ARMOUR WELDER

COMPETENCY BASED CURRICULUM

(Duration: 1 Yr. 3 Months)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL- 4

SECTOR – STRATEGIC MANUFACTURING

सत्यमेव जयते

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

Directorate General of Training

Skill India
कौशल भारत-कुशल भारत

ARMOUR WELDER

(Designed in 2020)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL - 4

Developed By

Ministry of Skill Development and Entrepreneurship
Directorate General of Training
Sectoral Trade Course Committee of Strategic Manufacturing
&
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
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1. Ordnance Factory Medak.
2. Bharat Dynamics Limited, Hyderabad
3. MIDHANI, Hyderabad
4. DRDO-Advanced System Lab, Hyderabad
5. Hindustan Aeronautics Limited, Hyderabad
6. Hindustan Machine Tools, Hyderabad.

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CONTENTS

1. BACKGROUND

1.1 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.

1.2 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.

1.3 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.

2. TRAINING SYSTEM

2.1 GENERAL

Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers range of vocational training courses catering to the need of different sectors of economy/ Labour market. The vocational training programmes are delivered under aegis of National Council of Vocational Training (NCVT). Craftsman Training Scheme (CTS) and Apprenticeship Training Scheme (ATS) are two pioneer programmes of NCVT for propagating vocational training.

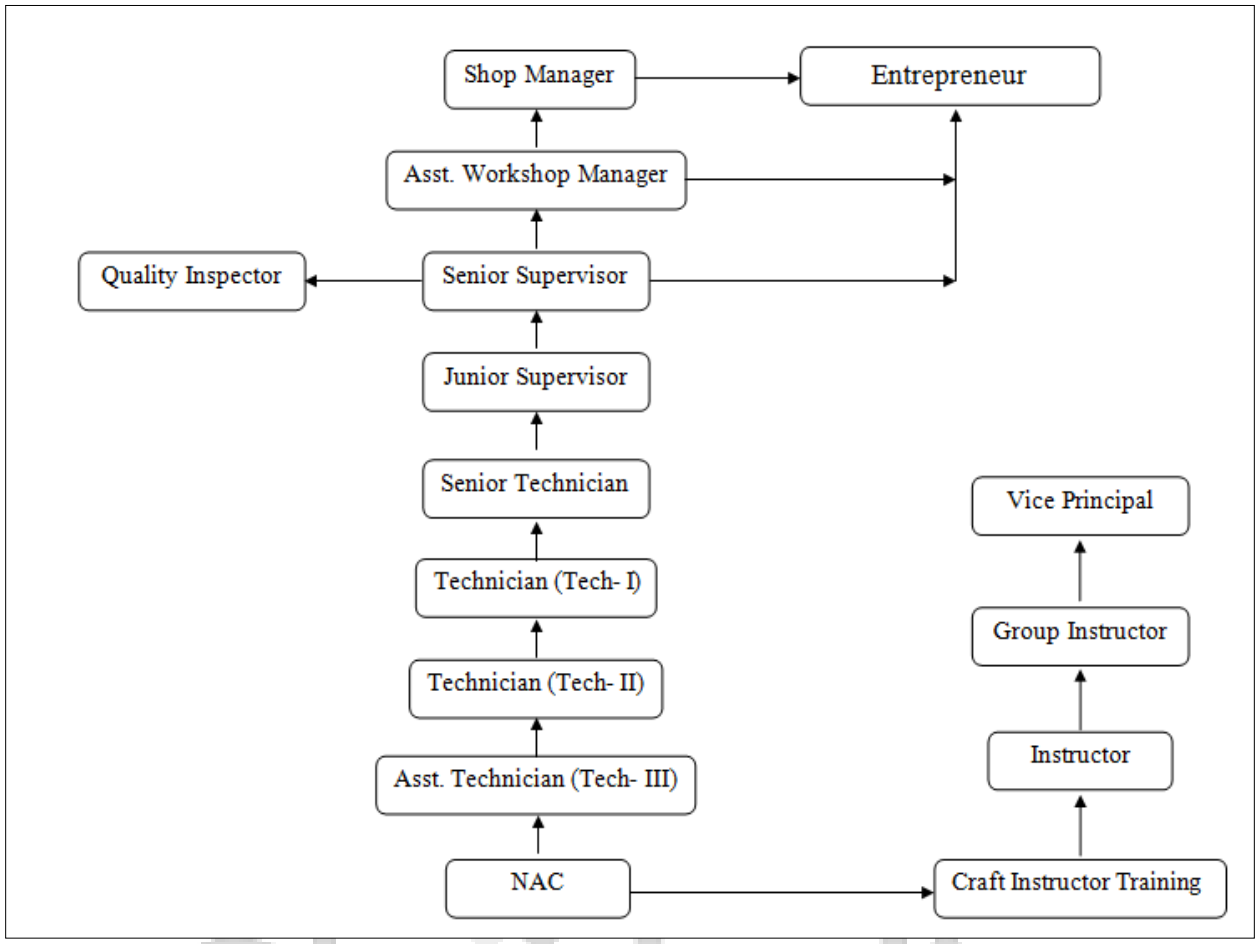
ARMOUR WELDER trade under ATS is one of the most popular courses delivered nationwide through different defence industries/establishments. The course is of 01 year (01 Block of 12 months) duration. After passing out the training programme, the trainee is being awarded National Apprenticeship Certificate (NAC) by NCVET having worldwide recognition.

Broadly candidates need to demonstrate that they are able to:

- Read & interpret technical parameters/document, plan and organize work processes, identify necessary materials and tools;
- Perform task with due consideration to safety rules, accident prevention regulations and environmental protection stipulations;
- Apply professional skill and knowledge, core skills & Entrepreneurship skills while performing jobs and solve problem during execution.
- Check the job/assembly as per drawing for functioning, identify and rectify errors in job/assembly.
- Document the technical parameters related to the task undertaken.

2.2 CAREER PROGRESSION PATHWAYS:

- Direct employment opportunities in welding area in Industries.
- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming instructor in ITIs.
- Further can grow and become an entrepreneur.



2.3 COURSE STRUCTURE:

Table below depicts the distribution of training hours across various course elements during a period of one year (*Basic Training and On-Job Training*): -

Total training duration details: -

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

A. Basic Training

For 02 yrs. course (Engg) :-(**Total 06 months:** 03 months in 1st yr. + 03 months in 2nd yr.)

For 01 yr. course (Engg) :-(**Total 03 months:** 03 months in 1st yr.)

S No.	Course Element	Total Notional Training Hours	
		For 02 Yrs. course	For 01 Yr. course
1.	Professional Skill (Trade Practical)	550	275
2.	Professional Knowledge (Trade Theory)	240	120
3.	Workshop Calculation & Science	40	20
4.	Engineering Drawing	60	30
5.	Employability Skills	110	55
	Total (Including internal assessment)	**1000**	**500**

B. On-Job Training: -

For 02 yrs. Course (Engg) :-(**Total 18 months:** 09 months in 1st yr. + 09 months in 2nd yr.)
Notional Training Hours for On-Job Training: 3120 Hrs.
For 01 yr. course (Engg) :-(**Total 12 months**)
Notional Training Hours for On-Job Training: 2080 Hrs.

C. Total training hours:-

Duration	Basic Training	On-Job Training	Total
For 01 yr. course (Engg)	500 hrs.	2080 hrs.	2580 hrs.
For 02 yrs. course (Engg)	1000 hrs.	3120 hrs.	4120 hrs.

2.4 ASSESSMENT & CERTIFICATION:

The trainee will be tested for his skill, knowledge and attitude during the period of course and at the end of the training programme as notified by Govt of India from time to time. The Employability skills will be tested in first two semesters only.

a) The **Internal assessment** during the period of training will be done by **Formative assessment method** by testing for assessment criteria listed against learning outcomes. The training institute have to maintain individual *trainee portfolio* as detailed in assessment guideline (Section 2.4.2). The marks of internal assessment will be as per the template (Annexure – II).

b) The final assessment will be in the form of summative assessment method. The All India Trade Test for awarding NAC will be conducted by NCVT on completion of course as per guideline of Govt of India. The pattern and marking structure is being notified by govt of India from time to time. **The learning outcome and assessment criteria will be basis for setting**

question papers for final assessment. The examiner during final examination will also check individual trainee's profile as detailed in assessment guideline (Section 2.4.2) before giving marks for practical examination.

2.4.1 PASS REGULATION

The minimum pass percent for Practical is 60% & minimum pass percent for Theory subjects 40%. The candidate pass in each subject conducted under all India trade test.

2.4.2 ASSESSMENT GUIDELINE

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

Assessment will be evidence based comprising the following:

- Job carried out in labs/workshop
- Record book/ daily diary
- Answer sheet of assessment
- Viva-voce
- Progress chart
- Attendance and punctuality
- Assignment

Evidences of internal assessments are to be preserved until forthcoming semester examination for audit and verification by examination body. The following marking pattern to be adopted while assessing:

Performance Level	Evidence
(a) Weightage in the range of 60 -75% to be allotted during assessment	
For performance in 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.	• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment • Below 70% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards.

	• 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	
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.	• Good skill levels in the use of hand tools, machine tools and workshop equipment • 70-80% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • 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	
For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship.	• High skill levels in the use of hand tools, machine tools and workshop equipment • Above 80% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • A high level of neatness and consistency in the finish. • Minimal or no support in completing the project.

3. JOB ROLE

Brief description of Job roles:

The Armour Welder is responsible for set-up, layout, tack-up and finish weld of various weldments and components. They must be able to tack up and weld to exact tolerances and finish product with grinders. The Armour Welder will be reading blue prints and specific weld symbols. They have to follow welding standards for welding calculations, Selection of Armour material, welding material, follow the preparation methods for weld and Heat treatment and testing. Armour material cutting, cleaning, Preparation of edges, and preparation and welding practice.

They have to practice safety equipment and their uses in day to day activities. Setting up of GMAW welding machine & accessories and striking an arc. Depositing straight line beads on Armour Plate. Follows the work process sheet for selection of materials and suitable welding materials. Types of joints / types of positions, safety precaution while welding. Edge preparations and cleaning with cleaning agent. Welding methods. Flat, vertical, horizontal and overhead positions. Baking the electrodes to avoid moisture with baking temperature in Oven. Testing like, visual inspections or NDT. To weld the Armour Plate, they have thorough knowledge and skills on Armour plates, Armour materials, Armour electrodes, welding Machines with accessories for quality of Armour weldments.

Testing of weld joints by visual inspection. Inspection of welds by using weld gauges. Perform on the armour plate, different positions. Check the weld defects. After completion of weld need for testing.

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

Reference NCO 2015: 7212.0302
7212.0303

4. NSQF LEVEL COMPLIANCE

NSQF level for Armour Welder trade under ATS: **Level 4**

As per notification issued by Govt. of India dated- 27.12.2013 on National Skill Qualification Framework total 10 (Ten) Levels are defined.

Each level of the NSQF is associated with a set of descriptors made up of five outcome statements, which describe in general terms, the minimum knowledge, skills and attributes that a learner needs to acquire in order to be certified for that level.

Each level of the NSQF is described by a statement of learning outcomes in five domains, known as level descriptors. These five domains are:

a. Process
b. professional knowledge,
c. professional skill,
d. core skill and
e. Responsibility.

The Broad Learning outcome of Armour Welder trade under ATS mostly matches with the Level descriptor at Level- 4

The NSQF level-4 descriptor is given below:

Level	Process Required	Professional Knowledge	Professional Skill	Core Skill	Responsibility
Level 4	Work in familiar, predictable, routine, situation of clear choice.	Factual knowledge of field of work or study.	Recall and demonstrate practical skill, routine and repetitive in narrow range of application, using appropriate rule and tool, using quality Concepts.	Language to communicate written or oral, with required clarity, skill to basic Arithmetic and algebraic principles, basic understanding of social political and natural Environment.	Responsibility for own work and learning.

5. GENERAL INFORMATION

Name of the Trade	**Armour Welder**
NCO - 2015	7212.0302, 7212.0303
NSQF Level	Level – 4
Duration of Apprenticeship Training (Basic Training + On-Job Training)	3 months + 1 year (01 Block of 15 months duration including basic training)
Duration of Basic Training	a) Block – I: 3 months **Total duration of Basic Training: 3 months**
Duration of On-Job Training	a) Block– I: 12 months **Total duration of Practical Training: 12 months**
Entry Qualification	Passed 8th class Examination.
Selection of Apprenticeship	The apprentices will be selected as per Apprenticeship Act amended time to time.
Instructors Qualification for Basic Training	As per ITI instructors qualifications as amended time to time for the specific trade.
Infrastructure for basic Training	As per related trade of ITI
Examination	The internal examination/ assessment will be held on completion of each block. Final examination for all subjects will be held at the end of course and same will be conducted by NCVT.
Rebate to Ex-ITI Trainees	3 Months Basic Training
CTS trades eligible for Armour Welder Apprenticeship	ITI Pass in Welder, Welder (GMAW & GTAW), Welder (Pipe), Welder (Structural), Welder (Fabrication & Fitting), Welder (Welding & Inspection)

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.*
- *For imparting Basic Training the industry to tie-up with ITIs having such specific trade and affiliated to NCVT.*

6. LEARNING OUTCOME

6.1 GENERIC LEARNING OUTCOME

The following are minimum broad Common Occupational Skills/ Generic Learning Outcome after completion of the Armour Welder course of 01 years 03 months duration under ATS.

Block I:-

1. Recognize & comply safe working practices, environment regulation and housekeeping.
2. Understand and explain different mathematical calculation & science in the field of study including basic electrical. [Different mathematical calculation & science - Unit, Basic Mathematics, Percentage, Material Science, Mass, Weight and Density, Mensuration, Elasticity, Heat & Temperature, Basic Electricity etc.]
3. Interpret specifications, different engineering drawing and apply for different application in the field of work. [Different engineering drawing-Lines, Free hand drawing, Drawing of Geometrical Figures, Sizes and Layout of Drawing Sheets, Method of presentation of Engineering Drawing, Drawing of Solid figures, Free hand Drawing of Solid figures, Free Hand sketch, Projections, Drawing of Orthographic projection in 3rd angle.]
4. Select and ascertain measuring instrument and measure dimension of components and record data.
5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.
6. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.
7. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.
8. Plan and organize the work related to the occupation.

6.2 SPECIFIC LEARNING OUTCOME

Block – I

9. Demonstrate workshop safety measures & First aid.
10. Understand setting of different welding machines and equipment.
11. Demonstrate Welding and cutting of metal plate by gas using appropriate welding equipment.
12. Demonstrate different joint (viz. Lap joint, corner joint, "T" joint, butt joint, etc.) on metal plate by GMAW Welding processes.
13. Demonstrate different joint (viz. Lap joint, corner joint, "T" joint, butt joint, etc.) on metal plate by GTAW Welding processes.

14. Demonstrate cutting of armour plates and edge preparation of armour plates.
15. Demonstrate Structural welding on pipe and plate.
16. Perform welding inspection, identify weld defects and its rectification.

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

7. LEARNING OUTCOME WITH ASSESSMENT CRITERIA

GENERIC LEARNING OUTCOME	
LEARNING OUTCOMES	**ASSESSMENT CRITERIA**
1. Recognize & comply safe working practices, environment regulation and housekeeping.	1. 1. Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements.
	1. 2. Recognize and report all unsafe situations according to site policy.
	1. 3. Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures.
	1. 4. Identify, handle and store / dispose off dangerous/unsalvageable goods and substances according to site policy and procedures following safety regulations and requirements.
	1. 5. Identify and observe site policies and procedures in regard to illness or accident.
	1. 6. Identify safety alarms accurately.
	1. 7. Report supervisor/ Competent of authority in the event of accident or sickness of any staff and record accident details correctly according to site accident/injury procedures.
	1. 8. Identify and observe site evacuation procedures according to site policy.
	1. 9. Identify Personal Productive Equipment (PPE) and use the same as per related working environment.
	1. 10. Identify basic first aid and use them under different circumstances.
	1. 11. Identify different fire extinguisher and use the same as per requirement.
	1. 12. Identify environmental pollution & contribute to avoidance of same.
	1. 13. Take opportunities to use energy and materials in an environmentally friendly manner

	1. 14.	Avoid waste and dispose waste as per procedure
	1. 15.	Recognize different components of 5S and apply the same in the working environment.
2. Understand and explain different mathematical calculation & science in the field of study including basic electrical. *[Different mathematical calculation & science - Unit, Basic Mathematics, Percentage, Material Science, Mass, Weight and Density, Mensuration, Elasticity, Heat & Temperature, Basic Electricity etc.]*	2.1	Explain concept -Unit, Basic Mathematics, Percentage, Material Science, Mass, Weight and Density, Mensuration, Elasticity, Heat &Temperature, Basic Electricity,
	2.2	Measure dimensions as per drawing
	2.3	Use scale/ tapes to measure for fitting to specification.
	2.4	Comply given tolerance.
	2.5	Prepare list of appropriate materials by interpreting detail drawings and determine quantities of such materials.
	2.6	Ensure dimensional accuracy of assembly by using different instruments/gauges.
	2.7	Explain basic electricity, insulation & earthing
3. Interpret specifications, different engineering drawing and apply for different application in the field of work. *[Different engineering drawing-Lines, Free hand drawing, Drawing of Geometrical Figures, Sizes and Layout of Drawing Sheets, Method of presentation of Engineering Drawing, Drawing of Solid figures, Free hand Drawing of Solid figures, Free Hand sketch, Projections, Drawing of Orthographic projection in 3rd angle.]*	3.1	Read & interpret the information on drawings and apply in executing practical work.
	3.2	Read &analyse the specification to ascertain the material requirement, tools, and machining /assembly /maintenance parameters.
	3.3	Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.

4. Select and ascertain measuring instrument and measure dimension of components and record data.	4.1 Select appropriate measuring instruments as per tool list.
	4.2 Ascertain the functionality & correctness of the instrument.
	4.3 Measure dimension of the components & record data to analyse with the given drawing/measurement.
5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.	5.1 Explain the concept of productivity and quality tools and apply during execution of job.
	5.2 Understand the basic concept of labour welfare legislation and adhere to responsibilities and remain sensitive towards such laws.
	5.3 Knows benefits guaranteed under various acts
6. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.	6.1 Explain the concept of energy conservation, global warming, pollution and utilize the available recourses optimally & remain sensitive to avoid environment pollution.
	6.2 Dispose waste following standard procedure.
7. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.	7. 1. Explain personnel finance and entrepreneurship.
	7. 2. Explain 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.
	7. 3. Prepare Project report to become an entrepreneur for submission to financial institutions.
8. Plan and organize the work related to the occupation.	8. 1. Use documents, drawings and recognize hazards in the work site.
	8. 2. Plan workplace/ assembly location with due consideration to operational stipulation
	8. 3. Communicate effectively with others and plan project tasks
	8. 4. Assign roles and responsibilities of the co-trainees

	for execution of the task effectively and monitor the same.
SPECIFIC OUTCOME	
*Assessment Criteria i.e. the standard of performance, for each specific learning outcome must ensure that the trainee works in familiar surroundings where nature of job is routine type, situation of clear choice & predictable. Assessment criteria should broadly cover the aspect of **Planning** (Identify, ascertain, etc.); **Execution** (apply factual knowledge of field of knowledge, recall and demonstrate practical skill during performing the work in routine and repetitive in narrow range of application, using appropriate rule and tool, complying basic arithmetic and algebraic principles and language to communicate in written or oral with required clarity; **Checking/ Testing** to ensure functionality during the assessment of each outcome. The assessments parameters must also ascertain that the candidate is responsible for his/her own work and learning.*	

8. SYLLABUS

BASIC TRAINING (Block – I)

Duration: (03) Three Months

Week no.	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
1	**Induction Training** - 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** - Elementary First Aid - Different process of metal joining methods: Bolting, riveting, soldering, brazing, seaming etc. - 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.
2	- Setting up of Arc welding machine & accessories and striking an arc. - Setting of oxy-acetylene welding equipment, Lighting and setting of flame. - Setting up of GMAW/GTAW welding machine & accessories.	- Various Welding Processes and its applications. - Types of welding joints and its applications. - Edge preparation and fit up for different thickness, Surface Cleaning. - Safety precautions in Shielded Metal Arc Welding, and Oxy-Acetylene Welding and Cutting. - Safety precautions pertaining to GTAW & GMAW. - Role of stiffeners in controlling distortion.
3	**Gas Welding & Cutting Practice** - Fusion run without and with filler rod on M.S. sheet 2 mm thick in flat position. - Edge joint on MS sheet 2 mm thick in flat position without filler rod. - Marking and straight line cutting of MS plate. 10 mm thick by gas.	**Gas Welding And Cutting** - Common gases used for welding & cutting, flame temperatures and uses. - Chemistry of oxy-acetylene flame. - Types of oxy-acetylene flames and uses. - Oxy-Acetylene Cutting Equipment, principle, parameters and application. - Color coding for different gas cylinders. - Gas regulators, types and uses. - Purging: Importance, Method of

		giving. -Oxy acetylene gas welding Systems (Low pressure and High pressure). - Difference between gas welding blow pipe (LP & HP) and gas cutting blow pipe.
4	**Gas Welding Practice** - Straight line beads on M.S. plate 10 mm thick in flat position. - Weaved bead on M. S plate 10mm thick in flat position. - Square butt joint on M.S. sheet 2 mm thick in flat Position . - Fillet "T" joint on M.S. Plate 10 mm thick in flat position.	**Gas Welding And Cutting** - Gas welding techniques. Rightward and Leftward techniques. - 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.
5	**GMAW Practices** - Straight line beads on MS plate by GMAW welding. - Lap joint on MS plate by GMAW welding in down hand position. - Open corner joint on MS plate in down hand position. - "T" joint on MS sheet in flat position by GMAW welding.	**GMAW** - 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. - 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. - Welding positions as per EN & ASME flat, horizontal, vertical and over head position. - Weld slope and rotation. - Welding symbols as per BIS & AWS. - Recent advances in power sources which gives better penetration and better root fusion with minimum heat addition.
6	**GMAW Practices** - "T" joint on MS sheet in horizontal, vertical, overhead positionby GMAW welding. - CO2 straight line bead, different position of CO2, Single "V' butt joint by	**GMAW** - Introduction to GMAW -equipment - accessories. - Various names of the process. (MIG- - MAG/ CO2 WELDING, FCAW). - Advantages& Limitations

	CO2 welding in down hand position, Single "V' butt joint by Argoshield welding in flat position (Gas: Argon and CO2 mixture).	- Trouble shooting in MIG welding - 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. - Special purpose electrodes and their applications. - Types of weld defects, causes and remedy in GMAW process. - Data and Tables related to CO2 welding.
7	**GTAW Practices** - Setting up GTAW welding plant and establishing the arc. - Beading practice on MS sheet by GTAW.	**GTAW** - Introduction to GTAW welding. - Various names of the process.(TIG, Argon arc welding). - Equipments& accessories. - Advantages & Limitations. - Reading of Welding procedure specifications (WPS). - Reading of Procedure qualification Record (PQR)
8	**GTAW Practices** - Square butt joint on MS in down hand position. - Beading practice on SS, aluminum by TIG/GTAW.	**GTAW** - Arc length - types - effects of arc length. - Polarity: Types and applications. - Tungsten electrode, Types, sizes, and uses. coding as per BIS,AWS. - Type of shielding gases- Types & properties.
9	**GTAW Practices** - Open corner joint on MS sheet in down hand position. - Lap joint on MS sheet in down hand position by GTAW. - Tee joint on MS sheet in down hand position. - Lap joint on MS sheet in Horizontal position by GTAW.	**GTAW** - GTAW Welding consumables-Types & Specifications as per BIS & AWS - Tables & data relating to TIG welding. - Different type of weld joints- plates & pipes - Advantages of root pass welding of pipes by TIG welding - Types of weld defects, causes and remedy in GTAW process.
10	**Preparation of Armour Materials.** - General practice on oxygen torch cutting machine. - Demonstration on modern techniques for cutting of armour	**Preparation of Armour Materials** - Basic composition of Armour material and their properties. - Understand cutting armour plate – cutting homogeneous armour

	welding plates on CNC laser cutting Machine and CNC plasma cutting machine. - Demo on edge preparation of the armour plates and practice on removing burrs and spatters by angular grinder.	plate, cutting face hardened armour plate. - Understand the cutting of armour materials by modern machines. - To understand the edge preparation parameters – Thickness, material, welding process, extent of penetration required, welding distortion and cost. - Material thickness in mm, type of joint welding current, different positions and diameter of electrode.
11	**Structural Welding Practice** - Structural pipe welding butt joint on MS pipe 0 50 and 3mm WT in 1G position. - Fillet Lap joint on M.S. Plate 10 mm in vertical position	**Metals & Properties** - Classification of steel. - Welding of low, medium and high carbon steel and alloy steels. - Effects of alloying elements on steel - Basic welding metallurgy. - Weldability of metals, Importance of pre-heating, post heating and maintenance of inter pass temperature. - Stainless steel types - Weld decay and Weldability. - Arc blow - causes and methods of controlling. - Distortion in arc & gas welding and methods employed to minimize distortion. - Arc Welding defects, causes and Remedies. - Preheating and Post heating. - Distortion and methods of control. - Stress Relieving or Post Welding Heat Treatment (PWHT).
12	**Testing Practices** Dye penetrant Magnetic particle testing	**Inspection** - Inspection & testing of weldments. - Visual inspection methods. - Inspection kits - universal gauge, Fillet gauge, etc. - Non-destructive Testing methods.

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		- PT, MPT, UT & RT. - Destructive testing - Bend test & tensile test.
	Assessment/Examination 03days	

NOTE: -

More emphasis to be given on video/real-life pictures during theoretical classes. Some real-life pictures/videos of related industry operations may be shown to the trainees to give a feel of Industry and their future assignment.

9. SYLLABUS - CORE SKILLS

9.1 WORKSHOP CALCULATION SCIENCE & ENGINEERING DRAWING

Block – I		
Sl. No.	**Workshop Calculation and Science (Duration: - 20 hrs.)**	**Engineering Drawing (Duration: - 30 hrs.)**
1.	**Unit**: Systems of unit- FPS, CGS, MKS/SI unit, unit of length, Mass and time, Conversion of units	**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.
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 with dimension 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	**Sizes and Layout of Drawing Sheets** - Selection of sizes - Title Block, its position and content - Item Reference on Drawing Sheet (Item List)

	metals. Difference between Ferrous and Non-Ferrous metals.	
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, Volume of solids – cube, cuboid, cylinder and Sphere. Surface area of solids – cube, cuboid, cylinder and Sphere.	**Drawing of Solid figures** (Cube, Cuboids, Cone) with dimensions.
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.

9.2 EMPLOYABILITY SKILLS

(DURATION: - 55 HRS.)

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, nonverbal, written, email, talking on phone. Nonverbal 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 and safety 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	

10. DETAILS OF COMPETENCIES (ON-JOB TRAINING)

The **competencies** on completion of On-Job Training are detailed below: -

Block – I

1. Identify precautions to be followed while working in welding jobs.
2. Use shop floor material handling equipment.
3. Read and interpret fabrication drawing & welding symbols. Interpret and apply mechanical drawings of layout/assemblies and perform measurements.
4. Ensure edge preparation & fitting practices as applicable to the armour welder trade and assembling components using clamps, Fixtures and Manipulators.
5. Perform Oxy-acetylene welding & cutting (using Oxygen and acetylene cylinders) observing safety guidelines.
6. Practice Oxy-acetylene gauging.
7. Prepare surfaces for armour welding.
8. Perform SMAW welding of different joints of Armour plates in down hand, horizontal & vertical positions using armour welding electrodes.
9. Identify Welding defects and their correction.
10. Perform Baking and drying of welding electrodes.
11. Perform Groove and fillet joints of Armour components in down hand, horizontal, vertical and overhead positions by SMAW.
12. Prepare Pipe joints in 1G & 2G positions by SMAW.
13. Perform Preheating, post heating of welds and Post weld heat treatment.
14. Check Fillet and groove joints of Armour parts in down hand, horizontal by GMAW and MMAW.
15. Perform Butt and Fillet joints of Aluminium (Bullet Proof) in down hand, horizontal and vertical positions by GTAW or TIG welding.
16. Apply the techniques of Welding Inspection and NDT test.

Note:

1. Industry must ensure that above mentioned competencies are achieved by the trainees during their on-job training.
2. In addition to above competencies/outcomes industry may impart additional training relevant to the specific industry.

ANNEXURE – I

INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

ARMOUR WELDER			
LIST OF TOOLS AND EQUIPMENT for Basic Training (For 20 Apprentices)			
A. TRAINEES TOOL KIT (For each additional unit trainees tool kit Sl. 1-18 is required additionally)			
Sl. no.	**Name of the Tool & Equipment**	**Specification**	**Quantity**
1	Welding helmet fiber	As per standard	20 nos.
2	Welding hand shield fiber	As per standard	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 double point	150 mm	20 nos.
9	Flat Tongs	350mm	20 nos.
10	Hack saw frame fixed	300 mm	20 nos.
11	File half round bastard	300 mm	20 nos.
12	File flat bastard	350 mm	20 nos.
13	Hammer ball pane with handle	1 kg	20 nos.
14	Tip Cleaner	As per standard	20 nos.
15	Try square	6"	20 nos.
B : INSTRUMENTS & GENERAL SHOP OUTFIT			
16.	Spindle key	As per cylinder	4
17.	Screw Driver	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	As per standard	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 flexible in case	5 meters	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	As per standard	2 set
32.	Argon Gas pressure regulator with flow meter	As per standard	2 set
33.	Metal rack	182 cm x 152 cm x 45 cm	1
34.	First Aid box	As per standard	1
35.	Steel lockers with	8 Pigeon holes	2
36.	Steel almirah / cupboard	As per standard	2
37.	Black board and easel with stand	As per standard	1
38.	Flash back arrester (torch mounted)	As per standard	4 pairs
39.	Flash back arrester (cylinder mounted)	As per standard	4 pairs
C : GENERAL MACHINERY INSTALLATIONS			
40	Welding Transformer with all accessories	(400A, OCV 60 - 100 V, 60% duty cycle)	2 sets
41	Welding Transformer or Inverter based welding machine with all accessories	(300A, OCV 60 - 100 V, 60% duty cycle)	2 sets
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 with air cooled torch, Regulator, Gas preheater, Gas hose and Standard accessories	400A capacity	2 set
44	AC/DC GTAW welding machine with water cooled torch, Argon regulator, Gas hose, water circulating system and standard accessories.	300 A	2 set
45	Air Plasma cutting equipment with all accessories,	capacity to cut 25 mm clear cut	01 set
46	Air compressor suitable for air plasma cutting system	As per standard	01 no
47	Auto Darkening Welding Helmet	As per standard	02 no
48	Portable abrasive cut-off machine	As per standard	1 No
49	Pug cutting machine Capable of cutting Straight & Circular with all accessories	As per standard	01 set
50	Pedestal grinder fitted with coarse and medium grain size grinding wheels	dia. 300 mm	1
51	Bench grinder fitted with fine grain size silicon carbide green grinding wheel	dia. 150 mm	1
52	AG 4 Grinder	As per standard	2 Nos

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53	Suitable gas welding table with fire bricks	As per standard	2 Nos
54	Suitable Arc welding table with positioner	As per standard	9
55	Trolley for cylinder (H.P. Unit)	As per standard	2
56	Hand shearing machine .	6mm.cut sheets and flats	1
57	Power saw machine	18''	1
58	Portable drilling machine	(Cap. 6 mm)	1
59	Oven, electrode drying 0 to 250°C,	10 kg capacity	1
60	Work bench with 4 bench vices of 150 mm jaw opening	340x120x75 cm	4 sets
61	Oxy Acetylene Gas cutting blow pipe	As per standard	2 sets
62	Oxygen, Acetylene Cylinders	As per standard	2 each*
63	CO_2 cylinder	As per standard	2 Nos *
64	Argon gas cylinder	As per standard	2 Nos *
65	Anvil 12 sq. inches working area with stand	12 sq.	1 No.
66	Swage block	As per standard	1 No.
67	Die penetrant testing kit	As per standard	1 set
68	Magnetic particle testing Kit	As per standard	1 set
69	Fire extinguishers (foam type and CO_2 type)	As per standard	1
70	Fire buckets with stand	As per standard	4 nos
71	Suitable gas cutting table	As per standard	1 No.
72	Welding Simulators for SMAW/GTAW/GMAW	As per standard	1 each (Optional)

Note: *In case of basic training, Tools, equipment and machinery available in the industry may be used for imparting basic training if the BTP is setup by the Industry*

INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

TOOLS & EQUIPMENTS FOR EMPLOYABILITY SKILLS

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

A : TRAINEES TOOL KIT:-			
Sl. No.	**Name of the items**	**Specification**	**Quantity**
1.	Draughtsman drawing instrument box	As per standard	20 set
2.	Set square celluloid 45^o	(250 X 1.5 mm)	20 set
3.	Set square celluloid 30^o-60^o	(250 X 1.5 mm)	20 set
4.	Mini drafter	As per standard	20 set
5.	Drawing board IS: 1444	(700mm x500 mm)	20 set
B : Furniture Required			
Sl. No.	**Name of the items**	**Specification**	**Quantity**
1	Drawing Board	As per standard	20
2	Models : Solid & cut section	As per standard	as required
3	Drawing Table for trainees	As per standard	as required
4	Stool for trainees	As per standard	as required
5	Cupboard (big)	As per standard	01
6	White Board	(size: 8ft. x 4ft.)	01
7	Trainer's Table	As per standard	01
8	Trainer's Chair	As per standard	01

2) Infrastructure:

Sl. No.	Name of the Equipment	Quantity
1.	Computer (PC) with latest configurations and Internet connection with standard operating system and standard word processor and worksheet software	10 Nos.
2.	UPS - 500VA	10 Nos.
3.	Scanner cum Printer	1 No.
4.	Computer Tables	10 Nos.
5.	Computer Chairs	20 Nos.
6.	LCD Projector	1 No.
7.	White Board 1200mm x 900mm	1 No.
Note: - Above Tools & Equipment not required, if Computer LAB is available in the institute.		

ANNEXURE-II

FORMAT FOR INTERNAL ASSESSMENT

Name & Address of the Assessor:			**Year of Enrollment:**
Name & Address of ITI (Govt./Pvt.):			**Date of Assessment:**
Name & Address of the Industry:			**Assessment location: Industry / ITI**
Trade Name:	**Semester:**		**Duration of the Trade/course:**
Learning Outcome:			

Sl. No	**Candidate Name**	**Father's/Mother's Name**	Safety consciousness	Workplace hygiene	Attendance/ Punctuality	Ability to follow Manuals/ Written instructions	Application of Knowledge	Skills to handle tools & equipment	Economical use of materials	Speed in doing work	Quality in workmanship	VIVA	**Total internal assessment Marks**	**Result (Y/N)**
Maximum Marks (Total 100 Marks)			**15**	**5**	**10**	**5**	**10**	**10**	**5**	**10**	**15**	**15**		
1														
2														

Abbreviations

ATS	Apprenticeship Training Scheme
DGT	Directorate General of Training
MSDE	Ministry of Skill Development and Entrepreneurship
NTC	National Trade Certificate
NAC	National Apprentice Certificate
SMAW	Shielded Metal Arc Welding
GMAW	Gas Metal Arc Welding
SP	Safety precautions
G I	General information
WD	Weld Drawing
OAW&OAC	Oxy acetylene welding, Oxy Acetylene cutting
WS	Welding standards
HT	Heat Treatment
ARW	Armour welding
NDT	Non destructive test
FCAW	Flux cored arc welding
GTAW	Gas tungsten arc welding
SAW	Submerged arc welding
WPS	Welding Procedure Specifications
PQR	Procedure Qualification Records
WQT	Welder Qualification Test
WPQ	Welder Performance Qualifications
MIGW	Metal Inert Gas Welding
MAGW	Metal Active Gas Welding
TIGW	Tungsten Inert Gas Welding