CURRICULUM

FOR THE TRADE OF

WELDER (GAS &ELECTRIC)

UNDER

APPRENTICESHIP TRAINING SCHEME

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. 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 **Welder（Gas & Electric）** trade]

Apprenticeship course in the trade of Welder **(**Gas & Electric**)** tradeis necessary due to following reasons:

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

1. It will enhance the ability to carry out surface preparation and welding at various positions e.g. Flat, Horizontal, Vertical and Overhead.
2. It will help the trainees to learn Oxy-acetylene welding, cutting torch and use of high pressure oxygen & acetylene cylinders/manifold with safety precautions.
3. It will enhance the ability to perform Gas welding on various objects, Brazing, Soldering of different joints of MS sheets.
4. It will help the trainees to appreciate Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) consequently enhances quality welding.
5. It will enhance the ability to select the welding process for a given application, understand welding defects and their prevention.
6. It will enhance the ability to set up and basic maintenance of various welding machines.
7. It will enhance the ability to use of different types of welding Electrodes, fluxes, their baking and drying.
8. It will enhance the ability to perform Shielded Metal Arc Welding, 1G/2G positions, groove/ fillet joints of MS parts in various positions.
9. It will enhance the ability to minimize distortion by weld sequence / heat input, Preheating & Post heating of welds, Reclamation of worn-out parts and Hard facing etc.
10. It will help the trainees to practice Gas Metal Arc Welding, Gas Tungsten Arc Welding, Purging techniques, Submerged Arc Welding, Resistance Spot and Seam Welding etc.
11. It will help the trainees to learn various methods of testing and inspection of welds and use of weld gauges.

4. JOB ROLES: REFERENCE NCO

Brief description of Job roles:

Welder (Gas & Electric) while doing gas weldingfuses 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 (Gas & Electric) operates spot welding machine to joint metal sheet by resistance welding method. Feeds metal sheets to be welded according to type of machine and welds them by pressing paddle, or by automatic arrangements.

Welder (Gas & Electric) while doing gas cutting, cuts metal to require shape and size by gas flame either manually or by machine. Examines material to be cut and marks it according to instruction of specification. Makes necessary connections and fits required size of nozzle in welding torch. Releases and regulates flow of gas in nozzle, ignites and adjusts flame. Guides flame by hand or machine along cutting line at required speed and cuts metal to required size.

Welder (Gas & Electric) while doing gas brazing, joints metal parts by heating using flux and filler rods. Cleans and fastens parts to be joined face to face by wire brush. Apply flux on the joint and heats by torch to melt filler rods into joint. Allows it to cool down. Clean and examines the joint.

Welder (Gas & Electric)while doing Gas Tungsten Arc welding also known as Tungsten Inert Gas (TIG) welding reads fabrication drawing, examines parts to be welded, cleans them and sets joints with clamps or any other suitable device. Selects suitable tungsten electrode, grinds the edges and fit in to the GTA welding torch. Selects gas nozzle and fit in to the GTA welding torch. Selects suitable filler rods and cleans them. Connects work piece with earth cable, Connects the machine with Inert gas Cylinder, regulator and flow meter. Starts the Constant current GTA welding machine, sets suitable welding current & polarity and inert gas flow. Establish arc through across a column of highly ionized inert gas between work piece and Tungsten electrode. Melts the metal and deposit weld beads on metal surfaces by passing the suitable filler rod in to the weld puddle. Joins metal pieces such as Steel, Stainless steel and Aluminiun metals.

Welder (Gas & Electric)while doing Gas Metal Arc welding also known as MIG/MAG Welding, reads fabrication drawing, examines parts to be welded, cleans them and sets joints with clamps or any other suitable device. Connects work piece with earth cable. Connects the machine with suitable gas Cylinder, regulator and flow meter.Connects preheater when CO2 is used as shielding gas. Selects suitable wire electrode, feed it to welding GMA Welding torch through wire feeder. Selects contact tip gas nozzle and fit in to the GMA welding torch. Preheats joints as required. Starts the Constant Voltage GMA welding machine, sets suitable welding voltage & wire feed speed and shielding gas flow, produces arc between work piece and continuously fed wire electrode. Melts the metal and deposit weld beads on the surface of metals or joins metal pieces such as Steel, and Stainless steel metals.

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: 7212.40
iv) NCO-2004: 7212.50
v) NCO-2004: 7212.65

5. GENERAL INFORMATION

1. **Name of the Trade** **: Welder (Gas & Electric**)

2. **N.C.O. NCO-2004** **:7212.10, 7212.20, 7212.40, 7212.50, 7212.65.**

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 8th Class Examination

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

6. **Rebate for ITI passed trainees** : i) **Three month** in the trade of **Welder**

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 and duration of industry training to be remain as 1 year.

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** :**Welder (Gas & Electric)**
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 on 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,		- Drawing of Solid figures (Cube, Cuboids, Cone) with dimensions.	

	circle, semi circle, Volume of solids – cube, cuboid, cylinder and Sphere. Surface area of solids – cube, cuboid, cylinder and Sphere.			
8.	**<u>Elasticity:</u>** 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: -

Week no.	Practical	Theory
1.	**Induction training:** - Familiarization with the Institute. - 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** - Importance of Welding in Industry - Safety precautions in Shielded Metal Arc Welding and Oxy-Acetylene Welding and Cutting. - Introduction and definition of welding. - Arc and Gas Welding Equipments, tools and accessories. - Arc and Gas Welding terms and definitions. Different process of metal joining methods: Bolting, riveting, soldering, brazing, seaming etc. - Types of welding joints and its applications.
2.	**Gas welding Practice** - Setting of oxy-acetylene welding equipment, Lighting and setting of flame. - Fusion run without and with fillerrod on M.S. sheet 2 mm thick in flat position. - Butt joint on MS sheet 2 mm thick in flat Position - Fillet "T" joint on MS sheet 2 mm thick in flat position	**Gas Welding** - Types of oxy-acetylene flames and uses. - Acetylene gas properties and generating methods. - Oxygen gas and its properties
3.	**Gas welding Practice** - Square Butt & Lap joint on M.S. sheet 2 mm thick by brazing - Silver brazing on copper tube to tube	**Gas Welding** - Oxygen and Dissolved Acetylene gas cylinders and Color coding for different gas cylinders. - Gas regulators, types and uses. - Difference between gas welding blow pipe and gas cutting blow pipe
4.	**Gas Cutting Practice** - Marking and straight line cutting of MS plate. 10 mm thick by gas. - Beveling of MS plates 10 mm thick by gas	**Gas Welding** - Gas welding techniques. Rightward and Leftward techniques. - Manifold system

	cutting.	- Gas welding filler rods, specifications and sizes. - Gas welding fluxes – types and functions. - Gas Brazing & Soldering : principles, types fluxes & uses - Gas welding defects, causes and remedies **Oxy-Acetylene Cutting-** Equipment principle, parameters and application.
5.	**MMAW Practices** - Setting up of Arc welding machine & accessories and Striking an arc - Straight line beads on M.S. plate 10 mm thick in flat position. - Weaved bead on M. S plate 10mm thick in flat position. - Fillet "T" joint on M.S. Plate 10 mm thick in flat position.	**MMAW** - Basic electricity applicable to arc welding and related electrical terms & definitions. - Principle of arc welding. - 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
6.	- Straight line beads and multi layer practice on M.S. Plate 10 mm thick in Horizontal position. - Fillet "T" joint on M.S. plate 10 mm thick in Horizontal position**.** - Straight line beads and multi layer practice on M.S. Plate 10 mm thick in Vertical position. - Weaved bead on M.S Plate 10mm in vertical position. -Fillet "T" joint on M.S. plate 10 mm thick in vertical position.	**MMAW** - Welding positions as per EN & ASME: flat, horizontal, vertical and over head position. - Welding symbols as per BIS & AWS. - Arc length – types – effects of arc length. - Polarity: Types and applications. - Arc blow – causes and methods of controlling.

7.	**GMAW Practices** - Setting up of GMAW welding machine & accessories and Striking an arc - Depositing straight line beads on M.S Plate. - Fillet weld – "T" joint on M.S plate 10mm thick in flat position by Dip transfer. - Fillet weld – "T" joint on M.S. sheet 3mmthick in flat position by Dip transfer.	**MMAW** - Electrode : types, functions of flux, coating factor, sizes of electrode Coding of electrode as per BIS, AWS, - Effects of moisture pick up. - Storage and baking of electrodes. - Arc Welding defects, causes and Remedies. - Safety precautions in Gas Metal Arc Welding and Gas Tungsten Arc welding. - Introduction to GMAW -equipment – accessories. - Advantages of GMAW welding over SMAW , limitations and applications - Process variables of GMAW. - Modes of metal transfer – dip or short circuiting transfer spray transfer and globular transfer and Pulsed metal transfer.
8.	**GMAW Practices** - Fillet weld – "T" joint on M.S plate 10mm thick in Horizontal position by Dip transfer. - Fillet weld – "T" joint on M.S. sheet 3mm thick in Horizontal position by Dip transfer. - Fillet weld – "T" joint on M.S plate 10mm thick in verticalposition by Dip transfer. - Fillet weld – corner joint on M.S. sheet 3mm thick in vertical position by Dip transfer. - Fillet weld – "T" joint on M.S sheet 3mm thick in over head position by Dip transfer.	**GMAW** - Wire feed system – types – care and maintenance. - Welding wires used in GMAW, standard diameter and codification as per AWS. - Types of shielding gases and gas mixtures used in GMAW and its applications. - Flux cored arc welding – description, advantage, welding wires, coding as per AWS. - GMAW defects, causes and remedies
9.	**GTAW practices:** - Depositing bead on Aluminium sheet 2 mm thick in flat position. - Square butt joint on Aluminium sheet 1.6mm thick in flat position.	**GTAW** - GTAW process -brief description Difference between AC and DC welding, equipments,polarities and applications. - Power sources for GTAW - AC & DC - Tungsten electrodes –types & uses, sizes and preparation - GTAW Torches- types, parts and their functions
10.	**GTAW practices:** - Fillet weld – "T" joint on Aluminium	**GTAW** - GTAW filler rods and selection criteria

	sheet1.6 mm thick in flat position. - Depositing bead on SS sheet 2 mm thick in flat position. - Fillet weld – "T" joint on Stainless steel sheet 1.6 mm thick in flat position.	- Edge preparation and fit up. - GTAW parameters for welding of different thickness of metals - Pulsed TIG welding - brief description, pulse parameters slope up and slope down. - Argon / Helium gas properties – uses. - GTAW Defects causes and remedy.
11-12	**Resistance welding practices:** - MS sheets joining by Resistance Spot welding	**Other Processes** - Resistance welding process -types, principles, power sources and welding parameters, Applications and limitations. - Submerged arc welding process – principles, equipment, advantages and limitations **Metals & Properties** - Classification of steel. - Welding of low, medium and high carbon steel and alloy steels. - Effects of alloying elements on steel - Weldability of metals and importance of pre heating, post heating - Stainless steel: types- weld decay and weldability. - Aluminium and its alloys, properties and weldability, Welding methods - Arc cutting & gouging, - Cast iron and its properties types. - Welding methods of cast iron.
13	**Testing practices** - Testing of weld joints by visual inspection . - Inspection of welds by using weld gauges. - Dye penetrant test, - Magnetic particle test. - Nick- break test. - Free bend test. - Fillet fracture test.	**Inspection** - Weld quality inspection, common welding mistakes and appearance of good and defective welds - Weld gauges & its uses - Types of Inspection methods - Classification of destructive and NDT methods - Welding codes and standards - Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR)

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** :**Welder (Gas & Electric)**

2) **Duration of On-Job Training** : As per Apprenticeship Act amended time to time.

3) **Batch size** :a) Apprentice selection as per Apprenticeship guidelines.
b) Maximum 20 candidates in a group.

4) **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

5) **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.

6) **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. Instructions in safety precautions on the shop floor and use of PPE.
2. Use of shop floor material handling equipments
3. Reading and interpreting of fabrication drawing & welding symbols. Interpret and apply mechanical drawings of layout/assemblies and perform measurements
4. Cutting of sheet metal to size
5. Edge preparation & fitting practices as applicable to the welder trade and assembling components using clamps, Jigs & Fixtures
6. Practice Oxy-acetylene welding & cutting (using Oxygen and acetylene cylinders/manifold system)observing safety guidelines
7. Practice Oxy-acetylene gauging.
8. Preparation of surfaces for welding
9. Gas welding and brazing of different joints of MS sheets in Down hand, horizontal & vertical positionsusing of different types of gas welding filler rods and flux
10. Braze welding of Cast iron in down held position (Optional)
11. Practice Silver alloy braze on similar and dissimilar metals.
12. Gas welding of pipe & tubes in different configuration
13. Significance of WPS and PQR, its variablesand Inspection Test Plan (ITP).
14. Identify Welding defects and their correction.
15. Baking and drying of welding electrodes
16. Groove and fillet joints of MS parts in down hand, horizontal, vertical and overhead positions by SMAW
17. Groove joints of grey cast iron/stainless steel parts in down hand positions by SMAW (optional)
18. Pipe joints in 1G & 2G positions by SMAW
19. Reclamation of worn-out parts by SMAW

20. Hard facing practice by SMAW
21. Preheating, post heating of welds and Post weld heat treatment of welds
22. Plasma cutting
23. Fillet and groove joints of MS parts in down hand, horizontal, vertical and overhead positions by GMAW
24. Fillet & groove joints by GMAW-Pulse and Flux Cored Arc Welding. (Optional)
25. Butt and Fillet joints of Aluminium and SS parts in down hand, horizontal and vertical positions by GTAW.
26. Welding of SS by purging techniques
27. Select operating parameters for the submerged arc welding(SAW)&weld thick plates by SAW
28. Welding of thin sheets by resistance spot and seam welding
29. Welding objects/assemblies according to drawing
30. Inspection and testing of welds and use of weld gauges
31. Testing of welds destructive and non destructive methods

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 ONE YEAR 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 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:WELDER (GAS AND ELECTRIC)
LIST OF TOOLS & EQUIPMENTS FOR 20APPRENTICES

A: TRAINEES TOOL 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.

B: INSTRUMENTS& GENERAL SHOP OUTFIT: -

SI. No.	Name and Description of Tools	Quantity
16	Spindle key	4 nos.
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 no.
26	S.S tape 5 meters flexible in case	1 no.
27	Electrode holder 600 amps	6 nos.
28	H.P. Welding torch with 5 nozzles	2 sets
29	Oxygen Gas Pressure regulator double stage	2 nos.
30	Acetylene Gas Pressure regulator double stage	2 nos.
31	CO_2 Gas pressure regulator, with flow meter	2 set
32	Argon Gas pressure regulator with flow meter	2 set
33	Metal rack 182 cm x 152 cm x 45 cm	1 no.
34	First Aid box	1 no.
35	Steel lockers with 8 Pigeon holes	2 nos.
36	Steel almirah / cupboard	2 nos.
37	Black board and easel with stand	1 no.
38	Flash back arrester (torch mounted)	4 pairs
39	Flash back arrester (cylinder mounted)	4 pairs

General Installation

40	Welding Transformer with all accessories (400A, OCV 60–100 V, 60% duty cycle)	1 set
41	Welding Transformer (or) Inverter based welding machine with all accessories (300A , OCV 60 – 100 V, 60% duty cycle)	1 set
42	D.C Arc welding rectifiers set with all accessories (400 A. OCV 60 – 100 V, 60% duty cycle)	1 sets
43	GMAW welding machine 400A capacity with air cooled torch, Regulator, Gas preheater, Gas hose and Standard accessories	1 set
44	AC/DC GTAW welding machine with water cooled torch 300 A, Argon regulator, Gas hose, water circulating system and standard accessories.	1 set
45	Air Plasma cutting equipment with all accessories, capacity to cut 12 mm clear cut	01 set
46	Air compressor suitable for above air plasma cutting system.	01 no
47	Auto Darkening Welding Helmet	2 nos.
48	Spot welding machine to 15 KVA with all accessories	01 set
49	Portable gas cutting machine capable of cutting Straight & Circular with all accessories	01 set
50	Pedestal grinder fitted with coarse and medium grain size grinding	1 no.

	wheels dia. 300 mm	
51	Bench grinder fitted with fine grain size silicon carbide green grinding wheel dia. 150 mm	1 no.
52	AG 4 Grinder	2 Nos
53	Suitable gas welding table with fire bricks	2 Nos
54	Suitable Arc welding table with positioner	6 nos.
55	Trolley for cylinder (H.P. Unit)	2 nos.
56	Hand shearing machine capacity to cut 6 mm sheets and flats	1 no.
57	Power saw machine 14''	1 no.
58	Portable drilling machine (Cap. 6 mm)	1 no.
59	Oven, electrode drying 0 to 350°C, 10 kg capacity	1 no.
60	Work bench 340x120x75 cm with 4 bench vices of 150 mm jaw opening	4 sets
61	Oxy Acetylene Gas cutting blow pipe	2 sets
62	Oxygen, Acetylene Cylinders	2 each*
63	CO_2 cylinder	2 Nos. *
64	Argon gas cylinder	2 Nos. *
65	Anvil 12 sq. inches working area with stand	1 No.
66	Swage block	1 No.
67	Die penetrant testing kit	1 set
68#	Magnetic particle testing Kit	1 set
69	Fire extinguishers (foam type and CO_2 type)	1 no.
70	Fire buckets with stand	4 nos.
71	Portable abrasive cut-off machine	1 no.
72	Suitable Gas cutting table	1 no.
73	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.

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: Welder (Gas & Electric)

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: Welder (Gas & Electric)

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.