OF SYLLABUS-SUGGESTIONS**

#### **T R A D E    T H E O R Y**

#### **Week No.                      Induction Training**

1. Importance of safety and general precautions-observed in the Institute and in the section. Importance of the trade in the development of Industrial Economy of the country. Related Instructions-Subject to be taught, Achievement to be made. Recreational, Medical facilities and other curricular activities of the Institute. (All necessary guidance to be provided to the new comers to become familiar with the working of Training Institute System including store procedures etc.) Introduction to the trade, safety precautions and protective devices, Library-Discipline in the Shop Floor.
2. Metals and Non-Metals : Metals and their Characteristics Types, Sizes and uses of Sheet Metals. (I.S. 1137-1959)Standard Wire gauge as per ISI. Use of reference Table.
3. Marking and laying out tools-try square dividers, trammels, marking block, steel square etc. Various types of snips, shears and their uses.
4. Descriptions and uses of guillotine shears and circle cutting machine. Brief description of Nibbling machine (Various Operations) Straight cutting, Circle cutting, Figure cutting, Louver cutting, Nibbling, slot cutting, Rect. Notching, Circular Punching, Square Punching, Folding Bending, Flanging.
5. Sheet Metal Folded Joints, Types of Metal Joints, Description of Sheet Metal Seamed, Grooved Seam, Locked Grooved seam, Paned down seam, Knocked up seam etc.
6. ASSESSMENT TEST  
 Sheet metal Workers Tool : bench Vice, 'C' clamps, Pliers, bench Stakes or Sheet formers, Types and their uses. Uses of groover and grooving rail.
7. Methods applied in laying out pattern-parallel line method, radial line method, triangular line method and geometrical construction.
8. Solder, different types of solder and their composition. Use of fluxes, their effect on different Metals. (IS : 193-1966)
9. Soldering Bit, their types (Copper, Iron) and classification weight of soldering iron, Process of soft soldering. Process of hard Soldering brazing. Heating appliances (Hand forge, Blow Lamp, L.P.G)
10. Solid and Hollow Punches. Description of hand punches as per ISI standard sizes of solid and Hollow Punches and their uses. Laying out pattern of Elbow pipe (Round) and 'T' shape equal dia.
11. 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 on metals. Difference between drilled and punched holes.
12. Rivets and its parts, selection of Rivet heads. Types of Rivet and their uses. Standard sizes of Rivets and Riveting tools. Calculation of Riveting allowances (pitch and Lap)
  13. Development on Radial Line Method, Selection of Rivets with reference to type of joint according to thickness. (Cone and Oblique cone and frustum of cone)
  14. Description of tools for riveting such as lazy tongs. Pneumatic riveting gun, rivet squeezer. Description about Air compressor.
  15. Technical abbreviations used in the Trade. Definition of Trade term, such as pattern, development, stretch out pattern, master pattern, (Gross pattern) Template.
  16. Sheet Metal Terms such as Folding, Bending, Seaming, Notching, Turning, Grooving, Edge Stiffening, Hemming, Wiring, Crimping, Swaging etc. Development of Spherical/Hemi Spherical shapes of articles.
  17. Sheet Metal hammers, Types, Classifications and their uses. Mallets, types of materials and their uses. Brief description of wheeling and raising machine.
  18. Description of Hacksaw Frame and Hacksaw blades their specifications. Description of folder type of bar folders, wing adjustments and explanations.
  19. Clips and connectors ; their uses, types and allowance of 'S' clips, Government clips, Drive clips, mailing clips etc.
  20. Fastening of Sheet Metal, various types of fastening devices for sheet metal. Screws, self threaded screws etc. development of 'T' pipe Round equal and unequal dial.
  21. Introduction to tubes and pipes. Laying out pattern of segmental quarter bend pipe. Description and operating principles of seaming machine.
  22. Laying out pattern of cylinder cut obliquely. Description of roll forming machine, types and operating principle. Description of slip roll forming machine and its function.
  23. Laying out pattern of 60 degrees unequal dial T' pipe. Corrosion on metals and Anti corrosive treatment.
  24. Introduction to pipe/tube bending. Brief description of Hydraulic pipe bending machine, operating principles etc.
  25. Preparation of pickling solution, protection-coating, cleaning and preparing of sheet metals.
  26. HALF YEARLY TEST.
  27. Laying out pattern of 60 degrees offset 'T' pipe. Pattern development of 'Y' pipe. Method of galvanizing, tinning, anodizing, sheradising and electroplating.
  28. Pattern development of frustum of cone (Short radius method) Description of swaging and beading machine, its parts, operating principles etc.
  29. Laying out pattern of taper chute square to square. Ferrous and Non-ferrous metals. Use of copper and alloys.
  30. Laying out pattern of conical elbows. Pattern development of lobster back bend. Chemical and physical properties of Aluminium, use of aluminium and its alloys.

#### ALLIED TRADE TRAINING : (WELDING)

31. Types of gas cylinders, differences between Oxygen and Acetylene cylinders. Pressure gauges used on cylinders. General description of Oxyacetylene plant and the equipments, precautions to be taken while operating gas cylinder.

32. Types and description of filler rods (I.S 1273-1967) Fusion welding and spot welding on black iron sheet. Description of welding using filler rods.
33. Description of fluxes for dissimilar metals.
34. Methods of brazing using blow pipes. Construction and use of blow pipes of Oxy-acetylene set.
35. Types of nozzles and purposes, other types of blow pipes for other gases, butane and coal gas. Principle of car-bide generator, use of coal gas for heating.
36. Fundamentals of arc welding. Advantages and disadvantages of electric arc welding. Precaution to be taken while welding other metals and alloys. Simple explanation about the use of Oxy-cutter, method of overcoming distortion while welding.

#### PROGRESS TEST

37. ALLIED TRADE TRAINING : (FITTING)  
Description of files, types and their classifications, chisels : I.S.I types specification, cutting angles for different metals.
38. Use of die and die holder description of taps and tap wrench. Reading of Micrometer. Brief description of reamers and their uses.
39. ALLIED TRADE TRAINING : (FORGER AND HEAT TREATOR)  
Brief description and use of blacksmiths and hand tools and hammer. Description of forging operations.
40. Types of forge, forging fuel and heat treatment process.
41. Definition of planning and its application, brief description of polishing machine . Various types of bobs and polishing compounds.
42. Description of fly-press/ball press. Operating principle of power press. Method to calculate the pressure adjustment. Clearance between Die and punch.
43. Laying out pattern of interpenetration to a cone. Properties of stainless steel and its uses
44. The need for induction. The places where ducting is employees and the working principle of a dust cyclone, gutter and its use. False ceiling.
45. Development of a hood triangulation method. Properties and uses of tin, lead, zinc, silver and gold.
46. Laying out of pattern for 'S' off-sets. Explain terms heel, check throat, etc. description and physical properties of Muntz Metal, Gun Metal, and White Metal etc.
47. Operating principles of spinning lathe. Description of spinning hand tools, coolant, dressing, principles of reading of vernier caliper, height gauge and screw pitch gauge. Combination set, Micro Meter.
48. Process of painting. Spray painting. Etch primer painting.
49. Method of operate folding/break folder for typical folding. Description and use of jigs and fixtures.
50. Types of Radiators and construction of Radiators, Silencer, Estimation of work.
51. Revision of Trade Theory.
52. F I N A L T E S T.

## TRADE : SHEET METAL WORKER

### REVISION OF SYLLABUS-SUGGESTIONS

#### WORKSHOP CALCULATION AND SCIENCE

##### Week No.

1. Importance of science and calculations to the trade skill and fundamental arithmetical operations-Addition, Subtraction, Multiplication and Division.
2. Properties and uses of cast iron, wrought iron, plain carbon steels and alloy steels.
3. Properties and uses of cast iron, wrought iron, plain carbon steels and alloy steels.
4. Properties and uses of copper, zinc, lead, tin and aluminium.
5. Properties and uses of Brass, Bronze, bearing metal, solder, rubber and timber.
6. Fraction-Addition, Subtraction, Multiplication and Division-problems
7. Fraction-Addition, Subtraction, Multiplication and Division-problems
8. Decimal-Addition, Subtraction, Multiplication and Division-problems
9. Decimal-Addition, Subtraction, Multiplication and Division-problems
10. Fractions and decimal conversions-Fraction to decimal and vice-versa.
11. Systems of units- British, Metric and S.I. units for length, mass, area, volume, capacity time.
12. Conversions between British and metric Systems.
13. The square root-The square and square root of a whole number and decimal.
14. The square root-shop problems.
15. Heat and temperature-Effects of heat, thermometric scales such as a Celsius, Fahrenheit, and Kelvin - Temperature measuring instruments.
16. Conversions between the above scales of temperature.
17. Units of Heat – Calorie, B.Th.U, C.H.U, Specific Heat, Latent Heat, heat loss and heat gain-simple problems.
18. Percentage-chaining percent to decimal and fraction and vice versa-problems on percentages related to the table.
19. Percentage-chaining percent to decimal and fraction and vice versa-problems on percentages related to the table.
20. Definition of Speed, Velocity, Acceleration, Mass, Weight and difference between Mass and Weight.
21. Newton 's Laws of Motion-Definition of Force-Units of Force in M.K..S. Systems and S.I. Units of Force.
22. Ratio- Simple Problems in Rations.
23. Proportion-Direct and Inverse Proportion-Shop Problems.
24. Work-Units of Work in M.KS Systems and S.I.. Unit of Work-Simple Problems.
25. Power-Practical Units of Power such as Watt and Horse Power Definition of I.H.P, B.H.P. and efficiency,
26. Definition of Energy, Potential Energy, Kinetic Energy, Law of Conservation of Energy- S.I. Unit of Energy-Simple Problems in P.E. and K.E.

27. Pythagoras Theorem – Shop Problems.
28. Algebraic Symbols and Fundamentals-addition, Subtraction, Multiplication and Division-Problems.
29. Algebraic Symbols and Fundamentals-Addition, Subtraction,
30. Algebra-Simple Equations-Problems.
31. Algebra-Simultaneous Equations-Problems.
32. Algebra- Quadratic Equations-Problems.
33. Lever-Types of levers With their examples.
34. Simple Problems on straight and bell cranked levers.
35. Logarithms-use of Logarithmic tables-Problems on Multiplication and Division by using Logarithmic tables.
36. Logarithms Problems on Power and roots by using Logarithmic Tables.
37. Further Practice in the use of Log Table.
38. Meaning of Stress, Strain-Simple Problems.
39. Mensuration -Areas- Square, Rectangle, Equilateral Triangle, Isosceles Triangle, Right Angled Triangle, Scalene Triangle – problems.
40. Mensuration -Areas- Square, Rectangle, Equilateral Triangle, Isosceles Triangle, Right Angled Triangle, Scalene Triangle – problems.
41. Areas-Hexagon, Circle, Circular ring, Sector, Ellipse-Problems.
42. Areas-Hexagon, Circle, Circular ring, Sector, Ellipse-Problems.
- 43.. Mensuration- Volume and Weight of Simple Solid bodies such as cube, Square Prism, Rectangular prism, Hexagonal Prism, Triangular prism, Cone Cylinder, Hollow Cylinder-Shop Problems
44. Mensuration- Volume and Weight of Simple Solid bodies such as cube, Square Prism, Rectangular prism, Hexagonal Prism, Triangular prism, Cone Cylinder, Hollow Cylinder-Shop Problems.
45. Mensuration - Volume and Weight of Simple Solid bodies such as cube, Square Prism, Rectangular prism, Hexagonal Prism, Triangular prism, Cone Cylinder, Hollow Cylinder-Shop Problems.
46. Finding the Capacity in litres of Square, Rectangle, Hexagon, Cone and Cylinder Shaped Vessels.
47. Finding the Lateral Surface area and Total Surface area of Square, Rectangle, Hexagon, Cone and Cylinder shaped Solids and Vessels.
48. Finding the Lateral Surface area and Total Surface area of Square, Rectangle, Hexagon, Cone and Cylinder shaped Solids and Vessels.
49. Further Practice of Mensuration Problems by using the logarithm.
50. REVISION.
51. REVISION.
52. TEST.

**TRADE : SHEET METAL WORKER****REVISION OF SYLLABUS-SUGGESTIONS****ENGINEERING DRAWING****Week No.**

1. Importance of Engineering Drawing and its knowledge.
2. Use of drawing instruments, T-square, Drawing board etc.
3. Letters, Numbers and Alphabets as per IS 696/1972
4. Letters, Numbers and Alphabets as per IS 696/1972
5. Freehand sketching of straight lines, rectangles, circles, polygons etc.
6. Use of different types of lines and symbols for drawing. Importance of putting dimension on the drawing as per IS 696/1972
7. Freehand sketching with dimension, scale and proportionate sketching.
8. Reading of simple blue print.
9. Isometric views and oblique views with dimensions such as cube, rectangular block, cylinder etc.
10. Explanation of simple Orthographic projection 1<sup>st</sup> angle as per IS 696/1972
11. Explanation of simple Orthographic projection 3rd angle as per IS 696/1972
12. Sketching the views of solid bodies when viewed perpendicular to their surfaces and axes.
13. Sketching the views of solid bodies when viewed perpendicular to their surfaces and axes.
14. Freehand sketching of plan and elevation of simple objects like Hexagonal bar, square bar, circular bar, tapered bar and hollow bar etc.
15. Reading of simple blue print.
16. Views of simple, hollow and solid bodies with dimensions.
17. Views of simple, hollow and solid bodies with dimensions.
18. Construct an Orthographic projection from the given isometric view of shaped blocks in first angle method.
19. Construct an Orthographic projection from the given isometric view of shaped blocks in first angle method.
20. Construct an Orthographic projection from the given isometric view of shaped blocks in third angle method.
21. Construct an Orthographic projection from the given isometric view of shaped blocks in third angle method.
22. Exercise on blue print reading related to missing lines and missing views.
23. Simple isometric drawing-from the given Orthographic views of simple objects.
24. Welding symbols as per I.S.I employed on drawings.
25. Freehand sketching of rivets and washers with dimensions from samples as per I.S.I.
26. Freehand Sketching of riveted joints.

27. Freehand Sketching of riveted joints.
28. Exercise on blue print reading related to missing lines and missing section.
29. Freehand sketching of nuts and bolts with dimensions from samples.
30. Freehand sketching of hand tools of the trade.
31. Freehand sketching of hand tools of the trade.
32. Freehand sketching of hand tools of the trade.
33. Freehand sketching of keys and cotters with their dimensions from samples as per I.S.I.
34. Freehand sketching of screw threads with their dimensions from samples as per I.S.I.
35. Geometrical development of Prism, Pyramid and Isometrics.
36. Exercise on blue print reading related to identification of surface symbols.
37. Triangular Prism and hexagonal Prism-projection and development.
38. Triangular Prism and hexagonal Prism-projection and development.
39. Cylinder Projection and Development, Cone projection and Development. Examples based on right cones.
40. Cylinder Projection and Development, Cone projection and Development. Examples based on right cones.
41. Views of simple solid bodies cut by section plane on drawing standard methods (Full and Half Sections) I.S. 696/1972.
42. Views of simple hollow bodies cut by section plane on drawing standard methods (Full and Half Sections) I.S. 696/1972.
43. Exercises on blue print reading.
44. Sketching of finished articles from drawing and preparation of sequence of operations.
45. Sketching of finished articles from drawing and preparation of sequence of operations.
46. Freehand sketching of simple objects related to the trade and preparation of simple working drawing from the sketches.
47. Free sketching of simple objects related to the trade and preparation of simple Working drawing from the sketches.
48. Exercises on blue print reading.
49. Conventional representation of machine by I.S.I.
50. Method of indicating surface roughness by I.S.I.
51. R E V I S I O N.
52. T E S T.

FINAL ACHIEVEMENT AFTER THE COMPLETION OF ONE YEAR OR FIFTY  
TWO WEEKS TRADING

Trade competences

1. To use measuring tools and equipment –Steel rule, Calipers, Dividers, Protractor, Templates.
2. To use common hand tools, snips, mallets, stakes, punches, chisel etc.
3. To manipulate machines and accessories-hand drill, electric drill, shears, simple welding equipment, blow lamp, brazing hearth, pedestal grinder, roll former, beading machine, circular cutting machine etc.
4. To identify –Metal like Copper, Brass, Aluminium, Stainless steel, Silver, Soft solder, Hard solder Mild steel, Cast Iron, high Carbon Steel etc. Sheets such as Black iron, Galvanized tinned etc.
5. To calculate-simple calculation on mensuration related to the trade e.g. determination of area, volume etc.
6. To perform shop operation –Marketing, cutting, Bending, Wiring, Riveting, Joining, Grooving, Hollowing, Soldering, Brazing, Simple Welding, Sharpening of tools, Drilling etc. and to perform repair work as applied to the trade.
7. To read, know and understand –Simple Blue print –reading, and making free hand sketches, development of objects. Safety precaution related to the trade. Use of fire extinguishers, Fire buckets, etc. Simple estimation reference table and hand book. Care and maintenance of the hand tools and equipment. Knowledge of material used for hand tools, general knowledge of the safe working of the equipment used and their elementary description.

TRADE : SHEET METAL WORKER

List of Indian standards to be following for the training of sheet metal workers under the Craftsmen Trading scheme D.G.E. & T., Government of India.

SI.NO.	I.S. NO.	Particulars
1	1137-1959	Thickness of the sheet and Diameters of Wires.
2	193-1982	Specifications of solder (4 <sup>th</sup> Revision)
3	2527-1984	Code of practice for fixing rain water gutters and pipes for roof drainage.(First Revision)
4	1278-1972	Specifications for filler rods and wires for gas welding (Second Revision)

## REVISION OF SYLLABUS

### TRADE : SHEET METAL WORKER

List of Tools and Equipment (for a batch of 16 trainees)

SI No.	Item	For A.T.O/J.T.O	For Trainees
1	2	3	4
<b>TRAINEES KIT</b>			I.S.Code No.
1.	Steel Rule 300 mm	1	16 I.S. 1481-1970
2.	Wing divider 200 mm	1	16
3.	Centre punch 100 mm	1	16 I.S. 7177-1974
4.	Spring dividers 150 mm	1	16 I.S 4083-1967
5.	Ordinary wooden mallet 50mm	1	16
6.	Soldering Copper Hatchet type 0.25kg	1	16
7.	Cross peen hammer 0.25 kg with handle	1	16
8.	Protractor with blade 150 mm	1	16
9.	Steel tape 2 meters	1	16 I.S. 1270
10.	Ball pane hammer 0.25 kg with handle	1	16 I.S. 841-1968
11.	Scriber 150mm x 3mm (Engineer's)	1	16
<b>SHOP OUT FIT PER UNIT</b>			
12.	Steel square 450mm x 600mm		4 Nos.
13.	Sheet metal gauge		1No.
14.	Hatcher Stake		4 Nos.
15.	Stake round and bottom		4 Nos.
16.	Half moon stake		4 Nos.
17.	Funnel stake		4 Nos.
18.	Anvil face stake		4 Nos.
19.	Bick iron stake		4 Nos.
20.	Tinman's Horse		2 Nos.
21.	Hammer pinning with handle		4 nos.
22.	Hammer creasing with handle		4 nos.
23.	Hammer planishing with handle		4 Nos.
24.	Hammer block with		2 Nos.



25.	handle Shear Tinman's 300 mm	1	8 Nos.
26.	Snips straight 250 mm	1	8 Nos.
27.	Right cut snips 250 mm		4 Nos.
28.	Left cut snips 250 mm		4 Nos.

29.	Hand Shear Universals 250 mm		
	4 nos.		
30.	Punch Round 3 mm Dia		
			4 nos.
31.	Punch round 4 mm Dia.		
			4 nos.
32.	Punch round 6 mm Dia.		
			4 nos.
33.	Rivet sets snao and dolly combined 3 mm		
	4 nos.		
34.	Rivet sets snap and Dolly combined 4 mm		
	4 nos.		
35.	Rivet sets snap and Dolly combined 6 mm		
	4 nos.		
36.	Chisel cold flat 25 mm x 250 mm		
	4 nos.I.S.402-1964		
37.	Punch Letter 4 mm		
	1 set		
38.	Punch number 4 mm		
	1 set		
39.	File flat 250 mm second cut		
			2 nos. I.S.1931-1962
40.	File flat 250 mm smooth		
			2 nos.
41.	File flat 300 mm bastard		
			2 nos. I.S.1931-1962
42.	file half round 300 mm smooth		
	2 nos. I.S. 1931-1962		
43.	Hacksaw frame 300 mm adjustable (Tubular)		4 nos.
44.	Hand Groover 3 mm		
	4 nos.		
45.	Hand Groover 4 mm		
	4 nos.		

46.	Hand Groover 5 mm	
4 nos.		
47.	Pliers Combination 150 mm	
		2 nos. I.S.3650-1973
48.	Grip Wrench 200 mm	
2 nos.		
49.	Ladle 150 mm Dia.	
2 nos.		
50.	Blow Lamp 1 liter.	
2 nos.		
51	H.S.S Twist Drill 3mm, 4mm and 6mm	
3 nos each		
		(parallel shank)
	I.S 5106-1969	
52.	hand drill 0 to 6 mm, 8 mm, 10mm and 12 mm	2 Nos.
53.	Soldering, copper, hatchet type 500 gms	
8 Nos.		
54.	Pneumatic Rivet gun	
2 Nos.		
55.	Trammel Point(with beam 600 mm)	
	1 No.	
56.	Vernier Caliper(0mm – 150 mm)	
	1 No. I.S 4239-1970	
57.	Micrometer Outside(0 to 25 mm)	
	1 No. I.S 2967-1964	
58.	Rasp cut file 250 mm	
4 Nos.		
59.	D.E. spanner G.P. (6 mm to 32 mm)	
	2 Set I.S 2028-1968	
		(Set of 12 spanner)
60.	Bossing mallet	
	4 Nos.	
61.	End faked mallet	

4 Nos.		
62.	Soft Hammer(Brass, copper, lead, rubber	
		and Rawhide heads with handle )
		4 Nos.
63.	Steel Rule 600 mm	
4 Nos.		
64.	Oil Cane Pressure feed 500 ml	
	2 Nos	

65.	Raising hammer with handle	4 Nos
66.	Rawl Punch holder and bits (No. 8, 10, 12, 14)	2 Sets
67.	Hollowing hammer with handle	4 Nos.
68.	Trepanning Tools 70 mm	1 No.
69.	Safety Glasses	4 pairs I.S. 1179-1967
70.	Hand vice 50 mm	4 Nos.
71.	Steel wire Brush 50 mm x 150 mm	4 Nos.
72.	Gloves for welding (leather and Asbestos)	4 No. each
73.	Leather Apron	4 Nos.
74.	Tongs, Closed mouth and pick up (1 each)	2 Pairs
75.	Portable electric grill (single phase)	2 nos.
76.	Crow bar 910 x 25 mm	2 Nos.
77.	Trowel Medium	1 No.
78.	Trowel small	1 No.
79.	Pop rivet Gun	2 Nos.
80.	Lazy tong	2 Nos.
81.	Screw Driver 250 mm	2 Nos.
82.	Round file 2 <sup>nd</sup> cut 250 mm	4 Nos. I.S 1931-1972
83.	triangular file Smooth 250mm	4 Nos. I.S 1931-1972
84.	Square file 2 <sup>nd</sup> cut 250 mm	4 Nos. I.S 1931-1972
85.	Needle file(Swiss File) 150mm 1 set of	12 Nos.
86.	'C' clamp 150mm	2 Nos.

### GENERAL INSTALLATION

1.	Light general purpose portable forge	2 Nos.
2.	Liquefied Petroleum gas (L.P.G) cylinder regulator and torch with burner	2 Nos.
3.	Bench Lever shears 250 mm blade x 3mm capacity	1 No.
4.	Air compressor (Pressure and displacement of air)	
A-4.	Pneumatic Pop rivet gun	1 No.
5.	Spray gun (painting) 500 ml	1 No.
6.	Combination turning up and wiring machine	1 No.
7.	Guillotine Shearing machine foot operated (1 mt x 18 G. capacity)	1 No.
8.	Welding plant Oxy-Acetylene complete	

(High pressure) ( to be provided where no welding trade exists)	1 No.
A-9. Circle cutting machine 300 mm dia	1 No.
A-10. Pillar type drilling machine 12 mm	1 No.
A-11. Slip roll former 1.6 mm x 1000 mm	1 No.
A-12. D.E. Grinder Pedestal motorized 200 mm	1 No.
A-13. Anvil 50 kgs. With stand	1 No.
A-14. Bench vice 120 mm 150 mm	2 each
A-15. Fly press/Ball press No. 4 single body	1 No.
A-16. Power press 20 tones	1 No.
A-17. Buffing and polishing machine	1 No.
A-18. Nibbling machine	1 No.
A-19. Spinning lathe	1 No.
A-20. Seaming machine	1 No.
A-21. Work bench 1820 x 1310 x 760 mm	4 Nos.
22. Almirah 1820 x 1210 x 450 mm	2 Nos.
23. Metal rack 1820 x 1520 x 450 mm	2 Nos.
24. steel lockers with 8 drawers	2 Nos.
25. Fire extinguisher soda acid and foam type	1 each
26. Fire buckets with stand	4 Nos.
27. Instructor's table	1 No.
28. Black Board with easel	1 No.
29. Wooden Stool 450 mm	1 No.
30. Portable Nibbler	2 Nos.
31. Portable Pneumatic shear	2 Nos.
32. Pipe bending machine (hydraulic type) 12 mm to 30 mm	1 No.
33. Hand press brake capacity (0.8 mm)	1 No.
34. Bending machine with 380 mm throat clearance (with crimping rollers)	1 No.
35. Welding Transformer (200 to 400 Amps.)	1 No.
36. Gas welding table 1220 mm x 760 mm	1 No.
37. Spot welding machine	1 No.
38. Tin smiths bench folder 600 x 1.6 mm	1 No.
39. Over Head projector	1 No.

## NOTE

1. No additional items are required to be provided for the batch working in the second shift except the items under trainees' tool kit and lockers.
2. No additional items marked (A) are required to be provided for additional batches.
3. Detail specifications of the tools and equipments may be worked out as far as possible in accordance with the Indian Standards, at the time of their purchase.

## **A.T.S SYLLABUS FOR PRACTICAL TRAINING : % YEARS**

### **TRADE : SHEET METAL WORKER**

The period of training for this Trade is 3 years consisting of Basic Training for a period of one year and Shop Training for the remaining period.

The syllabus for this trade should be considered as a guide for imparting apprenticeship training according to the facilities available in the industry. List of operations/skills to be learnt during practical training which includes basic training.

#### **NOTE**

1. All freshers should undergo one year basic training followed by two years training in the shop floor. The apprentices should have more practice on the shop floor on those operations/skills which have been already learnt during Basic training and additional operations/skills during the shop floor training to develop the method of speed, work, accuracy and finish in job.
2. The content of one year training in the Industrial Training Institutes in this trade is exactly same as mentioned (1) above. The trainees of Industrial Training Institutes who may be engaged for two years for shop floor training after one year training in Industrial Training Institutes should follow the same course for apprenticeship as in (1) above.

#### **SHOP TRAINING – 2 YEARS**

1. Introduction of Sheet metal trade.
2. Instruction in safety precautions on the shop floor.
3. Transferring the measurement, finding out centre of a round bar using dividers, calipers, combination set etc.
4. Grinding of tools including grills.
5. Spray painting.
6. Galvanizing, Sheradising.
7. Electroplating/Iron, Nickel plating.
8. Tinning.
9. Use of duralumin rivet.
10. Riveting : Using pop riveting gun.
11. Further practice of brazing using blow pipe.
12. Metal spinning.
13. Gas cutting of Sheets/plates.
14. Use of power operated machine/tools.
15. Use of hydraulic press tools.
16. Practice on deep drawing by press tools.
17. Setting machines for production work.
18. Practice on triangulation line method of development for Ducting.

19. Repairing of damaged mudguard using wheeling and raising machine
31. Use of jigs and fixtures.
32. Making steel furniture.
33. Making twisted duct, oblong duct for room cooler or air conditioner using aluminium alloy metal.
34. Practice on bus body building work.
35. Practice on argon welding, mig and tig welding.
36. Further practice on tube bending (both ferrous and non-ferrous).
37. Practice on submerged welding.

## **WORKSHOP CALCULATION & SCIENCE**

( 1 hour per week or 50 hours per year approximately)

1. Revision of previous year work.
2. Elementary trigonometry and its application to the Shop floor problems.
3. Problems connected with the Estimation of Time, materials, Cost etc. for the trade.
4. Algebra : Algebraic Symbols, Addition, Subtraction, Multiplication and Division of Expressions involving Algebraic Symbols.
5. Further problems as applicable to the trade.
6. Advance problems on mensuration work, power and energy.
7. Meaning of tenacity, elasticity, malleability, plasticity, hardness, compressibility and ductility.
8. Meaning of tenacity, elasticity, malleability.
9. Meaning of stress, strain, modulus of elasticity , ultimate tensile strength, factor of safety and different types of stresses.
10. Descriptive explanation of expansion of solids, liquids and gases due to heat-co-efficient of expansion.
11. Brief description of transference of heat-condition, convection and radiation.
12. Properties and use of common fuels-coal, oil, British-thermal unit, centigrade heat unit, calorie-specific heat of liquid and solid calorific value of different types of fuels.

## **ENGINEERING DRAWING**

(2 hours per week or 100 hours per year approximately)

1. Revision of previous year's work.
2. Development of surfaces of simple objects.
3. Curves of interpenetration-simple experience.
4. Free-hand sketching a jigs and fixtures as applicable to the trade.
5. Advanced Blue print Reading.
6. Development as applicable to the trade.
7. Code of practice of General Engineering Drawing according to I.S.I. (IS : 696 – 1972)

## SYLLABUS FOR RELATED INSTRUCTION

Related instruction should be imparted to all apprentices during the entire period of training including basic training. The Syllabus given for related instruction should be considered as a guide.

The subject to be thought to the apprentice in Related instruction:

- I. Trade Theory
- II. Workshop Calculation & Science.
- III. Engineering Drawing
- IV. Social Studies

### FIRST YEAR

The content of the syllabus for the apprentices during the first year training should be the same as the content of the one year course of I.T.I. trainees in the trade.

### SECOND AND THIRD YEAR

- A. Trade Theory (3 hours per week or 150 hours per year approximately)  
(The number of hours to be spent on the different topics in the Trade Theory has been indicated. The Hours indicated are flexible and are only intended as a guide.)
  1. Safety at work –Accidents do not happen, they are caused – 1 hour.
  2. Revision of the previous year's work – 14 hours.
  3. Properties and use of common fuels-coal, oil, British Thermal Unit, Centigrade Heat Unit, Calorie-specific heat of liquid and solid. Calorie value of different types of fuels – 3 hours.
  4. Testing Materials-compressive test, tensile test, Brinell hardness shear and impact test.
  5. Heat Treatment: Hardening, Tempering, Annealing, Normalizing and Case Hardening. Heat Treatment of Sheet Metals, Ferrous and Non-Ferrous Metals.
  6. Corrosion and its preventive methods, such as Galvanizing, Tinning, Anodizing, Electroplating etc.
  7. Development, Layout and marking out on Sheet Metal and formation of object true to the drawings, Such as Sheet Cabinet, Water Tank, oil Tank, Spout of oil measuring can, Lobster back, Segmental Pipe, Conical Hopper, Round to Square hood etc. Rule for triangulation method of development.
  8. Tubes-filling-filling and bending of steel tubes, stainless steel tubes, copper tubes, etc. expanding tubes into plates.
  9. Process of manufacturing articles made of copper, Aluminum, Brass, Stainless Steel sheet etc.
  10. Description of common machines/tools used in sheet metal, swaging and beading machine, automatic metal working machines, sinning lathe etc. Description of hand operated machines used in the trade. Jigs and fixtures. Commonly used refractory materials-properties and uses.
  11. Use of reference table and hand books (Shop lay out).
  12. Trade Technology (Trade terms). Heating appliances used the trade.
  13. Inspection-reduction of scrap by stage inspection.



14. Introduction to work simplification related to the trade job study, job analysis including planning of sequence of operation. Critical approach and method of Working and Submerged Welding.
15. Quality and finish of work – importance of quality and finish of jobs at all stage. Practice of finished surfaces removal of sharp edge etc.
16. Revision and Test.

**NOTE**

Id 2<sup>nd</sup> year 300 hours approximately should be spent and the hours indicated above should be doubled.