

STRUCTURAL WELDER

COMPETENCY BASED CURRICULUM

(Duration: 1 Yr. 3 Months)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL- 3



SECTOR – FABRICATION



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

STRUCTURAL WELDER

(Revised in 2018)

APPRENTICESHIP TRAINING SCHEME (ATS)



NSQF LEVEL - 3

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Developed By

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Directorate General of Training
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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.



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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.

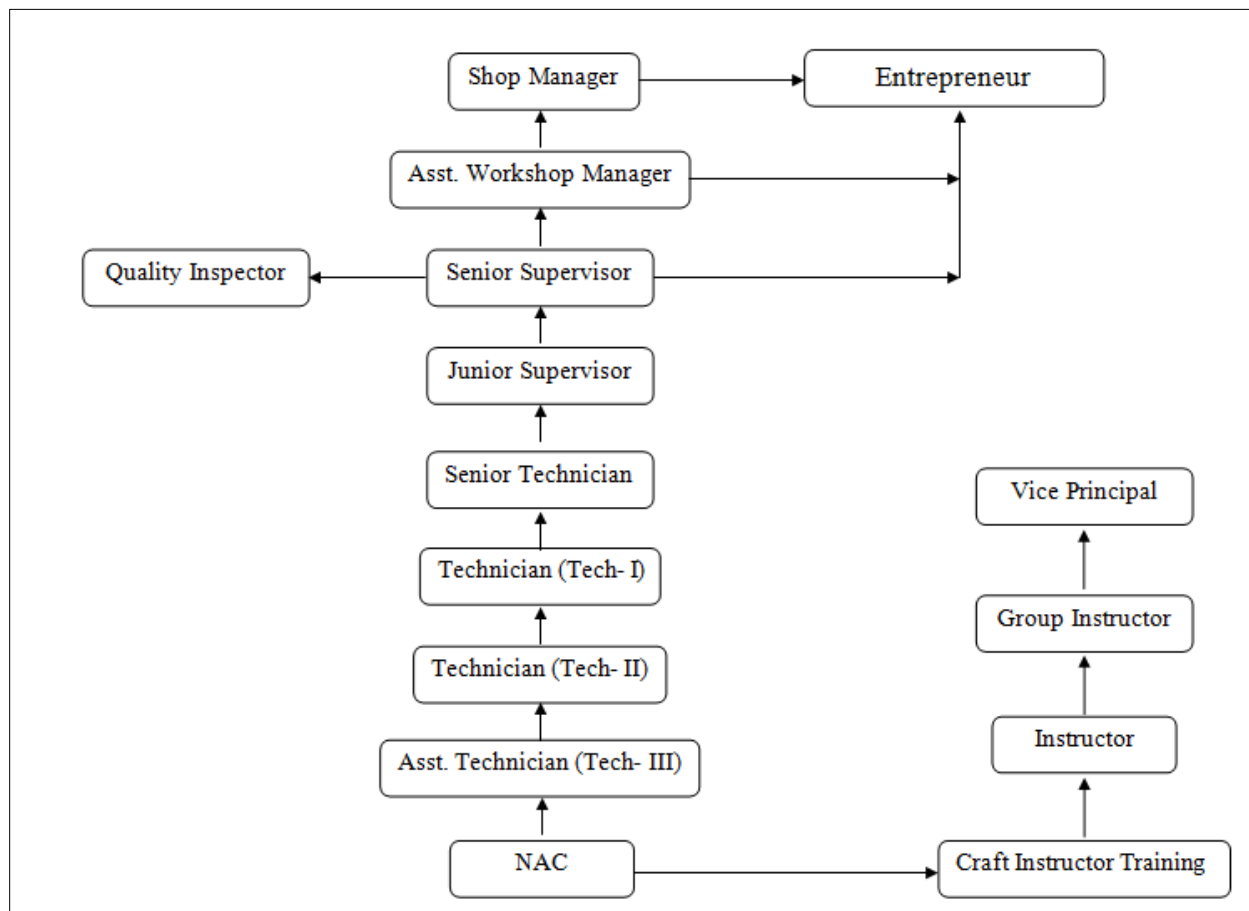
Structural Welder trade under ATS is one of the most popular courses delivered nationwide through different industries. The course is of one year three months (01 Block of 15 months including basic training) duration. It mainly consists of Domain area and Core area. In the Domain area Trade Theory & Practical impart professional - skills and knowledge, while Core area - Workshop Calculation and science, Engineering Drawing and Employability Skills imparts requisite core skills & knowledge and life skills. After passing out the training programme, the trainee is being awarded National Apprenticeship Certificate (NAC) by NCVT 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, knowledge, core skills & employability 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:

- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming instructor in ITIs.
- Indicative pathways for vertical mobility.



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 02 yrs. course (Engg.)	1000 hrs.	3120 hrs.	4120 hrs.
For 01 yr. course (Engg.)	500 hrs.	2080 hrs.	2580 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. 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 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
- Project work

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	• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment

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and practices, has produced work which demonstrates attainment of an acceptable standard of craftsmanship.	- 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 above 75% - 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.

Brief description of Job roles:

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

Structural Welder 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.

Structural Welder 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.

Structural Welder 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.

Structural Welder 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.

Structural Welder 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.

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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 Aluminium metals.

Structural Welder 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 pre-heater 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 - 2015: 7212.0303 - Gas Metal Arc Welder/Metal Inert Gas/Metal Active Gas/Gas Metal Arc Welder (MIG/MAG/GMAW)

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4. NSQF LEVEL COMPLIANCE

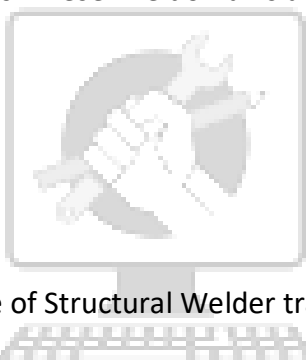
NSQF level for STRUCTURAL WELDER trade under ATS: **Level 3**

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 Structural Welder trade under ATS mostly matches with the Level descriptor at Level- 3.

The NSQF level-3 descriptor is given below:

Level	Process Required	Professional Knowledge	Professional Skill	Core Skill	Responsibility
Level 3	Person may carry out a job which may require limited range of activities routine and predictable	Basic facts, process and principle applied in trade of employment	Recall and demonstrate practical skill, routine and repetitive in narrow range of application	Communication written and oral, with minimum required clarity, skill of basic arithmetic and algebraic principles, personal banking, basic understanding of social and natural environment	Under close supervision Some Responsibility for own work within defined limit.

5. GENERAL INFORMATION

Name of the Trade	STRUCTURAL WELDER
NCO - 2015	7212.0303
NSQF Level	Level – 3
Duration of Apprenticeship Training (Basic Training + On-Job Training)	3 months+ One year (01 Blocks of 15 month duration).
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 8 th 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	i) Three month in the trade of Welder ii) Three months (Basic training) for Fabrication sector with advance module in Structural Welding under CoE.
CTS trades eligible for Structural Welder Apprenticeship	Welder

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.
- -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 STRUCTURALWELDER course of 01 years 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]
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

1. Introduction to safety equipment used in structural welding and their use, setting up Gas cutting equipment and cutting MS Flats to required size.
2. Setting up SMAW Welding equipment and making straight and weaving bead on MS in all positions, Practice on plasma cutting, Practice on gouging techniques.
3. Weld joint preparation for fillet weld/Structural fitting (Cutting to size, fit up, tack weld etc.), Fillet, Lap and T joint on MS flat by SMAW, position - 1F, 2F, 3F, 4F & 5F.

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4. Weld joint preparation for plate groove welding, Full penetration Single "V" butt joint on MS Flat by SMAW in 1G, 2G, 3G & 4G Positions, Root pass welding & LPI(Liquid Penetrant Inspection) testing, Cover pass welding & inspection.
5. Setting up GTAW welding equipment and making beading practice on MS in down hand position, Square butt joint on M.S, SS Sheet and Aluminium in down hand position. Root pass welding by TIG and LPI test, cover pass welding, inspection clearance.
6. M.S square butt Tube (Square or rectangular) welding and T, Y, K tube (Square or rectangular) joints by TIG welding.
7. Double bevel butt joint on MS Flats in dissimilar thickness in down hand positions by SMAW, Root Inspection, Back Gouging, Adopting weld sequence for controlling distortion.
8. Pipe Elbow and T joints on MS pipes by SMAW in flat position, Pipe Y and K connection on M.S. pipe by SMAW, positions – Horizontal.
9. Practice on CO₂ welding, Lap, T, Corner joints on GMAW process in down hand position.
10. Practice on Submerged Arc Welding machine - butt joint.
11. Dissimilar welding like SS and MS by SMAW/TIG.
12. Manufacturing of simple structures with L angles, channel and I & T sections using welding fixture by SMAW, Correction of distortion by cold & hot method.
13. Manufacturing of structures using M.S. Flat by SMAW, Adapting skip welding & back step welding method for controlling distortion.
14. Fabrication of pipe/cone on M.S. sheet by SMAW and Pressure pipe welding and joint by SMAW 5 F position and flange joints, M.S. pipe joint.
15. Weld test specimen - preparation as per a standard, Inspection & Testing. Preparation of WPS and PQR, weld inspection and test.
16. Root inspection by gouging, adopting weld sequence for controlling distortion, joints with dissimilar thickness.
17. **Ultrasonic Testing, Radiographic film reviewing** : Ultrasonic Testing, Radiographic film reviewing.

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 Protective 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, explain different mathematical calculation & science-Unit, Basic Mathematics,	2.1 Explain concept - Unit,, Basic Mathematics, Percentage, Material Science, Mass, Weight and Density, Mensuration, Elasticity, Heat & Temperature, Basic Electricity.

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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. <i>[Different Lines, Free hand drawing, Drawing of Geometrical Figure, 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 engineering drawing.]</i>	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 such as micrometers, Vernier calipers, dial gauge, bevel protector and height gauge (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 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	6.1 Explain the concept of energy conservation, global

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conservation, global warming and pollution and contribute in day to day work by optimally using available resources.	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	
Block-I (Section:10 in the competency based curriculum)	
<i>Assessment Criteria i.e. the standard of performance, for each specific learning outcome mentioned under block – I (section: 10) must ensure that the trainee performs job that requires limited range of activities which are routine and predictable. Assessment criteria should broadly cover the aspect of Planning (Identify, ascertain, etc.); Execution (perform, illustration, etc. by applying basic methods, tools, materials and information 2) Knowledge of basic facts, process and principle applied in trade of employment 3) Basic Mathematical Skills and Checking/ Testing to ensure functionality during the assessment of each outcome. The assessments parameters must also ascertain that the candidate is responsible for own work within defined limit.</i>	

BASIC TRAINING (Block – I)**Duration: (03) Three Months**

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

Structural Welder

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

Structural Welder

	- Practice on gouging techniques.	- Weldability of metals, importance of pre heating, post heating and maintenance of inter pass temperature. - Stainless steel: types- weld decay and Weldability.
11-12	- Setting up GTAW welding equipment and making beading practice on MS in down hand position. - Square butt joint on M.S & SS sheet in down hand position. - Practice on CO₂ welding. - Lap, T, Corner joints on GMAW process in down hand position.	- GTAW equipment. - Advantages of GTAW welding process. - Power source types AC/DC. - Types of polarity and application. - Accessories – HF unit and DC Suppressor. - GTAW Defects, Causes and Remedies. - Stress Relieving or Post Welding Heat Treatment (PWHT). - Introduction to GMAW, Flux cored arc welding - Power source - Wire feeder - Electrode wires - shielding gases. - Types of metal transfer and welding parameters. - GMAW Defects , Causes and Remedies - Advantage and limitation.
13	Assessment / Examination (03 days)	

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 metals.	Sizes and Layout of Drawing Sheets - Selection of sizes - Title Block, its position and content - Item Reference on Drawing Sheet (Item List)

	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	
1.	Concept of Entrepreneurship Entrepreneurship- Entrepreneurship - Enterprises:-Conceptual issue. Source of business ideas, Entrepreneurial opportunities, The process of setting up a business.	8
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.	6
3.	Personal Finance Management Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and Insurance.	
	Occupational Safety, Health & Environment Education	
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	

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10. DETAILS OF COMPETENCIES (ON-JOB TRAINING)

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

Block – I

1. Introduction to safety equipment used in structural welding and their use, setting up Gas cutting equipment and cutting MS Flats to required size.
2. Setting up SMAW Welding equipment and making straight and weaving bead on MS in all positions, Practice on plasma cutting, Practice on gouging techniques.
3. Weld joint preparation for fillet weld/Structural fitting (Cutting to size, fit up, tack weld etc.), Fillet, Lap and T joint on MS flat by SMAW, position - 1F, 2F, 3F, 4F & 5F.
4. Weld joint preparation for plate groove welding, Full penetration Single "V" butt joint on MS Flat by SMAW in 1G, 2G, 3G & 4G Positions, Root pass welding & LPI (Liquid Penetrant Inspection) testing, Cover pass welding & inspection.
5. Setting up GTAW welding equipment and making beading practice on MS in down hand position, Square butt joint on M.S, SS Sheet and Aluminium in down hand position. Root pass welding by TIG and LPI test, cover pass welding, inspection clearance.
6. M.S square butt Tube (Square or rectangular) welding and T,Y,K tube(Square or rectangular) joints by TIG welding.
7. Double bevel butt joint on MS Flats in dissimilar thickness in down hand positions by SMAW, Root Inspection, Back Gouging, Adopting weld sequence for controlling distortion.
8. Pipe Elbow and T joints on MS pipes by SMAW in flat position, Pipe Y and K connection on M.S. pipe by SMAW, positions – Horizontal.
9. Practice on CO₂ welding, Lap, T, Corner joints on GMAW process in down hand position.
10. Practice on Submerged Arc Welding machine - butt joint.
11. Dissimilar welding like SS and MS by SMAW/TIG.
12. Manufacturing of simple structures with L angles, channel and I & T sections using welding fixture by SMAW, Correction of distortion by cold & hot method.
13. Manufacturing of structures using M.S. Flat by SMAW, Adapting skip welding & back step welding method for controlling distortion.
14. Fabrication of pipe/cone on M.S. sheet by SMAW and Pressure pipe welding and joint by SMAW 5 F position and flange joints, M.S. pipe joint.
15. Weld test specimen - preparation as per a standard, Inspection & Testing. Preparation of WPS and PQR, weld inspection and test.
16. Root inspection by gouging, adopting weld sequence for controlling distortion, joints with dissimilar thickness.

17. **Ultrasonic Testing, Radiographic film reviewing:** Ultrasonic Testing, Radiographic film reviewing.

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.



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INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

STRUCTURAL 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 & Equipments	Specification	Quantity
1	Welding helmet fiber	As per standard MMA welding	20
2	Welding hand shield fiber	As per standard MMA welding	20
3	Chipping hammer with metal handle	250 Grams	20
4	Chisel cold flat	19 mm x 150 mm	20
5	Centre punch	9 mm x 127 mm	20
6	Dividers	200 mm	20
7	Stainless steel rule	300mm	20
8	Scriber double point	150 mm	20
9	Flat Tongs	350mm long	20
10	Hack saw frame fixed	300 mm	20
11	File half round bastard	300 mm	20
12	File flat	350 mm bastard	20
13	Hammer ball pane with handle	1 kg	20
14	Tip Cleaner	As per standard GAS welding	20
15	Try square	6"	20
B : INSTRUMENTS & GENERAL SHOP OUTFIT			
16	Spindle key	As per cylinder	4 nos.
17	Screw Driver	300 mm 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	As per standard	2 nos.
22	Earth clamp	600Amps	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 flexible in case	5 meters	1 no.
27	Electrode holder	600 amps	6 nos.
28	H.P. Welding torch with	5 nozzles	2 sets

Structural Welder

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	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 no.
34	First Aid box		1 no.
35	Steel lockers.	8 Pigeon holes	2 nos.
36	Steel almirah / cupboard	As per standard	2 nos.
37	Black board and easel with stand	As per standard	1 no.
38	Flash back arrester (torch mounted)	As per standard	4 pairs
39	Flash back arrester (cylinder mounted)	As per standard	4 pairs
40	Auto Darkening Welding Helmet	As per standard	2 nos.
C : GENERAL MACHINERY INSTALLATIONS			
41	Welding Transformer with all accessories	(400A, OCV 60–100 V, 60% duty cycle)	1 set
42	Welding Transformer (or) Inverter based welding machine with all accessories	(300A , OCV 60 – 100 V, 60% duty cycle)	1 set
43	D.C Arc welding rectifiers set with all accessories	(400 A. OCV 60 – 100 V, 60% duty cycle)	1 sets
44	GMAW welding machine with air cooled torch, Regulator, Gas pre-heater, Gas hose and Standard accessories	400A capacity	1 set
45	AC/DC GTAW welding machine with water cooled torch, Argon regulator, Gas hose, water circulating system and standard accessories.	300 A	1 set
46	Air Plasma cutting equipment with all accessories, clear cut	capacity to cut 25 mm clear cut	01 set
47	Air compressor	8 Bar	01 no
48	Power shearing machine	As per standard	01 no
49	Portable abrasive cut-off machine	As per standard	01 set
50	Pug cutting machine Capable of cutting Straight & Circular with all accessories	As per standard	01 set
51	Pedestal grinder fitted with coarse and medium grain size grinding wheels	dia. 300 mm	1 no.
52	Bench grinder fitted with fine grain size silicon carbide green grinding wheel	dia. 150 mm	1 no.
53	AG 4 Grinder	As per standard	2 Nos.
54	Die penetrant testing kit	As per standard	1 set
55	Suitable Arc welding table with positioner	As per standard	7 nos.
56	Trolley for cylinder (H.P. Unit)	As per standard	2 nos.

Structural Welder

57	Hand shearing machine	capacity to cut 6 mm sheets and flats	1 no.
58	Power saw machine	18"	1 no.
59	Portable drilling machine	Cap. 6 mm	1 no.
60	Oven, electrode drying	0 to 250°C, 10 kg capacity	1 no.
61	Work bench	340x120x75 cm with 4 bench vices of 150 mm jaw opening	4 sets
62	Oxy Acetylene Gas cutting blow pipe	As per standard	2 sets
63	Oxygen, Acetylene Cylinders	As per standard	2 each*
64	CO ₂ cylinder	As per standard	1 No. *
65	Argon gas cylinder	As per standard	1 No. *
66	Anvil	12 sq. inches working area with stand	1 No.
67	Swage block	As per standard	1 No.
68	Fire buckets with stand	As per standard	4 nos.
69	Universal Testing Machine	As per standard	1 set
70	Fire extinguishers	foam type and CO ₂ type	1 no.
71	Suitable gas cutting table	As per standard	1 No.
72	Welding Simulators for SMAW/GTAW/GMAW	As per standard	1 Each (optional)

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.

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**INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING
DRAWING**

TRADE: STRUCTURAL WELDER

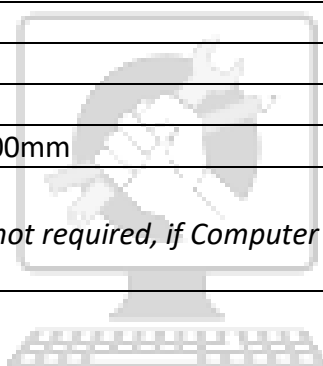
LIST OF TOOLS& EQUIPMENTS FOR -20APPRENTICES

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

2) **Infrastructure:**

A : TRAINEES TOOL KIT:-			
Sl. No.	Name of the items	Specification	Quantity
1.	Draughtsman drawing instrument box	As per standard	20+1 set
2.	Set square celluloid 45°	(250 X 1.5 mm)	20+1 set
3.	Set square celluloid 30°-60°	(250 X 1.5 mm)	20+1 set
4.	Mini drafter	As per standard	20+1 set
5.	Drawing board IS: 1444	(700mm x500 mm)	20+1 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

TOOLS & EQUIPMENTS FOR EMPLOYABILITY SKILLS		
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.
<i>Note: - Above Tools & Equipments not required, if Computer LAB is available in the institute.</i>		



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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	Maximum Marks (Total 100 Marks)	15	5	10	5	10	10	5	10	15	15	Total internal assessment Marks	Result (Y/N)
	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	
1													
2													