

TIG/MIG WELDER

COMPETENCY BASED CURRICULUM

(Duration: 1 Yr. 3 Months)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL- 4



SECTOR – FABRICATION



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

TIG/MIG WELDER

(Revised in 2018)

APPRENTICESHIP TRAINING SCHEME (ATS)



Skill India
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Developed By

Ministry of Skill Development and Entrepreneurship
Directorate General of Training

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The DGT sincerely expresses appreciation for the contribution of the Industry, State Directorate, Trade Experts and all others who contributed in revising the curriculum. Special acknowledgement to the following industries/organizations who have contributed valuable inputs in revising the curricula through their expert members:

1. Larsen & Turbo, Mumbai.
2. BHEL, Noida.

Special acknowledgement is extended by DGT to the following expert members who had contributed immensely in this curriculum.

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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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2.1 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.

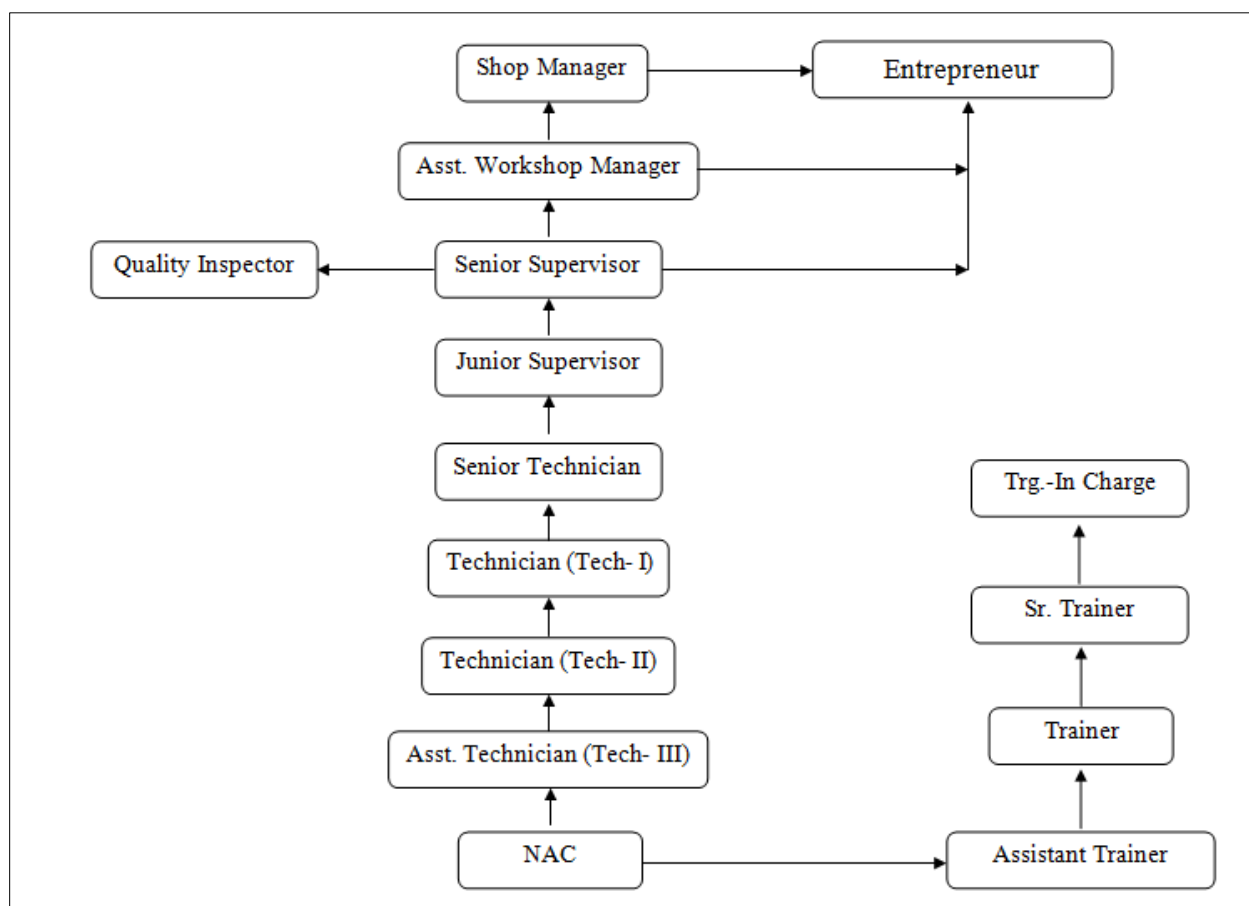
TIG/MIG Welder trade under ATS is one of the most popular courses delivered nationwide through different industries. The course is of one years (01 Blocks) duration. It mainly consists of Domain area and Core area. In the Domain area Trade Theory & Practical impart professional - skills and knowledge, 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:

- 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

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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.)

Sl. 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 OSHS 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) Weight age 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)Weight age 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) Weight age 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:

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

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

TIG/MIG Welder welds M.S. Sheet and M.S. Pipe by GAS welding process. Welds M.S. Plate in all position by SMAW process. Cuts Straight, Bevel & Circular on MS Plate by Oxy-Acetylene cutting process. Undertakes repair & maintenance works. Setup GTAW plant and weld M.S, S.S and Aluminium sheets in all positions. Welds Tubes by GTAW process and setup and Weld Lap, "T", corner and butt joint on M.S, S.S and Aluminium by GMAW process. Welds by FCAW process.

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

1.7212.0303 (MIG/MAG WELDER)

2.7212.0105 (TIG WELDER)

4. NSQF LEVEL COMPLIANCE

NSQF level for TIG/MIG 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 TIG/MIG 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 knowledge 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	TIG /MIG Welder
NCO - 2015	7212.0303 7212.0105
NSQF Level	Level – 4
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 10 th Class with Science and Mathematics under 10+2 system of Education or its equivalent
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	03 months
CTS trades eligible for TIG/MIG WELDER Apprenticeship	1. Broad Based Basic Training in Fabrication (Fitting & Welding) Sector under Centre of Excellence Scheme and Advanced module of Centre of Excellence Scheme in TIG/MIG Welding. 2. 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.

6.1 GENERIC LEARNING OUTCOME

The following are minimum broad Common Occupational Skills/ Generic Learning Outcome after completion of the TIG/MIG WELDER 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. Practice and understand precautions to be followed while working in fitting jobs.
2. Prepare different types of documentation as per industrial need by different methods of recording information.
3. Straight line beads on SS plate by GMAW welding, Lap & Square butt and T joint on S.S sheet.
4. Straight line beads on Aluminium plate by GMAW welding, Single "V" and fillet joint on Aluminium plate.
5. Square butt joint on MS sheet in Horizontal & Vertical position by GMAW welding.

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6. Lap & Tee joint on MS sheet in Vertical position, Square butt joint on MS sheet in Overhead position by GMAW welding.
7. Square butt joint and Open corner joint on SS and Aluminium sheet by TIG/GTAW in Flat position.
8. Square butt joint and Lap joint on SS sheet in Vertical position by GTAW welding.
9. Tee joint on SS sheet in Vertical position, Square butt joint welding of SS sheet with back purging Technique.
10. Square butt joint on Aluminium sheet in Vertical position, Single V butt joint on Aluminum sheet by TIG/GTAW.
11. Square butt joint on Tube welding practice on MS, SS &Aluminium tube metals in rolled position.
12. Plasma cutting of SS sheets &Aluminum plates.
13. Use of jigs & fixture in welding shop and use of different weld gauges.
14. Position welding - horizontal, vertical, down/over head, inclined, rotary.
15. Edge preparation by grinding on pipes.
16. Pipe flange welding by TIG/GTAW, various types of pipe joints.
17. Dissimilar welding like SS and MS by SMAW/TIG.
18. Root pass welding pipes by TIG in 5G, 6G positions.
19. Submerged Arc welding (SAW) on plates and pipes, parameter setting of Micro plasma cutting.
20. Dimensional inspection of weldments, Weld test specimen preparation, Visual inspection of weldments. Dye penetrant, Magnetic particle testing. Weld testing and inspection, specimen preparation, visual, magnetic, ultrasonic, radiographic.
21. 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.

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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 -	2.1 Explain concept -Unit,, Basic Mathematics, Percentage , Material Science , Mass, Weight and Density , Mensuration , Elasticity , Heat &

Unit,, Basic Mathematics, Percentage , Material Science , Mass, Weight and Density , Mensuration, Elasticity , Heat & Temperature , Basic Electricity ,	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. engineering drawing-	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, verniercalipers, 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 the with given drawing/measurement.
5. Explain the concept in productivity, quality tools, and	5.1 Explain the concept of productivity and quality tools and apply during execution of job.

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labour welfare legislation and apply such in day to day work to improve productivity & quality.	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 resources 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	
<u>Block-I</u>	
<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 works in familiar, predictable, routine, situation of clear choice. 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 with 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.</i>	

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 position by GMAW welding. - CO₂ straight line bead, different	GMAW - Introduction to GMAW - equipment - accessories. - Various names of the process. (MIG-MAG/ CO₂ WELDING, FCAW).

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	position of CO ₂ , Single "V" butt joint by CO ₂ welding in down hand position, Single "V" butt joint by Argoshield welding in flat position (Gas: Argon and CO ₂ mixture).	- Advantages& Limitations - 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	- Horizontal, Vertical, Downward and Overhead welding by GMAW/GTAW.	Other Processes - Submerged Arc welding - Principles, application-Types of fluxes, welding

	- Gas cutting, plasma cutting, profile cutting. Bending.	head, power source and Parameter setting. - Micro plasma welding principles, Equipment, power source, parameter settings, Advantages & limitations. - Plasma Cutting principles and advantages. - 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.
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.



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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. Difference between Ferrous and Non-Ferrous metals.	Sizes and Layout of Drawing Sheets - Selection of sizes - Title Block, its position and content Item Reference on Drawing Sheet (Item List)
6.	Mass, Weight and Density: Mass, Unit of Mass, Weight, difference between mass and weight. Density, unit of density. Relation between mass, weight & density. Simple problems related to mass, weight, and density.	Method of presentation of Engineering Drawing - Pictorial View - Orthographic View Isometric view
7.	Mensuration : Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle, Volume of solids – cube, cuboid, cylinder and Sphere. Surface area of solids –	- 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.



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9.2 EMPLOYABILITY SKILLS

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.	

TIG/MIG Welder

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

Block – I

1. Practice and understand precautions to be followed while working in fitting jobs.
2. Prepare different types of documentation as per industrial need by different methods of recording information.
3. Straight line beads on SS plate by GMAW welding, Lap & Square butt and T joint on S.S sheet.
4. Straight line beads on Aluminum plate by GMAW welding, Single "V" and fillet joint on Aluminum plate.
5. Square butt joint on MS sheet in Horizontal & Vertical position by GMAW welding.
6. Lap & Tee joint on MS sheet in Vertical position, Square butt joint on MS sheet in Overhead position by GMAW welding.
7. Square butt joint and Open corner joint on SS and Aluminum sheet by TIG/GTAW in Flat position.
8. Square butt joint and Lap joint on SS sheet in Vertical position by GTAW welding.
9. Tee joint on SS sheet in Vertical position, Square butt joint welding of SS sheet with back purging Technique.
10. Square butt joint on Aluminum sheet in Vertical position, Single V butt joint on Aluminum sheet by TIG/GTAW.
11. Square butt joint on Tube welding practice on MS, SS & Aluminum tube metals in rolled position.
12. Plasma cutting of SS sheets & Aluminum plates.
13. Use of jigs & fixture in welding shop and use of different weld gauges.
14. Position welding - horizontal, vertical, down/over head, inclined, rotary.
15. Edge preparation by grinding on pipes.
16. Pipe flange welding by TIG/GTAW, various types of pipe joints.
17. Dissimilar welding like SS and MS by SMAW/TIG.
18. Root pass welding pipes by TIG in 5G, 6G positions.

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19. Submerged Arc welding (SAW) on plates and pipes, parameter setting of Micro plasma cutting.
20. Dimensional inspection of weldments, Weld test specimen preparation, Visual inspection of weldments. Dye penetrant, Magnetic particle testing. Weld testing and inspection, specimen preparation, visual, magnetic, ultrasonic, radiographic.
21. Ultrasonic Testing, Radiographic film reviewing: Ultrasonic Testing, Radiographic film reviewing.



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INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

TIG/MIG 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	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

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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

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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
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)

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

TRADE: TIG/MIG 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
2.	Set square celluloid 45°	(250 X 1.5 mm)	20
3.	Set square celluloid 30°-60°	(250 X 1.5 mm)	20
4.	Mini drafter	As per standard	20
5.	Drawing board IS: 1444	(700mm x500 mm)	20
B : Furniture Required			
Sl. No.	Name of the items	Specification	Quantity
1	Drawing Board	As per standard	as required
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 no.
6	White Board (size: 8ft. x 4ft.)	(size: 8ft. x 4ft.)	01 no.
7	Trainer's Table	As per standard	01 no.
8	Trainer's Chair	As per standard	01 no.

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.
Note: - Above Tools & Equipments not required, if Computer LAB is available in the institute.		

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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													