CURRICULUM

FOR THE TRADE OF

SHEET METAL WORKER

UNDER

APPRENTICESHIP TRAINING SCHEME

सत्यमेव जयते
Government of India

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

CONTENTS

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Co-ordinator for the course: Sh. Nirmalya Nath., ADT

Sl. No.	Name & Designation Sh./Mr./Ms.	Organization	Remarks
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2.	R. N. Manna, T.O.	CSTARI, Kolkata	Expert
3.	Dhiraj Kumar Ghosh, V.I.	ATI, Kolkata	Expert

2. BACKGROUND

2. 1. Apprenticeship Training Scheme under Apprentice Act 1961

The Apprentices Act, 1961 was enacted with the objective of regulating the programme of training of apprentices in the industry by utilizing the facilities available therein for imparting on-the-job training. The Act makes it obligatory for employers in specified industries to engage apprentices in designated trades to impart Apprenticeship Training on the job in industry to school leavers and person having National Trade Certificate(ITI pass-outs) issued by National Council for Vocational Training (NCVT) to develop skilled manpower for the industry**.** There are four categories of apprentices namely**; trade apprentice, graduate, technician and technician (vocational) apprentices.**

Qualifications and period of apprenticeship training of **trade apprentices** vary from trade to trade. The apprenticeship training for trade apprentices consists of basic training followed by practical training. At the end of the training, the apprentices are required to appear in a trade test conducted by NCVT and those successful in the trade tests are awarded the National Apprenticeship Certificate.

The period of apprenticeship training for graduate (engineers), technician (diploma holders and technician (vocational) apprentices is one year. Certificates are awarded on completion of training by the Department of Education, Ministry of Human Resource Development.

2. 2. Changes in Industrial Scenario

Recently we have seen huge changes in the Indian industry. The Indian Industry registered an impressive growth during the last decade and half. The number of industries in India have increased manifold in the last fifteen years especially in services and manufacturing sectors. It has been realized that India would become a prosperous and a modern state by raising skill levels, including by engaging a larger proportion of apprentices, will be critical to success; as will stronger collaboration between industry and the trainees to ensure the supply of skilled workforce and drive development through employment. Various initiatives to build up an adequate infrastructure for rapid industrialization and improve the industrial scenario in India have been taken.

2. 3. Reformation

The Apprentices Act, 1961 has been amended and brought into effect from 22nd December, 2014 to make it more responsive to industry and youth. Key amendments are as given below:

- Prescription of number of apprentices to be engaged at establishment level instead of trade-wise.

- Establishment can also engage apprentices in optional trades which are not designated, with the discretion of entry level qualification and syllabus.

- Scope has been extended also to non-engineering occupations.

- Establishments have been permitted to outsource basic training in an institute of their choice.

- The burden of compliance on industry has been reduced significantly.

3. RATIONALE

(Need for Apprenticeship in **Sheet Metal Worker** trade)

1. It will help the trainees to recognize potential safety hazards on the job when using hand tools, power tools, metal cutting, and bending machinery.
2. It will enhance the ability to solve sheet meal problems involved with measurement or lines, area, volume, weight, and geometric figures.
3. It will help the trainees to demonstrate the use of various kinds of fasteners used sheet metal work.
4. It will help the trainees to demonstrate skill and competence in the construction of seams, edges, notches, locks and clips.
5. It will help the trainees to identify layout fabrication of selected truck runs and duct run fittings.
6. It will help the trainees to identify and describe proper use and maintenance of all sheet metal work.
7. It will enhance the ability to stand for long periods, heavy lifting and carrying and work in high, awkward and noisy places and also the ability to work in a construction or shop environment.
8. It will enhance the ability to fasten seams and joints together with welds, bolts, cement, rivets, solder, caulks, metal drive clips, and bonds in order to assemble components into products or to repair sheet metal items.
9. It will help the trainees to fabricate or alter parts at construction sites, using shears, hammers, punches, and drills.
10. It will help the trainees to Select gauges and types of sheet metal or non-metallic material, according to product specifications.
11. It will enhance the ability to install assemblies, such as flashing, pipes, tubes, heating and air conditioning ducts, furnace casings, rain gutters, and down spouts, in supportive frameworks.

4. JOB ROLES: REFERENCE NCO

Brief description of Job roles:

Sheet Metal Worker, General 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 scriber, 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, rivetting, soldering etc., using mallets, hammers, formers, sets, stakes, etc., or by various machines such as shearing, bending, beading,channelling , circle cutting. Checks work at stages during operations and does soldering, brazing as necessary. May undertake pneumatic and hydraulic tests. May also undertake repair work. May specialize in different metal sheets such as tin, copper, brass.

Dent Remover; Panel Beater removes dents from sheet metal parts such as mudguards, body panels, tanks, containers, trunks by beating with mallets, smoothens surface for painting and other operations. Gets parts dismantled, examines dents caused by stress or accidents and starts beating from highest point on inner side with mallet to bring it back to original shape. Supports outer surface with soft metal-piece, wood or broader mallet to avoid distortion in reverse direction. Manipulates support and uniformly beats inner portion till damaged portion is reformed to original shape. May engage an assistant to hold support and guide him in manipulating it. May also scrape or lightly file outer surface to remove further defects, if any, for obtaining finer finish.

Sheet Metal Workers, Other perform number of routine and low skilled tasks, such as doing primary development of sheet metal, cutting sheets to sizes, assisting in operating sheet metal machines, applying brazing compound on joints to be brazed, heating rivets for assembly etc. and are designated as: Sheet Metal Helper if assists Sheet Metal Worker by performing simple flanging, punching, shearing soldering etc. for fabrication of sheet metal products, Tin Smith Helper if cuts tin sheets according to drawing or sample using foot rule, callipers and compass and assists Tin Smith in bending, shaping and joining various component parts. Sheet Metal Machine Helper if assists Sheet Metal Machine Operator in setting and operating sheet metal working machines such as bending machine, channeling machine, shearing machine etc.

Sheet Metal Machine Operator operates sheet metal machine for sizing, bending and forming sheet metal for further operations. Sets machine to required dimensions (except press tools) using common measuring instruments such as foot rule, calipers etc. Operates machine, feeds trial piece and checks for dimensions and resets machine if necessary. Checks out-turn from time to time to ensure correctness. May operate one or more sheet metal working machines such as shearing machine, bending machine, channeling machine, forming machine and is designated as SHEARING MACHINE OPERATOR, BENDING MACHINE OPERATOR , CHANNELING MACHINE OPERATOR, GROOVING MACHINE OPERATOR, FORMING MACHINE OPERATOR, etc. May set cutters, blades, dies etc. and undertake minor repairs under guidance.

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

Perform TPM (Total Production Management), TQM (Total Quality Management) and record keeping system.

Reference NCO:

i). **NCO-2004:** 7213.10**,** 7213.30, 7213.90, 8211.61

5. GENERAL INFORMATION

1. **Name of the Trade** **: SHEET METAL WORKER**

2. **N.C.O. Code No.** **: NCO-2004:** 7213.10**,** 7213.30, 7213.90, 8211.61

3. **Duration of Apprenticeship Training (Basic Training + Practical Training):**2years

3.1 **For Freshers: -** Duration of Basic Training: -

a) Block –I : 3 months

b) Block – II : 3 months

Total duration of Basic Training: **6 months**

Duration of Practical Training (On -job Training): -

a) Block–I: 9 months

b) Block–II : 9 months

Total duration of Practical Training: **18 months**

3.2 **For ITI Passed: -** Duration of Basic Training: - **NIL**

Duration of Practical Training (On -job Training): **12 months**

4. **Entry Qualification** **:** Pass 8th Class Examination

5. **Selection of Apprentices:** The apprentices will be selected as per Apprentices Act amended time to time.

6. **Rebate for ITI passed trainees** : i) **One year** in the trade of **Sheet Metal Worker**

Note: Industry may impart training as per above time schedule for different block, however this is not fixed. The industry may adjust the duration of training considering the fact that all the components under the syllabus must be covered. However the flexibility should be given keeping in view that no safety aspects is compromised.

6. COURSE STRUCTURE

Training duration details: -

Time (in months)	1-3	4-12	13-15	16-24
Basic Training	**Block– I**	**-----**	**Block – II**	**------**
Practical Training (On - job training)	**----**	**Block – I**	**------**	**Block – II**

Components of Training	Duration of Training in Months																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Basic Training Block - I																								
Practical Training Block - I																								
Basic Training Block - II																								
Practical Training Block - II																								

7. SYLLABUS

7.1 BASIC TRAINING
(BLOCK – I & II)
DURATION: 06 MONTHS

GENERAL INFORMATION

1) **Name of the Trade** : **SHEET METAL WORKER**
2) **Hours of Instruction** : 1000 Hrs. (500 hrs. in each block)
3) **Batch size** : 20
4) **Power Norms** : 11 KW for Workshop
5) **Space Norms** : 80 Sq. m.

6) **Examination** : The internal assessment will be held on completion of each Block.
7) **Instructor Qualification** :

i) Degree/Diploma in **Mechanical/ Metallurgy/ Production Engineering/ Mechatronics** Engg. from recognized university/Board with one/two year post qualification experience respectively in the relevant field.

OR

ii) NTC/NAC in the trade of Sheet **Metal Worker** with three year post qualification experience in the relevant field.

Preference will be given to a candidate with Craft Instructor Certificate (CIC)

8) **Tools, Equipments & Machinery required**: - As per Annexure – I

7.1.1 DETAIL SYLLABUS OF CORE SKILL

A. Block– I
Basic Training

Topic No.	a) Engineering Drawing	Duration (in hours)	b) Workshop Science & Calculation	Duration (in hours)
1.	Engineering Drawing: Introduction and its importance Different types of standards used in engineering drawing. Drawing Instruments: their uses Drawing board, T-Square, Drafter (Drafting M/c), Set Squares, Protractor, Drawing Instrument Box (Compass, Dividers, Scale, Diagonal Scales etc.), Pencils of different Grades, Drawing pins / Clips.	**30**	**Units & Measurements-** FPS, CGS, MKS/SI unit, unit of length, Mass and time. Fundamentals and derived units Conversion of units and applied problems.	**20**
2.	Lines : types and applications in Drawing as per BIS SP:46-2003 Drawing geometrical object using all types of lines. **Drawing of Geometrical Figures:** Angle, Triangle, Square, Rectangle and Circle. **Letters: -** Lettering styles, Single stroke letters and numbers as per IS standard. Lettering practice		**Material Science** : properties - Physical & Mechanical, Types - Ferrous & Non-Ferrous, difference between Ferrous and Non-Ferrous metals	
3.	**Dimensioning-** Types of dimension, elements of dimensions, Methods of indicating Values, Arrangement, Alignment and indication of dimensions. **Scales**:-Types use and construction. Representative factor of scale.		**Mass .Weight and Density** : Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density,	
4.	Method of presentation of Engineering Drawing - Pictorial View - Orthogonal View - Isometric view		**Speed and Velocity:** Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation. Average Velocity, Acceleration & Retardation. Related problems. Circular Motion: Relation between circular motion and Linear motion, Centrifugal	

			force, Centripetal force	
5.	**Constructions: -** Draw proportionate free hand sketches of plane figures. Sketch horizontal, vertical and inclined line by free hand, Draw circles by free hand using square and radial line method, Draw arcs and ellipse by free hand		**Ratio & Proportion** : Simple calculation on related problems. **Percentage:** Introduction, Simple calculation.	
6.	Projections: Concept of axes plane and quadrant. Orthographic projections Method of first angle and third angle projections (definition and difference) Symbol of 1^{st} angle and 3^{rd} angle projection as per IS specification. Free hand Drawing of Orthographic projection from isometric/3D view of geometrical blocks		**Work, Power and Energy:** work, unit of work, power, unit of power, Horse power of engines, mechanical efficiency, energy, use of energy, potential and kinetic energy, examples of potential energy and kinetic energy. Meaning of H.P., I.H.P., B.H.P., and F.H.P. and CC and Torque.	

B. Block- II
Basic Training

Topic No.	a) Engineering Drawing	Duration (in hours)	b) Workshop Science & Calculation	Duration (in hours)
1.	**Screw :-** Its Types and Sizes, Screw thread, their standard forms as per BIS, external and internal thread.	**30**	**Algebra:** Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	**20**
2.	**Rivets and Joints:-** Prepare a drawing sheet on rivets nomenclature and Joints.		**Heat & Temperature:** Heat and temperature, their units, difference between heat and temperature, boiling point, melting point, scale of temperature, relation between different scale of temperature, Thermometer, pyrometer, transmission of heat, conduction, convection, radiation.	
3.	Free hand Sketches for simple pipe line with general fittings.		**Mensuration:** Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle, Volume of solids - cube, cuboid, cylinder and Sphere. Surface area of solids -cube, cuboid, cylinder and Sphere. Volume of cut-out solids: hollow cylinders, frustum of cone, block section. Volume of simple solid blocks.	
4.	Reading of drawing. Simple exercises related to missing lines, dimensions. How to make queries.		**Basic Electricity:** Introduction, use of electricity, how electricity is produced, Types of current_ AC, DC, their comparison, voltage, resistance, their units. Conductor, insulator, Types of connections - series, parallel, electric power, Horse power, energy, unit of electrical energy. Concept of earthling.	
5.	Simple exercises related to trade related symbols. Basic electrical and electronic symbols		**Simple machines** **Transmission of power:** - Transmission of power by belt, pulleys & gear drive. **Heat treatment process:** - Heat treatment and advantages.	

			Annealing, Normalizing, Hardening, Tempering.	
6.	Free hand sketch of trade related components / parts /cutting tool indicating angles.		**Trigonometry:** Trigonometrical ratios, measurement of angles. Trigonometric tables. Finding the value of unknown sides and angles of a triangle by Trigonometrical method. Finding height and distance by trigonometry. Application of trigonometry in shop problems. (viz. taper angle calculation). Calculate the area of triangle by using trigonometry and application of Pythagoras theorem.	
7.			**Concept of pressure** - **Definition**:-Force, Pressure, and their units, atmospheric pressure, gauges used for measuring pressure, problems. Introduction to pneumatics & hydraulics systems.	
8.	**Simple exercises related to trade related Test Papers. Solution of NCVT test papers.**			

7.1.2 DETAIL SYLLABUS OF PROFESSIONAL SKILLS & PROFESSIONAL KNOWLEDGE

A. Block –I

Basic Training

Week No.	Professional Skills	Professional Knowledge
1.	Induction to safety devices used in shop floor. Identification of Tools and Equipments Induction 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.	General safety precautions Safety precaution in sheet metal work Introduction of First aid. Safety attitude development of the trainee by educating him to use Personal Protective Equipment (PPE). Response to emergencies eg; power failure, fire, and system failure. Introduction to 5S concept & its application. Fire: - Types, causes and prevention methods. Fire Extinguisher, its types. 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.
2.	Mark and cut through the straight lines. Planishing of Sheet Metal and Practice in drawing simple Geometrical shapes. Practice in marking and cutting of sheets to various angles.	Marking and laying out tools and accessories. Measuring Tools: steel Rule, calipers, try square, L square, SWG, Bevel Protractor etc. Cutting tools : Snips, shears, hacksaw, chisel, cutting plier, files, drills, tap & die sets etc
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 off profiles. Practice on Sheet Metal seams. "Grooved seam, Locked Grooved seam, Pane down seam, Bottom lock seam or Corner Fold (Knocked-up seam) and hemming practice	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.. Sheet Metal Folded Joints: Description of Sheet Metal Seam, Grooved seam, Locked Grooved seam, Paned down seam, Knocked up seam inside and outside, capstrip seam, pitsburg seam etc..

4.	Forming rectangular shapes using stakes. Forming Cylindrical job using various stakes such as Hollow Mandrel, Hatchet Stake; Tin Man's' Anvil stake etc. Folding, Bending Sheet Metal to 90 degree using wooden mallet , 'C' clamps etc. Making a cylindrical container with knocked- up, bottom (Bottom Locked), Grooved Joint and hemmed Top. Making of Mug. Hemming (single, Double) wire edge by hand process	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 by parallel line method, radial line method.
5.	Make a taper chute square to round. Making holes with solid punches , round punches as per BIS and use of hollow punches Making hole in sheet metal with help of wood block.	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.
6.	Riveting practice using various types of rivet heads. Single chain riveted joint. Double chain and Zig-zag, Lap & butt riveted joints	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)
7.	Solder Lap joint Single plated solder butt joint Making funnel by soldering process	Fastening of Sheet Metal:. Self taping screws, Clips and Connectors; Their uses, Types and Allowance of 'S' Clips, Government Clips, Drive Clips, Mailing Clips etc. Solder, Different types of solder and their composition. Types and uses of fluxes, their effect on different metal.
8.	Make by soldering Elbow 90° equal dia pipe T joint 90° equal dia pipe T joint 90° unequal dia pipe by soldering Make by soldering T Pipe 60°branch joint unequal dia pipe Offset T joint equal dia	Process of soft soldering, hard soldering (brazing). Heating appliances (Hand Forge, Blow Lamp, L.P.G.) Development & laying out pattern of elbow pipe, T pipe and offset pipe in equal diameter.
9.	Make a taper lobster back bend 90 degree from oblique cone by soldering Forming square section segmental quarter bend pipe with suitable lock and forming round section segmental quarter bend pipe	Development of T pipe, round equal and unequal. Introduction to tubes and pipes. Laying out pattern of 600 off-set 'T' pipe. Pattern Development of Y' pipe.
10.	Making a square duct elbow with snap block Make a conical hopper by soldering	Method of galvanizing, tinning, anodising, sheradising and Electroplating. Development and laying out of pattern of segmental quarter bend pipe

11.	Setting up of Oxy-acetylene plant and types of flames Setting up of Arc welding plant and striking & maintaining the arc & laying short beads	Need for ducting. Places where ducting is employed and the working principle of a dust cyclone. Safety precaution in gas & arc welding Description of Oxyacetylene plant and the equipments, accessories & tools
12.	Fusion run with/without filler rod in flat position. Square butt joint in flat position by gas. Brazing copper sheet in lap joint in flat position	Types of oxy-acetylene flames &its uses Types and description of flux Types of welding blow pipes .& its functions Various types of pipe joints.
13.	**Revision & Internal Assessment**	

B. Block –II
Basic Training

Week No.	Professional Skills	Professional Knowledge
1.	Introduction to machinery safety including firefighting equipment and their uses etc Locked groove joint by aluminum sheet Single riveted lap joint by aluminum sheet. Double strap single row riveted butt joint by aluminum sheet	Review of Types of sheet metal Fabrication. Methods of developments. Ferrous and Non-Ferrous metals. Use of Copper and Alloy Chemical and Physical properties of Aluminium. Use of Aluminium and its Alloys.
2.	Exercise involving practical work on Aluminium Sheet, and using Pop Rivet. Aluminium Windows with. different extruded sections, Aluminium Soldering.	Brief Description of hand punch machine. Angles for Drilling Sheet Metals, effect of speed, Feed Cutting Fluids, etc., on metals. Difference between drilled and punched holes.
3.	Making holes in sheet metal using Punching Machine. Making holes in sheets with a twist drill. Practice in Drilling Holes in walls and Ceilings as applied to ducting work.	Description of swaging and beading machine, its parts, operating principles etc. Method to calculate the pressure adjustment. Clearance between Die and Punch.
4.	Practice on hollowing and raising on non-ferrous sheet as well as ferrous sheet. Practice on pipe bending by hand. Development of a cone: Cylinder fitted to a cone. Equal dia pipe joint with crimping and Ogee beading.	Properties of stainless steel and its uses. Properties and uses of tin, lead, zinc and silver. Introduction to pipe/tube bending. Description of roll forming machine types and operating principles, description of slip roll forming machine and its function
5.	Typical folding, Bending Practice, Making Steel-Racks, Reinforcement with angle iron. Use of self taping screws and other fasteners. Making a cylindrical medicine container of Aluminium Sheet	Use of Die and Die Holder, Description of taps and tap wrench. Method to operate folding/brake folder for typical folding.
6.	Practice of Buffing and polishing Angle iron bending in different angles and different radii. 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.

7.	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. Pipe butt joint in down hand position Butt joint on MS flat in down hand position by arc	Different process of metal joining types of weld joint &weld positions. Oxy-acetylene welding equipments & application. Principle of arc welding. Types of welding machines and their uses.
8.	Spot welding, seam welding. Deposit bead on MS sheet in flat position. Lap joint T joint and butt joint in down hand position.	Arc length and its importance Welding defects Welding symbols Welding equipments and accessories.
9.	TIG welding. Deposit bead on SS sheet in flat position. Making butt, Tee and corner joint.	TIG welding process. Advantages. Description of equipments. Types of Tungsten Electrodes, Filler rods, Shielding Gases. Defects, causes and remedy in TIG welding process
10.	MS/SS pipe butt and Y joint by TIG welding process.	Specification of aluminium channels angles, strips, tubes beadings, packing rubber, cardboard, glasses etc.
11.	Electrical Panel, trunk boxes & ducts fabrication and Painting .	Tools and equipments used in aluminium fabrication. Process of painting. Spray painting. Etch primer painting, Powder coating, buffing, grinding, and sanding..
12.	Any Special Exercises: Repairing Mudguard and Radiators and testing of Sheet metal containers.	Material handling: handling of light, medium and heavy materials. Estimation and costing
13.	**Revision & Internal Assessment**	

7.1.3 EMPLOYABILITY SKILLS

GENERAL INFORMATION

1)	**Name of the subject**	**:**	**EMPLOYABILITY SKILLS**
2)	**Applicability**	**:**	ATS- Mandatory for fresher only
3)	**Hours of Instruction**	**:**	**110 Hrs. (55 hrs. in each block)**
4)	**Examination**	**:**	The examination will be held at the end of two years Training by NCVT.
5)	**Instructor Qualification**	**:**	

i) MBA/BBA with two years experience or graduate in sociology/social welfare/Economics with two years experience and trained in Employability skill from DGET Institute.

And

Must have studied in English/Communication Skill and Basic Computer at 12th /diploma level

OR

ii) Existing Social Study Instructor duly trained in Employability Skill from DGET Institute.

7.1.3.1 SYLLABUS OF EMPLOYABILITY SKILLS

A. Block – I
Basic Training

Topic No.	Topic	Duration (in hours)
	English Literacy	**15**
1	**Pronunciation :** Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech)	
2	**Functional Grammar** Transformation of sentences, Voice change, Change of tense, Spellings.	
3	**Reading** Reading and understanding simple sentences about self, work and environment	
4	**Writing** Construction of simple sentences Writing simple English	
5	**Speaking / Spoken English** Speaking with preparation on self, on family, on friends/ classmates, on know, picture reading gain confidence through role-playing and discussions on current happening job description, asking about someone's job habitual actions. Cardinal (fundamental) numbers ordinal numbers. Taking messages, passing messages on and filling in message forms Greeting and introductions office hospitality, Resumes or curriculum vita essential parts, letters of application reference to previous communication.	
	I.T. Literacy	**15**
1	**Basics of Computer** Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer.	
2	**Computer Operating System** Basics of Operating System, WINDOWS, The user interface of Windows OS, Create, Copy, Move and delete Files and Folders, Use of External memory like pen drive, CD, DVD etc, Use of Common applications.	
3	**Word processing and Worksheet** Basic operating of Word Processing, Creating, opening and closing Documents, use of shortcuts, Creating and Editing of Text, Formatting the Text, Insertion & creation of Tables. Printing document. Basics of Excel worksheet, understanding basic commands, creating simple worksheets, understanding sample worksheets, use of simple formulas and functions, Printing of simple excel sheets	
4.	**Computer Networking and INTERNET** Basic of computer Networks (using real life examples), Definitions of Local Area Network (LAN), Wide Area Network (WAN), Internet, Concept of Internet (Network of Networks), Meaning of World Wide Web (WWW), Web Browser, Web Site, Web page	

	and Search Engines. Accessing the Internet using Web Browser, Downloading and Printing Web Pages, Opening an email account and use of email. Social media sites and its implication. Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT - ACT, types of cyber crimes.	
	Communication Skill	**25**
1	**Introduction to Communication Skills** Communication and its importance Principles of Effective communication Types of communication - verbal, non verbal, written, email, talking on phone. Non verbal communication -characteristics, components-Para-language Body - language Barriers to communication and dealing with barriers. Handling nervousness/ discomfort. Case study/Exercise	
2	**Listening Skills** Listening-hearing and listening, effective listening, barriers to effective listening guidelines for effective listening. Triple- A Listening - Attitude, Attention & Adjustment. Active Listening Skills.	
3	**Motivational Training** Characteristics Essential to Achieving Success The Power of Positive Attitude Self awareness Importance of Commitment Ethics and Values Ways to Motivate Oneself Personal Goal setting and Employability Planning. Case study/Exercise	
4	**Facing Interviews** Manners, Etiquettes, Dress code for an interview Do's & Don'ts for an interview	
5	**Behavioral Skills** **Organizational Behavior** Problem Solving Confidence Building Attitude Decision making Case study/Exercise	

B. Block– II
Basic Training

Topic No.	Topic	Duration (in hours)
	Entrepreneurship skill	**15**
1	**Concept of Entrepreneurship** **Entrepreneurship**- Entrepreneurship - Enterprises:-Conceptual issue Entrepreneurship vs. Management, Entrepreneurial motivation. Performance & Record, Role & Function of entrepreneurs in relation to the enterprise & relation to the economy, Source of business ideas, Entrepreneurial opportunities, The process of setting up a business.	
2	**Project Preparation & Marketing analysis** Qualities of a good Entrepreneur, SWOT and Risk Analysis. Concept & application of Product Life Cycle (PLC), Sales & distribution Management. Different Between Small Scale & Large Scale Business, Market Survey, Method of marketing, Publicity and advertisement, Marketing Mix.	
3	**Institutions Support** Preparation of Project. Role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non financing support agencies to familiarizes with the Policies /Programmes & procedure & the available scheme.	
4	**Investment Procurement** Project formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment procedure - Loan procurement - Banking Processes.	
	Productivity	**10**
1	**Productivity** Definition, Necessity, Meaning of GDP.	
2	**Affecting Factors** Skills, Working Aids, Automation, Environment, Motivation How improves or slows down.	
3	**Comparison with developed countries** Comparative productivity in developed countries (viz. Germany, Japan and Australia) in selected industries e.g. Manufacturing, Steel, Mining, Construction etc. Living standards of those countries, wages.	
4	**Personal Finance Management** Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and Insurance.	
	Occupational Safety, Health & Environment Education	**15**
1	**Safety & Health** Introduction to Occupational Safety and Health importance of safety and health at workplace.	

2	**Occupational Hazards** Basic Hazards, Chemical Hazards, Vibro-acoustic Hazards, Mechanical Hazards, Electrical Hazards, Thermal Hazards. Occupational health, Occupational hygienic, Occupational Diseases/ Disorders & its prevention.	
3	**Accident & safety** Basic principles for protective equipment. Accident Prevention techniques - control of accidents and safety measures.	
4	**First Aid** Care of injured & Sick at the workplaces, First-Aid & Transportation of sick person	
5	**Basic Provisions** Idea of basic provision legislation of India. of safety, health, welfare under legislation of India.	
6	**Ecosystem** Introduction to Environment. Relationship between Society and Environment, Ecosystem and Factors causing imbalance.	
7	**Pollution** Pollution and pollutants including liquid, gaseous, solid and hazardous waste.	
8	**Energy Conservation** Conservation of Energy, re-use and recycle.	
9	**Global warming** Global warming, climate change and Ozone layer depletion.	
10	**Ground Water** Hydrological cycle, ground and surface water, Conservation and Harvesting of water	
11	**Environment** Right attitude towards environment, Maintenance of in -house environment	
	Labour Welfare Legislation	**5**
1	**Welfare Acts** Benefits guaranteed under various acts- Factories Act, Apprenticeship Act, Employees State Insurance Act (ESI), Payment Wages Act, Employees Provident Fund Act, The Workmen's compensation Act.	
	Quality Tools	**10**
1	**Quality Consciousness :** Meaning of quality, Quality Characteristic	
2	**Quality Circles :** Definition, Advantage of small group activity, objectives of quality Circle, Roles and function of Quality Circles in Organization, Operation of Quality circle. Approaches to starting Quality Circles, Steps for continuation Quality Circles.	
3	**Quality Management System :** Idea of ISO 9000 and BIS systems and its importance in maintaining qualities.	
4	**House Keeping :** Purpose of Housekeeping, Practice of good Housekeeping.	
5	**Quality Tools** Basic quality tools with a few examples	

7.2 PRACTICAL TRAINING (ON-JOB TRAINING)
(BLOCK – I & II)
DURATION: 18 MONTHS (9 months in each block)

GENERAL INFORMATION

1) **Name of the Trade** : **SHEET METAL WORKER**

2) **Batch size** : a) Apprentice selection as per Apprenticeship guidelines.

b) Maximum 20 candidates in a group.

3) **Examination** : i) The internal assessment will be held on completion of each block

ii) NCVT exam will be conducted at the end of 2nd year.

4) **Instructor Qualification** :

i) Degree/Diploma in **Mechanical/ Metallurgy / Production Engineering/ Mechatronics** Engg. from recognized university/Board with one/two year post qualification experience in the relevant field.

OR

ii) NTC/NAC in the trade of Sheet **Metal Worker** with three year post qualification experience in the relevant field.

Preference will be given to a candidate with Craft Instructor Certificate (CIC)

5) **Infrastructure of On-Job Training** : - As per Annexure – II

7.2.1 BROAD SKILL COMPONENT TO BE COVERED DURING ON-JOB TRAINING

A. BLOCK – I (09 months)

1. Safety and best practices/Basic Industrial Culture (5S, KAIZEN, etc.)
2. Prepare different types of documentation as per industrial need by different methods of recording information.
3. Development in radial line method, triangulation method, geometrical constructions etc.
4. Selects sheet of required type, thickness (gauge) and size and mark it with scriber, square, divider, foot rule etc., according to drawing or sample.
5. Use of different machines of sheet metal section.
6. Shear sheet metal by machine or hand shear and make it to required shape and size by bending, seaming, forming, riveting, soldering etc., using mallets, hammers, formers, sets, stakes, etc.
7. Performs soldering, brazing
8. Makes sheet metal different articles according to drawing or sample.
9. Sheet metal forming processes: Shearing, Forming and Finishing.

B. BLOCK – II (09 months)

1. Undertakes Aluminium frame works and other sheet metals such as tin, copper, brass.
2. Undertake repair work of different sheet metal components.
3. Transferring the measurement, Finding out centre of a round bar using dividers, calipers, combination set etc.
4. Spray painting, Galvanizing, Sheradizing, Electroplating/Iron, Nickel plating, Tinning.
5. Use of Duralumin Rivet, Riveting: Using Pop riveting Gun.
6. Metal Spinning.
7. Gas cutting of Sheets/Plates.

8. Use of power operated machines/tools such as portable pneumatic grinder/chisel/nibbler/riveter etc.
9. Use of Hydraulic Press Tools, Practice on deep drawing by press tools.
10. Practice on triangulation line method of development for Ducting.
11. Repairing of damaged mudguard using wheeling and raising machine.
12. Use of jigs and fixtures.
13. Making Twisted Duct, oblong duct for room cooler or air conditioner using Aluminium Alloy Metal. Principle of Ductwork for air handling systems in industry and types and PEB Work (Pre Engineering Building structure).
14. Practice on bus body building work.
15. Practice on Argon Welding, MIG and TIG Welding Projection, Seam and Resistance spot welding (RSW) machines.
16. Further practice on tube bending (both ferrous and non-ferrous)
17. Perform TPM (Total Productive Maintenance), TQM (Total Quality Management) and record keeping system.

8. ASSESSMENT STANDARD

8.1 Assessment Guideline:

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking assessment. Due consideration to be given while assessing for team work, avoidance/reduction of scrape/wastage and disposal of scarp/wastage as per procedure, behavioral attitude and regularity in training.

The following marking pattern to be adopted while assessing:

a) Weightage in the range of 60-75% to be allotted during assessment under following performance level:

For this grade, the candidate with occasional guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of an acceptable standard of craftsmanship.

In this work there is evidence of:

- good skill levels in the use of hand tools, machine tools and workshop equipment
- many tolerances while undertaking different work are in line with those demanded by the component/job.
- a fairly good level of neatness and consistency in the finish
- occasional support in completing the project/job.

b) Weightage in the range of above75%- 90% to be allotted during assessment under following performance level:

For this grade, the candidate, with little guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of a reasonable standard of craftsmanship.

In this work there is evidence of:

- good skill levels in the use of hand tools, machine tools and workshop equipment
- the majority of tolerances while undertaking different work are in line with those demanded by the component/job.
- a good level of neatness and consistency in the finish
- little support in completing the project/job

c) Weightage in the range of above 90% to be allotted during assessment under following performance level:

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.

In this work there is evidence of:

- high skill levels in the use of hand tools, machine tools and workshop equipment
- tolerances while undertaking different work being substantially in line 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

8.2 FINAL ASSESSMENT- ALL INDIA TRADE TEST

(SUMMATIVE ASSESSMENT FOR TWO YEARS TRADE)

SUBJECTS	Marks	Sessional Marks	Full Marks	Pass Marks	Duration of Exam.
Practical	300	100	400	240	**08 hrs.**
Trade Theory	100	20	120	48	3 hrs.
Workshop Cal. & Sc.	50	10	60	24	3 hrs.
Engineering Drawing	50	20	70	28	4 hrs.
Employability Skill	50		50	17	2 hrs.
Grand Total	**550**	**150**	**700**	**-**	

Note: - The candidate pass in each subject conducted under all India trade test.

9. FURTHER LEARNING PATHWAYS

- On successful completion of the course trainees can opt for Diploma course (Lateral entry). [Applicable for candidates only who undergone ATS after CTS]
- On successful completion of the course trainees can opt for CITS course.

Employment opportunities:

On successful completion of this course, the candidates may be gainfully employed in the following industries:

1. Production & Manufacturing industries.
2. Structural Fabrication like bridges, Roof structures, Building & construction.
3. Automobile and allied industries
4. Service industries like road transportation and Railways.
5. Ship building and repair
6. Infrastructure and defence organisations
7. In public sector industries (Central and State) and private industries in India & abroad.
8. Self employment

ANNEXURE – I

TOOLS & EQUIPMENT FOR BASIC TRAINING

INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

TRADE: SHEET METAL WORKER

LIST OF TOOLS & EQUIPMENTS FOR 20 APPRENTICES

A : TRAINEES TOOL KIT:-

Sl. No.	Name of the items	Quantity (indicative)
1.	Steel Rule 300 mm	20 Nos.
2.	Wing Divider 200 mm	20 Nos.
3.	Centre Punch 100 mm	20 Nos.
4.	Spring Dividers 150 mm	20 Nos.
5.	Ordinary Wooden Mallet	20 Nos.
6.	Soldering Copper Hatchet Type 0.25 kg	20 Nos.
7.	Cross Peen Hammer 0.25 kg with handle	20 Nos.
8.	Protractor with blade 150mm	20 Nos.
9.	Steel tape 2 mtrs.	20 Nos.
10.	Ballpene hammer 0.5kg with handle	20 Nos.
11.	Scriber 150 mm x 3 mm (Engineer's)	20 Nos.
12.	Prick punch 100mm	20 Nos.

B : TOOLS INSTRUMENTS AND GENERAL SHOP OUTFITS

Sl. No.	Name of the items	Quantity (indicative)
13.	Steel Square 450 mm x 600 mm	4 Nos.
14.	Sheet Metal Gauge	1 No
15.	Hatcher Stake	4 Nos.

16.	Stake Round and Bottom	4 Nos.
17.	Half Moon Stake	4 Nos.
18.	Funnel Stake	4 Nos.
19.	Anvil Face Stake	4 Nos.
20.	Bick Iron Stake	4 Nos.
21.	Tinman's Horse	2 Nos.
22.	Hammer Peaning with handle	4 Nos.
23.	Hammer Creasing with handle	4 Nos.
24.	Hammer Planishing with handle	4 Nos.
25.	Hammer Block with handle	2 Nos.
26.	Shear Tinman 300mm	8 Nos
27.	Snip straight	8 Nos
28.	Right cut snips 250mm	4 Nos
29.	Left cut snips 250mm	4 Nos
30.	Hand Shear Universal 250 mmID	4 Nos.
31.	Hollow Punch set Round 3 mm Dia	2 Nos.
32.	Rivet sets snap and Dolly combined 3 mm	4 Nos.
33.	Chisel cold flat 25 mm x 250 mm .	4 Nos
34.	Punch Letter 4 mm	1 set
35.	Punch Number 4 mm	1 set
36.	File flat 250 mm second cut	2 Nos.
37.	File flat 250 mm smooth	2 Nos.
38.	File flat 300 mm bastard	2 Nos.
39.	File half round 300 mm smooth	2 Nos.
40.	Hacksaw frame 300 mm adjustable (Tubular)	4 Nos.
41.	Hand Groover 5 mm	4 Nos.
42.	Plier.Combination 150 mm	2 Nos.
43.	Grip Wrench 200 mmID	2 .Nos.
44.	Ladle 150 mm Dia.	2 Nos
45.	Blow Lamp 1 litre.	2 Nos
46.	H.S.S. Twist Drill 3 mm, 4 mm & 6 mm each (parallel Shank)	3 Nos.
47.	Hand Drill machine 0 to 12 mm	2 Nos.
48.	Soldering Copper Hatchet type 500 gms.	8 Nos
49.	Pneumatic rivet gun	2 Nos.
50.	Trammel Point (with beam 600 mm)	1 No.
51.	Vernier caliper (0 mm - 150 rom)	1 No
52.	Micrometer Outside (0 to 25 mm)	1 No.
53.	File Rasp cut 250 mm	2 Nos.
54.	D.E. Spanner G.P. (6 mm to 32 mm) (Set of 12 spanner)	2 Set
55.	Bossing Mallet	4 Nos
56.	End tacked Mallet	4 Nos
57.	Soft hammer (Brass, copper, Lead)	4 Nos
58.	Steel Rule 600mm	4 Nos
59.	Oilcan pressure feed 500ml	2Nos
60.	Raising hammer with handle	4 Nos
61.	Rawl Punch holder and bits (No.8, 10, 12, 14)	2 . Sets
62.	Hollowing Hammer with handle	4 Nos.
63.	Tripaning tool 70 mm	1 No.
64.	Hand vice 50 mm	4 Nos.
65.	Tongs Flat	2 Pairs.

66.	Portable Electric drill (Single phase) -6mm	2 Nos
67.	Pop rivet gun	2 Nos.
68.	Lazy Tong	2 Nos.
69.	Screw Driver 250 mm	2 Nos.
70.	Round File 2nd Cut 250 mm	4 Nos.
71.	Triangular File 'Smooth 250 mm	4 Nos.
72.	Square File 2nd Cut 250 mm.	4 Nos.
73.	Needle File (Swiss File) 150 mm	1 set
74.	C Clamp 150 mm	2 Nos.

C : GENERAL MACHINERY INSTALLATIONS:-

Sl. No.	Name & Description of Machines	Quantity (indicative)
1.	Bench leaver shears 250 mm Blade x 3mm Capacity	1 No.
2.	Air Compressor (Pressure and displacement of air) Pneumatic Pop rivet Gun	1 . No
3.	Spray Gun(painting) 500 ml.	1 No.
4.	Combination turning up and wiring machine	1 No.
5.	Guillotine. Shearing Machine foot operated	1 No.
6.	Oxy acetylene welding plant (complete set)	1 set
7.	Circle cutting machine 300 mm dia	1 set
8.	Pillar type drilling machine 12 mm	1 No.
9.	Slip roll former 1.6. mm x 1000 mm	1 No.
10.	D.E. Grinder Pedestal motorised 200 mm	1 No.
11.	Anvil 50 kgs with Stand	1 No.
12.	Bench vice 120 mm, 150 mm	2 each
13.	Fly press Ball press No.4 single body	1 No.
14.	Power Press 2 Tons	1 No.
15.	Buffing and Polishing Machine	1 No.
16.	Nibbling Machine	1 No.
17.	Spinning Lathe	1 No.
18.	Seaming Machine .	1 No.
19.	Glass cutter - Diamond point	1 No.
20.	Work Bench 1820 x 1310 x 760 mm	4 Nos.

21.	Almirah 1820 x 1210 x 450 mm	2 Nos.
22.	Metal rack 1820 x-1520 x 450 mm	2 Nos.
23.	Steel Lockers with 8 Drawers .	2 Nos.
24.	Fire extinguisher Soda Acid and foam type	1 each
25.	Fire buckets with Stand-	4, Nos.
26.	Black Board with Easel .	1 No.
27.	Wooden Stool 450.mm.	1 No.
28.	Portable Nibbler	2 Nos.
29.	Portable Pneumatic Shear.	2 Nos.
30.	Pipe Bending Machine (Hydraulic Type) 12 mm to 30 mm	1 No.
31.	Hand Press Brake Capacity (0.8 mm)	1 No.
32.	Beading Machine with 380 mm throat clearance (with crimping rollers)	1 No.
33.	Tin . smiths bench folder 600 x 1.6 mm	1 No.
34.	Gas Welding Table 1220 mm x 760 mm	1 No.
35.	Spot Welding Machine	1 No.
36.	Arc welding Transformer/ Rectifier/Inverter 300Amps with accessories	1 set
37.	Co_2 welding machine complete set 300Amps	1 set
38.	TIG welding machine complete set 200 Amps	1 set
39.	Universal cutting machine	1 No.

Note: In case of basic training setup by the industry the tools, equipment and machinery available in the industry may also be used for imparting basic training.

INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

TRADE: SHEET METAL WORKER

LIST OF TOOLS& EQUIPMENTS FOR 20 APPRENTICES

1) **Space Norms** : 45 Sq. m.(For Engineering Drawing)

2) Infrastructure:

A : TRAINEES TOOL KIT:-

Sl. No.	Name of the items	Quantity (indicative)
1.	Draughtsman drawing instrument box	20 Nos.
2.	Set square celluloid 45^0 (250 X 1.5 mm)	20 Nos.
3.	Set square celluloid 30^0-60^0 (250 X 1.5 mm)	20 Nos.
4.	Mini drafter	20 Nos.
5.	Drawing board (700mm x500 mm) IS: 1444	20 Nos.

B : FURNITURE REQUIRED

Sl. No.	Name of the items	Quantity (indicative)
1	Drawing Board	20 Nos.
2	Models : Solid & cut section	as required
3	Drawing Table for trainees	as required
4	Stool for trainees	as required
5	Cupboard (big)	01
6	White Board (size: 8ft. x 4ft.)	01
7	Trainer's Table	01
8	Trainer's Chair	01

ANNEXURE – II

INFRASTRUCTURE FOR ON-JOB TRAINING

TRADE: SHEET METAL WORKER

For Batch of 20 APPRENTICES

Actual training will depend on the existing facilities available in the establishments. However, the industry should ensure that the broad skills defined against On-Job Training part (i.e. 9 months + 9 months) are imparted. In case of any short fall the concern industry may impart the training in cluster mode/ any other industry/ at ITI.

ANNEXURE-III

GUIDELINES FOR INSTRUCTORS AND PAPER SETTERS

1. Due care to be taken for proper & inclusive delivery among the batch. Some of the following some method of delivery may be adopted:

A) LECTURE
B) LESSON
C) DEMONSTRATION
D) PRACTICE
E) GROUP DISCUSSION
F) DISCUSSION WITH PEER GROUP
G) PROJECT WORK
H) INDUSTRIAL VISIT

2. Maximum utilization of latest form of training viz., audio visual aids, integration of IT, etc. may be adopted.

3. The total hours to be devoted against each topic may be decided with due diligence to safety & with prioritizing transfer of required skills.