CURRICULUM

FOR THE TRADE OF

STRUCTURAL WELDER

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. NirmalyaNath., ADT

Sl. No.	Name & Designation Sh./Mr./Ms.	Organization	Expert Group Designation
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2.	M. Thamizharasan, JDT	CSTARI, Kolkata	Expert
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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**Structural Welder** trade]

Apprenticeship course in the trade of Structural Welder tradeis necessary due to following reasons:

- This course is meant forthe candidates who aspire to become a professional welder.

1. Weld structural steel in all positions.
2. Weld stainless steel and carbon steel and possibly other alloys.
3. Operate safety equipment and use safe work habits.
4. Lay out, position, align, and secure parts and assemblies prior to assembly, using straightedges, combination squares, calipers, flange line up pins, wrap arounds, center finders and rulers.
5. Examine work pieces for defects and measure work pieces with straightedges or templates to ensure conformance with specifications.
6. Recognize, set up, and operate hand and power tools common to the welding trade.
7. Clamp, hold, tack-weld, heat-bend, grind or bolt component parts to obtain required configurations and positions for welding.
8. Exceptional attendance.
9. Conduct activities in a safe and healthy manner and work in accordance with established safety and company requirements.
10. Perform set-up, material handling duties, and minor general maintenance.
11. Responsible for area housekeeping.
12. Participate in the processes of continuous improvement.
13. Ability to effectively perform similar position on the floor at any point in time.
14. Promote a positive working environment in order to achieve the organization's goals.
15. Ability to perform work in an uncontrolled atmosphere. Exposure to harsh conditions—such as: dust, fumes, chemicals, hazardous materials, noise, and varying weather and temperatures.

4. JOB ROLES: REFERENCE NCO

Brief description of Job roles:

Welder (Gas & Electric) while doing gas welding fuses metal parts together using welding rod and oxygen acetylene flame. Examines parts to be welded, cleans portion to be joined, holds them together by some suitable device and if necessary makes narrow groove to direct flow of molten metal to strengthen joint. Selects correct type and size of welding rod, nozzle etc. and tests welding, torch. Wears dark glasses and other protective devices while welding. Releases and regulates valves of oxygen and acetylene cylinders to control their flow into torch. Ignites torch and regulates flame gradually. Guides flame along joint and heat it to melting point, simultaneously melting welding rod and spreading molten metal along joint shape, size etc. and rectifies defects if any.

Welder (Gas & Electric) while doing Arc welding,fuses metals using arc-welding power source and electrodes. Examines parts to be welded, cleans them and sets joints together with clamps or any other suitable device. Starts welding power source and regulates current according to material and thickness of welding. Connect one lead to part to be welded, selects required type of electrode and clamps other lead to electrode holder. May join parts first at various points for holding at specified angles, shape, form and dimension by tack welding. Establish arc between electrode and joint and maintain it throughout the length of the joint.

Welder, Machine operates gas or electric welding machine to joint metal parts by fusion. Sets machine for operation by igniting burners and adjusting flames or by switching on current. Regulates flow of gas or current and adjusts machine according to material to be welded. Checks cooling system and adjusts movement of conveyor, if any. Feeds material to be welded with either one by one or in batch according to type of machine and welds them by pressing paddle, or by automatic arrangements. May use fixtures or other suitable devices for mass production work.

Structural Welder welds M.S. Sheet and M.S. Pipe by GAS welding process. Welds M.S. Plate in all position by SMAW process.Cuts Straight, Bevel & Circular on MS plate by Oxy-Acetylene cutting process. Undertake repair &maintenance works. Welds Fillet, Lap, T and Butt joint on MS Plates by SMAW welding in all position. Perform TIG&C0_2welding.Prepare and fit pipes for T, Y, K joints joint for SMAW.

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

i) NCO-2004: 7212.10
ii) NCO-2004: 7212.20
iii) NCO-2004: 7212.30

5. GENERAL INFORMATION

1. **Name of the Trade** **: STRUCTURAL WELDER**

2. **N.C.O. NCO-2004** :7212.10**,** 7212.20, 7212.30

3. **Duration of Apprenticeship Training**

(Basic Training + Practical Training) : 15 Months

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

a) Block –I : 3 months

Total duration of Basic Training: **3 months**

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

a) Block–I: 12 months

Total duration of Practical Training: **12 months**

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

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

4. **Entry Qualification** **:** Passed 10th class examination under 10+2 system of education or its equivalent

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

6. **Rebate for ITI passed trainees** **:** i) **Three months (**Basic training) in the trade of **Welder**

ii) **Three months(**Basic training) for Fabrication sector with advance module in **Structural Welding** under CoE.

Note: Industry may impart training as per above time schedule, 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 aspect is compromised.

6. COURSE STRUCTURE

Training duration details: -

Time (in months)	1-3	4-15
Basic Training	Block– I	-----
Practical Training (On - job training)	----	Block – I

Components of Training	Duration of Training in Months →														
↓	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Basic Training Block - I															
Practical Training Block - I															

7. SYLLABUS

7.1 BASIC TRAINING (BLOCK – I)

DURATION: 03 MONTHS

GENERAL INFORMATION

1) **Name of the Trade** :**Structural Welder**
2) **Hours of Instruction** : 500 Hrs.
3) **Batch size** : 20
4) **Power Norms** : 16 KW for Workshop
5) **Space Norms** : 80 Sq.m.
6) **Examination** : The internal assessment will beheld on completion of the eachBlock.
7) **Instructor Qualification** :

1.INSTRUCTORS' QUALIFICATION	: Degree in Mechanical / Metallurgy / Production Engineering/Mechatronics with one year experience in relevant field. **OR** Diploma in Mechanical and allied with two years experience in relevant field. **OR** 10th Class Pass + NTC/NAC in the Trade of "Welder" With 3 years post qualification experience in the relevant field.
2. DESIRABLE QUALIFICATION	**:** Preference will be given to a candidate with CIC (Craft Instructor Certificate) in Welder trade.

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

7.1.1 DETAILSYLLABUS OF CORE SKILL

Block– I
Basic Training

Sl.No.	Workshop Calculation and Science	Duration (hrs.)	Engineering Drawing	Duration (hrs.)
1.	**Unit**: Systems of unit- FPS, CGS, MKS/SI unit, unit of length, Mass and time, Conversion of units	20	Introduction to Engineering Drawing and Drawing Instruments : - Conventions - Viewing of engineering drawing sheets. - Method of Folding of printed Drawing Sheet as per BIS SP:46-2003 - 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
2.	**Basic Mathematics** - BODMAS rule Fraction-Addition, Subtraction, multiplication and Division-Problem solving, Decimal-Addition. Simple calculation using Scientific Calculator.		Lines : - Definition, types and applications in Drawing as per BIS SP:46-2003 - Classification of lines (Hidden, centre, construction, Extension, Dimension, Section) - Drawing lines of given length (Straight, curved) - Drawing of parallel lines, perpendicular line - Methods of Division of line segment	
3.	Conversion of Fraction to Decimal and vice-versa.		Free hand drawing of - Lines, polygons, ellipse, etc. - geometrical figures and blocks	

			withdimension Transferring measurement from the given object to the free hand sketches.	
4.	**Percentage**: Introduction, Simple calculation. Changing percentage to fraction and decimal & vice-versa.		Drawing of Geometrical Figures: Definition, nomenclature and practice of - Angle: Measurement and its types, method of bisecting. - Triangle -different types - Rectangle, Square, Rhombus, Parallelogram. - Circle and its elements.	
5.	**Material Science** : Definition, properties (physical & mechanical) and uses of Metal, Non-metal, Alloy &Insulator. Types of ferrous and Non-ferrous metals. Difference between Ferrous and Non-Ferrous metals.		Sizes and Layout of Drawing Sheets - Selection of sizes - Title Block, its position and content - Item Reference on Drawing Sheet (Item List)	
6.	**Mass, Weight and Density**: Mass, Unit of Mass, Weight, difference between mass and weight. Density, unit of density. Relation between mass, weight & density. Simple problems related to mass, weight, and density.		Method of presentation of Engineering Drawing - Pictorial View - Orthographic View - Isometric view	
7.	**Mensuration :** Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle,		- Drawing of Solid figures (Cube, Cuboids, Cone) with dimensions.	

	Volume of solids – cube, cuboid, cylinder and Sphere. Surface area of solids – cube, cuboid, cylinder and Sphere.			
8.	**Elasticity:** Elastic & Plastic material. Stress & strain and their units. Young's modules. Ultimate stress and breaking stress.		Free hand Drawing of Solid figures (Prism, Pyramid, Frustum of Cone and Pyramid.) with dimensions.	
9.	**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.		Free Hand sketch of hand tools and measuring tools used in respective trades.	
10.	**Basic Electricity:** Introduction and use of Electricity. AC, DC & their comparisons. Current, Voltage,Resistance& their units. Power, Energy & their units. Insulator and conductors & their uses.		Projections: - Concept of axes plane and quadrant. - Orthographic projections - Method of first angle and third angle projections (definition and difference) - Symbol of 1st angle and 3rd angle projection as per IS specification.	
11.	-----		Drawing of Orthographic projection in 3rd angle.	

7.1.2 DETAIL SYLLABUS OF PROFESSIONAL SKILLS & PROFESSIONAL KNOWLEDGE

Block –I

Basic Training Institute Level Training: - (03 Months)

Week no.	Practical	Theory
1.	- Importance of trade Training - Machinery used in the trade. - Introduction to safety equipment and their use etc. - Hack sawing, filing square to dimensions. - Marking out on MS plate and punching.	- General discipline in the institute - Elementary First Aid - Different process of metal joining methods: Bolting, riveting, soldering, brazing, seaming etc. - Safety precautions in Shielded Metal Arc Welding, and Oxy-Acetylene Welding and Cutting.
2.	- Setting up of Arc welding machine & accessories and striking an arc. - Setting of oxy-acetylene welding equipment, Lighting and setting of flame. - Fusion run without and with filler rod on M.S. sheet 2 mm thick in flat position by Oxy-Acetylene Welding(**OAW**). - Edge joint on MS sheet 2 mm thick in flat position without filler rod by OAW.	- Introduction and definition of welding. - Importance of Welding in Industry. - Arc and Gas Welding Equipments, tools and accessories - Arc and Gas Welding terms and definitions. - Role of stiffeners in controlling distortion.
3.	- Marking and straight line cutting of MS plate. 10 mm thick by Oxy Acetylene Gas Cutting (**OAGC**). - Straight line beads on M.S. plate 10 mm thick in flat position by SMAW. - Weaved bead on M. S plate 10mm thick in flat position by SMAW.	- Various Welding Processes and its applications. - Types of welding joints and its applications. Edge preparation and fit up for different thickness. - Surface Cleaning. - Recent advances in power sources which gives better penetration and better root fusion with minimum heat addition.
4.	- Square butt joint on M.S. sheet 2 mm thick in flat Position by OAW. - Fillet "T" joint on M.S. Plate 10 mm thick in flat position by SMAW.	- Basic electricity applicable to arc welding and related electrical terms & definitions. - Heat and temperature and its terms related to welding - Principle of arc welding. And characteristics of arc.
5.	- Beveling of MS plates 10 mm thick. By OAGC. - Open corner joint on MS sheet 2 mm	- Common gases used for welding & cutting, flame temperatures and uses.

	thick in flat Position by OAW. - Fillet lap joint on M.S. plate 10 mm thick in flat position by SMAW.	- Welding positions as per EN &ASME : Flat, Horizontal, Vertical and Overhead position. - Weld slope and rotation. - Welding symbols as per BIS & AWS.
6.	- Circular gas cutting on MS plate 10 mm thick by profile cutting machine. - Fillet "T" joint on MS sheet 2mm (OAW) and 10 mm (SMAW) thick in flat position. - Open Corner joint on MS plate 10 mm thick in flat position by SMAW.	- Arc welding power sources: Transformer, Motor Generator set, Rectifier and Inverter type welding machines and its care & maintenance. - Advantages and disadvantages of A.C. and D.C. welding machines.
7.	- Fillet Lap joint on MS sheet 2mm (OGW) and 10 mm (SMAW) thick in Flat position. - Single "V" Butt joint on MS plate 12 mm thick in flat position (1G) by SMAW.	- Principles of shielded metals arc welding, its advantages and limitations. - Arc length - types - effects of arc length. - Polarity: Types and applications. - Electrode: types, functions of flux, coating factor, sizes of electrode, Coding of electrode as per BIS, AWS. - Special purpose electrodes and their applications.
8.	- Structural pipe welding butt joint on MS pipe Ø 50 and 3mm WT in 1G position by OAW. - Fillet Lap joint on M.S. Plate 10 mm in vertical position by SMAW.	- Effects of moisture pick up. - Storage and baking of electrodes. - Arc blow - causes and methods of controlling. - Distortion in arc & gas welding and methods employed to minimize distortion - Arc Welding defects, causes and Remedies.
9.	- Single "V" Butt joint on MS plate 10mm thick in overhead position(4G) by SMAW. - Pipe butt joint on M. S. pipe 50mm WT 6mm (1G Rolled) by SMAW. - Square Butt joint on S.S. sheet. 2 mm thick in flat position by OAW.	- Specification of pipes, various types of pipe joints, pipe welding positions, and procedure. - Difference between pipe welding and plate welding. - Pipe development for Elbow joint, "T" joint, Y joint and branch joint. - Manifold system.
10.	- Setting up SMAW Welding equipment and making straight and weaving bead on MS in all positions. - Practice on plasma cutting. - Practice on gouging techniques.	- Classification of steel. - Welding of low, medium and highcarbon steel and alloy steels. - Effects of alloying elements on steel - Weldability of metals, importance of pre heating, post heating and maintenance of inter pass temperature.

		- Stainless steel: types- weld decay and Weldability.
11.	- Setting up GTAW welding equipment and making beading practice on MS in down hand position. - Square butt joint on M.S & SS sheet in down hand position.	- GTAW equipment. - Advantages of GTAW welding process. - Power source types AC/DC. - Types of polarity and application. - Accessories – HF unit and DC Suppressor. - GTAW Defects, Causes and Remedies. - Stress Relieving or Post Welding Heat Treatment (PWHT).
12.	- Practice on CO_2 welding. - Lap, T, Corner joints on GMAW process in down hand position.	- Introduction to GMAW, Flux cored arc welding - Power source - Wire feeder - Electrode wires - shielding gases. - Types of metal transfer and welding parameters - GMAW Defects , Causes and Remedies - Advantage and limitation
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**	**:**	**55Hrs.**
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

Block – I
Basic Training

Topic No.	Topic	Duration (in hours)
	English Literacy	**7**
1.	**Reading** Reading and understanding simple sentences about self, work and environment	
2.	**Writing** Construction of simple sentences Writing simple English	
3.	**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. 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	**10**
1.	**Basics of Computer** Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer.	
2.	**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. Use of External memory like pen drive, CD, DVD etc,	
3.	**Computer Networking and INTERNET** 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.	
	Communication Skill	**18**
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 - components-Para-language Body - language Barriers to communication and dealing with barriers.	
2	**Listening Skills** Listening-hearing and listening, effective listening, barriers to effective listening guidelines for effective listening.	

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.	
4	**Facing Interviews** Manners, Etiquettes, Dress code for an interview Do's & Don'ts for an interview	
	Entrepreneurship skill	**8**
1.	**Concept of Entrepreneurship** **Entrepreneurship**- Entrepreneurship - Enterprises:-Conceptual issue. Source of business ideas, Entrepreneurial opportunities, The process of setting up a business.	
2.	**Institutions Support** 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.	
	Productivity	
1.	**Productivity** Definition, Necessity.	
2.	**Affecting Factors** Skills, Working Aids, Automation, Environment, Motivation How improves or slows down.	
3.	**Personal Finance Management** Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and Insurance.	
	Occupational Safety, Health & Environment Education	**6**
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 andsafety measures.	
4	**First Aid** Care of injured & Sick at the workplaces, First-Aid & Transportation of sick person	
	Labour Welfare Legislation	
1	**Welfare Acts**	

	Benefits guaranteed under various acts- Factories Act, Apprenticeship Act, Employees State Insurance Act (ESI), Employees Provident Fund Act.	
	Quality Tools	**6**
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.	**House Keeping :** Purpose of Housekeeping, Practice of good Housekeeping.	
4.	**Quality Tools** Basic quality tools with a few examples	

7.2 PRACTICAL TRAINING (ON-JOB TRAINING)

(BLOCK – I)

DURATION: 12 MONTHS

GENERAL INFORMATION

1) **Name of the Trade** :**STRUCTURAL WELDER**

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 the block

ii) NCVT exam will be conducted at the end of Apprenticeship Training

4) **Instructor Qualification** :

(A) : Essential (any one of the below)

(i) NTC/NAC with Three years Experience in relevant field with Craft Instructors Training Certificate.

(ii) Diploma in Mechanical and allied with two years experience in relevant field.

(iii) Degree in Mechanical / Metallurgy / Production Engineering/Mechatronics with oneYear experience in relevant field.

(B) Desirable qualification: for (ii) & (iii) Craft Instructors Training Certificate.

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

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

BLOCK – I (Duration- 12 months)

The candidate should be competent to execute following operation/ skills after completion of the industrial training: -

1. Introduction to safety equipment used in structural welding and their use, setting up Gas cutting equipment and cutting MS Flats to required size.
2. Setting up SMAW Welding equipment and making straight and weaving bead on MS in all positions, Practice on plasma cutting, Practice on gouging techniques.
3. Weld joint preparation for fillet weld/Structural fitting (Cutting to size, fit up, tack weld etc.), Fillet, Lap and T joint on MS flat by SMAW, position - 1F, 2F, 3F, 4F & 5F.
4. Weld joint preparation for plate groove welding, Full penetration Single "V"butt joint on MS Flat by SMAW in 1G, 2G, 3G & 4G Positions, Root pass welding & LPI(Liquid Penetrant Inspection) testing, Cover pass welding & inspection.
5. Setting up GTAW welding equipment and making beading practice on MS in down hand position, Square butt joint on M.S, SS Sheet and Aluminium in down hand position. Root pass welding by TIG and LPI test, cover pass welding, inspection clearance.
6. M.S square butt Tube (Square or rectangular) welding and T,Y,K tube(Square or rectangular) joints by TIG welding.
7. Double bevel butt joint on MS Flats in dissimilar thickness in down hand positions by SMAW,Root Inspection, Back Gouging, Adopting weld sequence for controlling distortion.
8. Pipe Elbow and T joints on MS pipes by SMAW in flat position, Pipe Y and K connection on M.S. pipe by SMAW, positions – Horizontal.
9. Practice on CO_2 welding, Lap, T, Corner joints on GMAW process in down hand position.
10. Practice on Submerged Arc Welding machine - butt joint.
11. Dissimilar welding like SS and MS by SMAW/TIG.
12. Manufacturing of simple structures with L angles, channel and I & T sections using welding fixture by SMAW, Correction of distortion by cold &hot method.
13. Manufacturing of structures using M.S. Flat by SMAW, Adapting skip welding & back step welding method for controlling distortion.

14. Fabrication of pipe/cone on M.S. sheet by SMAW and Pressure pipe welding and joint by SMAW 5 F position and flange joints, M.S. pipe joint.
15. Weld test specimen - preparation as per a standard, Inspection & Testing. Preparation of WPS and PQR, weld inspection and test.
16. Root inspection by gouging, adopting weld sequence for controlling distortion, joints with dissimilar thickness.
17. **Ultrasonic Testing, Radiographic film reviewing:** Ultrasonic Testing, Radiographic film reviewing.

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 FOR APPRENTICE

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 and 10th standard,trainees can opt for CITS course.

Employment opportunities:

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

- Structural Fabrication like bridges, Roof structures, Building & construction.
- Automobile and allied industries
- Site construction activities for power stations, process industries and mining.
- Service industries like road transportation and Railways.
- Ship building and repair
- Infrastructure and defense organizations
- In public sector industries (Central/State) and private industries in India & abroad.
- Petrochemical industries.
- Self employment

ANNEXURE – I

TOOLS & EQUIPMENT FOR BASIC TRAINING

INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

TRADE:STRUCTURAL WELDER

LIST OF TOOLS & EQUIPMENTS FOR 20APPRENTICES

Trainees Tools Kit

SI. No.	Name of the items	Quantity
1	Welding helmet fiber	20 nos.
2	Welding hand shield fiber	20 nos.
3	Chipping hammer with metal handle 250 Grams	20 nos.
4	Chisel cold flat 19 mm x 150 mm	20 nos.
5	Centre punch 9 mm x 127 mm	20 nos.
6	Dividers 200 mm	20 nos.
7	Stainless steel rule 300mm	20 nos.
8	Scriber 150 mm double point	20 nos.
9	Flat Tongs 350mm long	20 nos.
10	Hack saw frame fixed 300 mm	20 nos.
11	File half round bastard 300 mm	20 nos.
12	File flat 350 mm bastard	20 nos.
13	Hammer ball pane 1 kg with handle	20 nos.
14	Tip Cleaner	20 nos.
15	Try square 6"	20 nos.

General Machinery Shop outfit

SI. No.	Name and Description of Tools	Quantity
16	Spindle key	4
17	Screw Driver 300mm blade and 250 mm blade	1 each
18	Number punch 6 mm	2 set
19	Letter punch 6 mm	2 set
20	Magnifying glass 100 mm . dia	2 nos
21	Universal Weld measuring gauge	2 nos
22	Earth clamp 600A	6 nos
23	Spanner D.E. 6 mm to 32mm	2 sets
24	C-Clamps 10 cm and 15 cm	2 each
25	Hammer sledge double faced 4 kg	1
26	S.S tape 5 meters flexible in case	1
27	Electrode holder 600 amps	6
28	H.P. Welding torch with 5 nozzles	2 sets
29	Oxygen Gas Pressure regulator double stage	2
30	Acetylene Gas Pressure regulator double stage	2
31	CO_2 Gas pressure regulator, with flow meter	1 set
32	Argon Gas pressure regulator with flow meter	1 set
33	Metal rack 182 cm x 152 cm x 45 cm	1
34	First Aid box	1
35	Steel lockers with 8 Pigeon holes	2
36	Steel almirah / cupboard	2
37	Black board and easel with stand	1
38	Flash back arrester (torch mounted)	4 pairs
39	Flash back arrester (cylinder mounted)	4 pairs
40	Auto Darkening Welding Helmet	2 nos.

General Installation

41	Welding Transformer with all accessories (400A , OCV 60 - 100 V, 60% duty cycle)	2 sets
42	Welding Transformer or Inverter based welding machine with all accessories (300A , OCV 60 - 100 V, 60% duty cycle)	1set
43	D.C Arc welding rectifiers set with all accessories (400 A. OCV 60 -100 V, 60% duty cycle)	2 sets
44	GMAW welding machine 400A capacity with air cooled torch, Regulator, Gas preheater, Gas hose and Standard accessories	1 set
45	AC/DC GTAW welding machine with water cooled torch 300 A, Argon regulator, Gas hose, water circulating system and standard accessories.	1 set
46	Air Plasma cutting equipment with all accessories, capacity to cut 25 mm clear cut	01 set
47	Air compressor 8 Bar	01 no
48	Power shearing machine	01 no
49	Portable abrasive cut-off machine	01 set

50	Pug cutting machine Capable of cutting Straight & Circular with all accessories	01 set
51	Pedestal grinder fitted with coarse and medium grain size grinding wheels dia. 300 mm	1
52	Bench grinder fitted with fine grain size silicon carbide green grinding wheel dia. 150 mm	1
53	AG 4 Grinder	2 Nos
54	Die penetrant testing kit	1 set
55	Suitable Arc welding table with positioner	7
56	Trolley for cylinder (H.P. Unit)	2
57	Hand shearing machine capacity to cut 6 mm sheets and flats	1
58	Power saw machine 18"	1
59	Portable drilling machine (Cap. 6 mm)	1
60	Oven, electrode drying 0 to 250°C, 10 kg capacity	1
61	Work bench 340x120x75 cm with 4 bench vices of 150 mm jaw opening	4 sets
62	Oxy Acetylene Gas cutting blow pipe	2 sets
63	Oxygen, Acetylene Cylinders	2 each*
64	CO_2 cylinder	1 No *
65	Argon gas cylinder	1 No *
66	Anvil 12 sq. inches working area with stand	1 No.
67	Swage block	1 No.
68	Fire buckets with stand	4 nos
69	Universal Testing Machine	1 set
70	Fire extinguishers (foam type and CO_2 type)	1
71	Suitable gas cutting table	1 No.
72	Welding Simulators for SMAW/GTAW/GMAW	1 each (Optional)

NOTE:

1. * Optionally Gas cylinders can also be hired as and when required
2. No additional items are required to be provided for unit or batch working in the Second shift except the items under trainee's tool kit and steel lockers.

Class Room Furniture for Trade Theory

Sl. No	Names & Description of Furniture	Quantity
1	Instructor's table and Chair (Steel)	1 set
2	Students chairs with writing pads	16
3	White board size 1200mm X 900 mm	1
4	Instructors lap top with latest configuration pre loaded with O.S and MS Office package.	1
5	LCD projector with screen.	1
6	Welding Process, Inspection & codes DVD/ CDs	1 set each (optional)

INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

TRADE: Structural Welder

LIST OF TOOLS& EQUIPMENTS FOR 20APPRENTICES

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	as required
2	Models : Solid & cut section	as required
3	Drawing Table for trainees	as required
4	Stool for trainees	as required
5	Cupboard (big)	01 no.
6	White Board (size: 8ft. x 4ft.)	01 no.
7	Trainer's Table	01 no.
8	Trainer's Chair	01 no.

ANNEXURE – II

INFRASTRUCTURE FOR ON-JOB TRAINING

TRADE: Structural Welder

For Batch of 20APPRENTICES

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. 12 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.