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

COMPETENCY BASED CURRICULUM

WELDER

(Duration: One Year)

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL- 2.5

SECTOR – CAPITAL GOODS AND MANUFACTURING

CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE

Kolkata-700091

WELDER

(Engineering Trade)

(Revised in August 2025)

Version: 3.0

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL – 2.5

Developed By

CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE

Directorate General of Training
Ministry of Skill Development and Entrepreneurship
EN-81, Sector-V, Salt Lake City,
Kolkata – 700 091
www.cstaricalcutta.gov.in

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1. COURSE INFORMATION

During the one-year duration a candidate is trained on subjects Professional Skill, Professional Knowledge and Employability Skills related to job roles. In addition to this a candidate is entrusted to undertake project work and extracurricular activities to build up confidence. The broad components covered under Professional Skill subject are as below:

The practical skills are imparted in simple to complex manner & simultaneously theory subject is taught in the same fashion to apply cognitive knowledge while executing task. The safety aspects cover components like OSH&E, PPE, Fire extinguisher, First Aid and in addition 5S being taught. The practical part starts with edge preparation by hacksawing, filing and fitting followed by Oxy Acetylene & Brazing, Oxy Acetylene Cutting, Shielded Metal Arc, Gas Metal Arc, Gas Tungsten Arc and Spot, Plasma Cutting and Arc Gouging. These processes are widely used in Industries.

During the practice on / Brazing process, the trainees will learn to read the job drawing, select the required base metal and filler metals, cut the metals by appropriate process, carry out edge preparation, setup the plant and do /Brazing on M.S, SS, Aluminum and Copper in different positions. On completion of each job the trainees will also evaluate their jobs by visual inspection, and identify the defects for further correction/improvement. They learn to adapt precautionary measures such as preheating; maintaining inter-pass temperature and post weld heat treatment for Alloy steel, Cast Iron etc. The Work Shop calculation taught will help them to plan and cut the required jobs economically without wasting the material and also used in estimating the Electrodes, filler metals etc. The Workshop Science taught will help them to understand the materials and properties, effect of alloying elements etc. Engineering Drawing taught will be applied while reading the job drawings and will be useful in understanding the location, type and size of weld to be carried out.

The professional knowledge taught will be useful in understanding the principles of, Brazing, induction and Cutting process, use of jigs and Fixtures, distortion and methods of control, selection of consumables and to take precautionary measures for storage and handling and apply the same for executing the Cutting, induction, and Brazing.

The knowledge and practice imparted on Destructive and Non-destructive testing will be use in understanding the standard quality of welds and to carry out shop floor Inspection and test in laboratories.

One project needs to be completed by the candidates in a group. In addition to above components the core skills components viz., Workshop calculation & science, Engineering drawing, employability skills are also covered. These core skills are essential skills which are necessary to perform the job in any given situation.

2. TRAINING SYSTEM

2.1 GENERAL

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

Welder trade under CTS is one of the most popular courses delivered nationwide through a network of ITIs. The course is of one-year duration. It mainly consists of Domain area and Core area. In the Domain area (Trade Theory & Practical) imparts professional skills and knowledge, while the core area (Employability Skill) imparts requisite core skills, knowledge, and life skills. After passing out the training program, the trainee is awarded National Trade Certificate (NTC) by DGT which is recognized worldwide.

Trainee broadly needs to demonstrate that they are able to:

- Read & interpret technical parameters/documentation, plan and organize work processes, identify necessary materials and tools;
- Perform tasks with due consideration to safety rules, accident prevention regulations and environmental protection stipulations;
- Apply professional knowledge, core skills & employability skills while performing the job, and repair & maintenance work.
- Check the job/ assembly as per drawing for functioning identify and rectify errors in job/ assembly.
- Document the technical parameters in tabulation sheet related to the task undertaken.

2.2 PROGRESSION PATHWAYS

- Can join industry as Technician and will progress further as Senior Technician, Supervisor and can rise up to the level of Manager.
- Can become Entrepreneur in the related field.
- Can join Apprenticeship programme in different types of industries leading to National Apprenticeship certificate (NAC).
- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming instructor in ITIs.

- Can join Advanced Diploma (Vocational) courses under DGT as applicable.

2.3 COURSE STRUCTURE:

Table below depicts the distribution of training hours across various course elements during a period of one year: -

S No.	Course Element	Notional Training Hours
1	Professional Skill (Trade Practical)	840
2	Professional Knowledge (Trade Theory)	240
3	Employability Skills	120
Total		**1200**
On the Job Training (OJT)/ Group Project *		150
Optional Courses**		240
Grand Total		**1590**

** The trainee has to undergo 150 hours of mandatory OJT (On the Job Training) at nearby industry or wherever industry not available then group project has to be done with the supervision of the trade instructor for every year.*

*** Trainees of one-year or two-year trade can also opt for optional courses of up to 240 hours in each year for obtaining 10th/ 12th class certificate from NIOS along with ITI certification, or, short term courses for extra skills/knowledge.*

2.4 ASSESSMENT &CERTIFICATION

The trainee will be tested for his /her skill, knowledge and attitude during the period of course through formative assessment and at the end of the training programme through summative assessment as notified by the DGT from time to time.

a) The **Continuous Assessment** (Internal)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 formative assessment template provided on www.cstaricalcutta.gov.in or www.bharatskills.gov.in

b) The final assessment will be in the form of summative assessment. The All-India Trade Test for awarding NTC will be conducted by DGT as per the guidelines. The pattern and marking structure is being notified by DGT 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

For the purposes of determining the overall result, weightage of 100% is applied for six months and one year duration courses and 50% weightage is applied to each examination for two years courses. The minimum pass percentage for Trade Practical and Formative assessment are 60% & for all other subjects is 33%.

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 Occupational Safety, Health and Environment (OSHE) and self-learning attitude are to be considered while assessing competency.

Assessment will be evidence based comprising some of 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
- Computer based multiple choice question examination
- Practical Examination

Evidences and records of internal (Formative) assessments are to be preserved until

forthcoming examination for audit and verification by examination body. The following marking pattern to be adopted for formative assessment:

Marks Allotted during Assessment	Performance Level	Evidence
Marks between 60% to 75%	For performance in this grade, the candidate should produce work which demonstrates attainment of an acceptable standard of craftsmanship with occasional guidance, and due regard for safety procedures and practices.	• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment. • 60-70% accuracy achieved while undertaking different work with those demanded by the component/job. • A fairly good level of neatness and consistency in the finish. • Occasional support in completing the project/job.
Marks above 75% to 90%	For this grade, a candidate should produce work which demonstrates attainment of a reasonable standard of craftsmanship, with little guidance, and regard for safety procedures and practices.	• Good skill levels in the use of hand tools, machine tools and workshop equipment. • 70-80% accuracy achieved while undertaking different work with those demanded by the component/job. • A good level of neatness and consistency in the finish. • Little support in completing the project/job.
Marks Above 90%	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% accuracy achieved while undertaking different work with those demanded by the component/job. • A high level of neatness and consistency in the finish. • Minimal or no support in completing the project.

3. JOB ROLE

Brief Description of Job Roles:

Welder, Gas; fuses metal parts together using 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 rod, nozzle etc. and tests, torch. Wears dark glasses and other protective devices while. 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 rod and spreading molten metal along joint shape, size etc. and rectifies defects if any.

Welder, Electric; fuses metals using arc- power source and electrodes. Examines parts to be welded, cleans them and sets joints together with clamps or any other suitable device. Starts power source and regulates current according to material and thickness. 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. Establish arc between electrode and joint and maintain it throughout the length of the joint.

Welder, Resistance; sets up and operates resistance machine to join metal parts, according to blueprints, work orders, or oral instructions. Turns machine dials to set air and hydraulic pressure, amperage, and joining time, according to specified type of metal, weld, and assembly. May select, install, and adjust electrodes. Aligns work pieces, using square and rule. May hold pieces together manually, fasten into jigs, or secure with clamps to align in specified assembly position. Holds part between electrodes or positions on machine worktable. Depresses pedal or pulls trigger to close electrodes and form weld at point of contact. Releases pedal or trigger after specified time. Cleans electrodes, using file, tip dresser, emery cloth. May operate machine which automatically releases electrodes from metal after cycle. May devise and build fixtures to hold pieces. May inspect finished work. May operate machine equipped with two or more electrodes which weld at several points simultaneously. Important variations include types of joints welded (seam, spot, butt) and types of materials welded (Aluminium, steel).

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 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.

Brazer; 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. or joining two or more metals together using resistive heat caused by changing electromagnetic fields. Check for induction welded joints.

Tungsten Inert Gas (TIG) welder; 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 torch. Selects gas nozzle and fit in to the GTA 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 machine, sets suitable current & polarity and inert gas flow. Establish arc through across a column of highly ionized inert gas between work piece and Tungsten electrode. Melts the metal and deposit weld beads on metal surfaces by passing the suitable filler rod in to the weld puddle. Joins metal pieces such as Steel, Stainless steel and Aluminium metals.

Gas Metal Arc Welder/ Metal Inert Gas/ Metal Active Gas/ Gas Metal Welder (MIG/MAG/GMAW); 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 CO_2 is used as shielding gas. Selects suitable wire electrode, feed it to GMA torch through wire feeder. Selects contact tip gas nozzle and fit in to the GMA torch. Preheats joints as required. Starts the Constant Voltage GMA machine, sets suitable 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.

Plastic welder; create joint between two thermoplastics by following the steps to any weld; pressing, heating and cooling.

Iron and Steel Plasma Cutter-Manual; cuts different materials (mild carbon steel, stainless steel, Aluminum, high tensile and special steels, and other materials) in various profiles. This involves setting-up and preparing operations interpreting the right information from the specification documents, obtaining the right consumables and other materials, etc.

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:

(i) 7212.0100 – Welder, Gas
(ii) 7212.0200 – Welder, Electric
(iii) 7212.0700 – Welder, Resistance
(iv) 7212.0400 – Gas Cutter
(v) 7212.0500 –Brazer
(vi) 7212.0105 – Tungsten Inert Gas Welder
(vii) 7212.0303 – Gas Metal Arc Welder/Metal Inert Gas/Metal Active Gas/Gas Metal Welder (MIG/MAG/GMAW)
(viii) 7212.0111- Repair Welder
(ix) 7212.0402- Plasma Cutter – Manual

Reference NOS:

(i) CSC/N9539
(ii) CSC/N9537
(iii) CSC/N9540
(iv) CSC/N9542
(v) CSC/N9546
(vi) CSC/N9541
(vii) CSC/N9545
(viii) CSC/N9547
(ix) CSC/N9548
(x) CSC/N9543
(xi) CSC/N9544
(xii) CSC/N9410
(xiii) CSC/N9411
(xiv) CSC/N9412
(xv) CSC/N9654
(xvi) CSC/N9655
(xvii) CSC/N9401
(xviii) CSC/N9402

4. GENERAL INFORMATION

Name of the Trade	**Welder**
Trade Code	DGT/1004
NCO - 2015	7212.0100, 7212.0200, 7212.0700, 7212.0400, 7212.0500, 7212.0105, 7212.0303, 7212.0111, 7212.0402
NOS Covered	CSC/N9539, CSC/N9537, CSC/N9540, CSC/N9542, CSC/N9546, CSC/N9541, CSC/N9545, CSC/N9547, CSC/N9548, CSC/N9543, CSC/N9544, CSC/N9410, CSC/N9411, CSC/N9412, CSC/N9654, CSC/N9655, CSC/N9401, CSC/N9402
NSQF Level	Level – 2.5
Duration of the Trade	One Year
Entry Qualification	Passed 8th class examination
Minimum Age	14 years as on first day of academic session.
Eligibility for PwD	LD, LC, DW, AA, DEAF, HH
Unit Strength (No. Of Student)	20 (There is no separate provision of supernumerary seats)
Space Norms	100 Sq. m
Power Norms	16 KW
Instructors Qualification for	
1. Welder Trade	B.Voc/Degree in Mechanical/ Metallurgy/ Production Engineering/ Mechatronics from AICTE /UGC recognized university/ college with **one year of teaching or industry experience** in the welding field. **OR** 03 years Diploma in Mechanical/ Metallurgy/ Production Engineering/ Mechatronics from AICTE/ recognized technical board of education with **two years of teaching or industry experience** in the welding field. **OR** NTC/NAC passed in the Trade of "Welder" with **three years of teaching or industry experience** in the welding field. **Essential Qualification:** Regular/ RPL variants of National Craft Instructor Certificate (NCIC) in Machinist trade under DGT. ***Note: - Out of two Instructors required for the unit of 2(1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications.***
2. Workshop Calculation & Science	B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with **one-year of teaching or industry experience.** **OR**

	03 years Diploma in Engineering from AICTE / recognized board of technical education with **two years' of teaching or industry experience.** **OR** NTC/ NAC in any one of the engineering trades with **three years' of teaching or industry experience.** **Essential Qualification:** Regular / RPL variants of National Craft Instructor Certificate (NCIC) in any one of the engineering trade or RoDA.
3. Engineering Drawing	B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with **one-year of teaching or industry experience.** **OR** 03 years Diploma in Engineering from AICTE / recognized board of technical education with **two years' teaching or industry experience.** **OR** NTC/ NAC in any one of the engineering/ Draughtsman group of trades with **three years' of teaching or industry experience**. **Essential Qualification:** Regular / RPL variants of National Craft Instructor Certificate (NCIC) in any one of the engineering trades or RoDA.
4. Employability Skill	MBA/ BBA / Any Graduate/ Diploma in any discipline with **Two years' of teaching or industry experience with short term ToT Course** in Employability Skills conducted by DGT institutions. (Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above) **OR** Existing Social Studies Instructors in ITIs with short term ToT Course in Employability Skills conducted by DGT institutions.
5. Minimum Age for Instructor	21 Years
List of Tools and Equipment	As per Annexure – I

5. LEARNING OUTCOME

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

5.1 LEARNING OUTCOMES

Sl. No.	NOS Code	Learning Outcome	Duration		
			Practical	Theory	Total
1.	CSC/N9539	Set the gas plant and join MS sheet in different position following safety precautions. *[Different position: - 1F, 2F, 3F, 1G, 2G, 3G.]*	52	8	60
2.	CSC/N9537	Set the SMAW machine and perform different type of joints on MS in different position observing standard procedure. *[different types of joints- Fillet (T-joint, lap & Corner), Butt (Square & V); different position - 1F, 2F, 3F,4F, 1G, 2G, 3G, 4G]*	160	50	210
3.	CSC/N9537	Set the oxy- acetylene cutting plant and perform different cutting operations on MS plate. *[Different cutting operation – Straight, Bevel, circular]*	25	5	30
4.	CSC/N9540	Perform in different types of MS pipe joints by Gas (OAW). *[Different types of MS pipe joints – Butt, Elbow, T-joint, angle (45°) joint, flange joint]*	85	5	90
5.	CSC/N9542	Set the SMAW machine and perform in different types of MS pipe joints by SMAW. *[Different types of MS pipe joints – Butt, Elbow, T-joint, angle (45°) joint, flange joint]*	55	5	60
6.	CSC/N9546	Choose appropriate process and perform joining of different types of metals and check its correctness. *[appropriate process – OAW, SMAW; Different metal – SS, CI, Brass, Aluminium]*	52	23	75
7.	CSC/N9541	Demonstrate arc gouging operation to rectify the weld joints.	28	2	30
8.	CSC/N9545	Test welded joints by different methods of testing. *[different methods of testing- Dye penetration test, Magnetic particle test, Nick break test, Free band test, Fillet fracture test]*	28	2	30

9.	CSC/N9547	Set GMAW machine and perform in different types of joints on MS sheet/plate by GMAW in various positions by dip/ spray/ globular mode of metal transfer. *[different types of joints- Fillet (T-joint, lap, Corner), Butt (Square & V); various positions- 1F, 2F, 3F,4F, 1G, 2G, 3G]*	129	36	165
10.	CSC/N9548	Set the GTAW plant and perform in different types of joints on different metals in different position by GTAW and check correctness of the weld. *[different types of joints- Fillet (T-joint, lap, Corner), Butt (Square & V); different metals- MS, Aluminium, Stainless Steel; different position- 1F & 1G]*	101	19	120
11.	CSC/N9548	Perform Aluminium & MS pipe joint by GTAW in flat position.	11	4	15
12.	CSC/N9543	Set the Plasma Arc cutting machine and cut ferrous & non-ferrous metals.	12	3	15
13.	CSC/N9544	Set the resistance spot machine and join MS & SS sheet.	13	2	15
14.	CSC/N9410	Perform joining of different similar and dissimilar metals by brazing operation as per standard procedure. *[different similar and dissimilar metals- Copper, MS, SS]*	43	2	45
15.	CSC/N9411	Repair Cast Iron machine parts by selecting appropriate welding process. (OAW, and SMAW]	13	2	15
16.	CSC/N9412	Hard facing of alloy steel components/ MS rod by using hard facing electrode.	13	2	15
17.	CSC/N9654	Fix the green welding simulator providing safe and controlled environment, select the joint design- the type of edge Preparation-welding position & set the process parameters for Virtual welding exercises.	10	5	15
18.	CSC/N9655	Perform repetitive virtual practice, take real-time feedback-offer advanced analysis & perform progress tracking with assessment.	10	5	15
19.	CSC/N9401	Read and apply engineering drawing for different application in the field of work.		30	30

20.	CSC/N9402	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.		30	30
Total			**840**	**240**	**1080**
Employability Skills				**120**	**120**
Grand Total			**840**	**360**	**1200**

6. ASSESSMENT CRITERIA

LEARNINGOUTCOMES	ASSESSMENT CRITERIA
1. Set the gas plant and join MS sheet in different position following safety precautions. *[Different position: - 1F, 2F, 3F, 1G, 2G, 3G.]* (NOS: CSC/N9539)	• Plan and select the nozzle size, working pressure, type of flame, filler rod as per requirement. • Prepare, set and tack the pieces as per drawing. • Set up the tacked joint in specific position. • Deposit the weld following proper technique and safety aspect. • Carry out visual inspection to ascertain quality weld joint.
2. Set the SMAW machine and perform different type of joints on MS in different position observing standard procedure. *[different types of joints- Fillet (T-joint, lap & Corner), Butt (Square & V); different position - 1F, 2F, 3F,4F, 1G, 2G, 3G, 4G].* (NOS: CSC/N9537)	• Plan and select the type & size of electrode, current. • Prepare edge as per requirement • Prepare, set SMAW machine and tack the pieces as per drawing. • Set up the tacked pieces in specific position. • Deposit the weld maintaining appropriate arc length, electrode angle, speed, weaving technique and safety aspects. • Clean the welded joint thoroughly. • Carry out visual inspection for appropriate weld joint & check by gauges.
3. Set the oxy- acetylene cutting plant and perform different cutting operations on MS plate. *[Different cutting operation – Straight, Bevel, circular].* (NOS: CSC/N9537)	• Plan and mark on MS plate surface for straight/bevel/circular cutting. • Select the nozzle size and working pressure of gases as per requirement. • Set the marked plate properly on cutting table. • Set the cutting plant & perform the cutting operation maintaining proper techniques and all safety aspects. • Clean the cutting burrs and inspect the cut surface for soundness of cutting.
4. Perform in different types of MS pipe joints *by* Gas (OAW). *[Different types of MS pipe joints – Butt, Elbow, T-joint, angle (45°) joint, flange joint]* (NOS: CSC/N9540)	• Plan and prepare the development for a specific type of pipe joint. • Mark and cut the MS pipe as per development. • Select the size of filler rod, size of nozzle, working pressure etc. • Set and tack the pieces as per drawing. • Deposit the weld bead maintaining proper technique and safety aspects.

	• Inspect the welded joint visually for poor penetration, uniformity of bead and surface defects.
5. Set the SMAW machine and perform in different types of MS pipe joints by SMAW. *[Different types of MS pipe joints – Butt, Elbow, T-joint, angle (45°) joint, flange joint].* (NOS: CSC/N9542)	• Plan and prepare the development for a specific type of pipe joint. • Mark and cut the MS pipe as per development. • Select the electrode size and current. • Set and tack the pieces as per drawing. • Deposit the weld bead maintaining proper technique and safety aspects. • Insect the welded joint visually for root penetration, uniformity of bead and surface defects.
6. Choose appropriate process and perform joining of different types of metals and check its correctness. *[appropriate process – OAW, SMAW; Different metal – SS, CI, Brass, Aluminium].* (NOS: CSC/N9546)	• Plan and prepare the pieces. • Select the type and size of filler rod and flux/electrode, size of nozzle and gas pressure/ current, preheating method and temperature as per requirement. • Set and tack metals as per drawing. • Deposit the weld maintaining appropriate technique and safety aspects. • Cool the welded joint by observing appropriate cooling method. Use post heating, peening etc. as per requirement. • Clean the joint and inspect the weld for its uniformity and different types of surface defects.
7. Demonstrate arc gouging operation to rectify the weld joints. (NOS: CSC/N9541)	• Plan and select the size of electrode for Arc gouging. • Select the polarity and current as per requirement. • Perform gouging adapting proper gouging technique. • Clean and check to ascertain the required stock removed.
8. Test welded joints by different methods of testing. *[different methods of testing- Dye penetration test, Magnetic particle test, Nick break test, Free band test, Fillet fracture test].* (NOS: CSC/N9545)	• Plan and select the job and clean the surface thoroughly. • Select the appropriate testing methods. • Perform testing of welded joints adapting standard operating procedure. • Record the test result & compare with standard parameter/ result value. • Accept/reject the job based on test result.

9. Set GMAW machine and perform in different types of joints on MS sheet/plate by GMAW in various positions by dip mode of metal transfer. *[different types of joints- Fillet (T-joint, lap, Corner), Butt (Square & V); various positions- 1F, 2F, 3F,4F, 1G, 2G, 3G].* (NOS: CSC/N9547)	• Select size of electrode wire, voltage, gas flow rate, wire feed rate as per requirement. • Prepare, set (machine & Job) and tack the pieces as per drawing and type of joints. • Set up the tacked joint in specific position. • Deposit the weld adapting proper technique and safety aspects. • Carry out visual inspection to ensure quality of welded joint. • Inspect the weld using Dye-penetration Test (DPT)/Magnetic particle Test (MPT).
10. Set the GTAW plant and perform in different types of joints on different metals in different position by GTAW and check correctness of the weld. [different types of joints- Fillet (T-joint, lap, Corner), Butt (Square & V); different metals- MS, Aluminium, Stainless Steel; different position- 1F & 1G] (NOS: CSC/N9548)	• Select power source as per material, size and type of Tungsten electrode, current, gas nozzle size, gas flow rate and filler rod size as per requirement. • Prepare, set (machine & Job) and tack the pieces as per drawing and type of joints. • Set up the tacked joint in specific position. • Deposit the weld by adapting proper technique and safety aspects. • Carry out visual inspection to ensure quality of welded joint. • Inspect the weld using Dye-penetration Test (DPT)/Magnetic particle Test (MPT).
11. Perform Aluminium & MS pipe joint by GTAW in flat position. (NOS: CSC/N9548)	• Plan and prepare development or edge preparation for specific type of pipe joint. • Mark and cut the MS pipe as per development. • Select the type of current, size and type of tungsten electrode, size of nozzle, gas flow rate and current as per requirement. • Set and tack the piece as per drawing. • Deposit the weld bead maintaining proper technique and safety aspects. • Inspect the welded joint visually for root penetration, bead uniformity and surface defects.
12. Set the Plasma Arc cutting machine and cut ferrous & non-ferrous metals. (NOS: CSC/N9543)	• Plan and mark on Ferrous/Non ferrous metal plates surface for plasma cutting. • Select the torch/nozzle size, current and working pressure of gas as per requirement. • Set the marked plate properly on cutting table.

	• Set the plasma cutting machine and perform the cutting operation by adapting proper techniques and safety aspects. • Clean and inspect the cut surface for quality of cutting.
13. Set the resistance spot machine and join MS & SS sheet. (NOS: CSC/N9544)	• Plan and select the material and clean the surface thoroughly. • Set the spot parameters on machine. • Spot weld the joint adapting appropriate techniques and safety. • Inspect the joint for soundness of weld.
14. Perform joining of different similar and dissimilar metals by brazing operation as per standard procedure. *[different similar and dissimilar metals- Copper, MS, SS]* (NOS: CSC/N9410)	• Plan and select the nozzle size, working pressure type of flame, filler rod and flux as per requirement. • Prepare, set and tack the pieces as per drawing. • Braze the joint adapting proper brazing technique and safety aspect. • Carry out visual inspection to ascertain quality weld joint.
15. Repair Cast Iron machine parts by selecting appropriate welding process. (OAW, and SMAW] (NOS: CSC/N9411)	• Plan and prepare the job as per requirement. • Select the type & size of electrode, power source, polarity, current as per requirement. • Set the part properly. • Deposit the weld adapting appropriate technique and safety aspects. • Clean the welded joint thoroughly. • Carry out visual inspection to ascertain quality of weld joint.
16. Hard facing of alloy steel components / MS rod by using hard facing electrode. (NOS: CSC/N9412)	• Plan and prepare the component by cleaning the surface thoroughly. • Select the type & size of electrode, power source, current as per requirement. • Deposit the weld observing standard practice and safety. • Clean the welded surface thoroughly. • Carryout visual inspection to ascertain quality of weld.
17. Fix the green welding simulator providing safe and controlled environment,	• Check the all-necessary connections of the Simulator plant. • Switch 'ON' the simulator.

select the joint design- the type of edge Preparation- welding position & set the process parameters for Virtual welding exercises. (NOS: CSC/N9654)	• Select SMAW /GMAW/GTAW process. • Follow the safety procedures for the welding operation. • Plan and select the different type of weld joint (e.g., butt joint, lap joint, T-joint etc.) and welding position. • Prepare properly the base metals for welding. • As per the selected process (SMAW /GMAW/GTAW), Set the welding parameters in the simulator like voltage, amperage, wire speed, gas flow etc. • Check how these parameters affect the weld quality.
18. Perform repetitive virtual practice, take real-time feedback-offer advanced analysis & perform progress tracking with assessment. (NOS: CSC/N9655)	• Practice the exercise multiple times for developing muscle memory and improving their welding skills. • Provide immediate feedback on each module of welding. • Explain among the trainees to adjust for improving their skills. • Analyze the weld quality for helping trainees to learn and adjust their techniques to achieve desired results. • Plan and set the simulator typically track for the trainee's progress, allow for automated assessment of weld quality, and provide personalized feedback.
19. Read and apply engineering drawing for different application in the field of work. (NOS: CSC/N9401)	• Read & interpret the information on drawings and apply in executing practical work. • Read &analyze the specification to ascertain the material requirement, tools and assembly/maintenance parameters. • Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
20. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: CSC/N9402)	• Solve different mathematical problems • Explain concept of basic science related to the field of study

7. TRADE SYLLABUS

SYLLABUS - WELDER				
DURATION: ONE YEAR				
Duration	**Reference Learning Outcome**	**Process code**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
Professional Skill 40 Hrs.; Professional Knowledge 15 Hrs.	1.a) Set the gas plant and join MS sheet in different position following safety precautions. *[Different position: - 1F, 2F, 3F, 1G, 2G, 3G.]* 2.a) Set the SMAW machine and perform different type of joints on MS in different positions observing standard procedure. *[different types of joints- Fillet (T-joint, lap & Corner), Butt (Square & V); different*		1. Demonstration of Machinery used in the trade. 2. Identification to safety equipment and their use etc. 3. Hacksawing, filing square to dimensions. 4. Marking out on MS plate and punching.	- Importance of trade Training. - General discipline in the Institute - Elementary First Aid. - Importance of welding in Industry - Introduction of SMAW and OAW Equipments, tools and accessories.
		OAW-01 SMAW-01	5. Setting of oxy-acetylene equipment, Lighting and setting of flame. 6. Performing fusion run without filler rod on MS sheet 2mm thick in flat position. 7. Setting up of SMAW machine & accessories and striking an arc. 8. Deposit straight line bead on MS plate in flat position.	- Terms and definitions of SMAW and OAW. - Safety precautions in Shielded Metal Arc, and Oxy-Acetylene gas welding and cutting.

	position - 1F, 2F, 3F,4F, 1G, 2G, 3G, 4G]			
Professional Skill 26 Hrs.; Professional Knowledge 04 Hrs.	1.b) Set the gas plant and join MS sheet in different positions following safety precautions. *[Different position: - 1F, 2F, 3F, 1G, 2G, 3G.]*	OAW-02 OAW-03	9. Edge joint on MS sheet 2 mm thick in flat position without filler rod. 10. Depositing bead with filler rod on M.S. sheet 2 mm thick in flat position.	- Different processes of metal joining methods: Bolting, riveting, soldering, brazing, seaming etc. - Classification of welding processes and their applications. - Basic types of welding joint and their applications. - Edge preparation and fit up for different thickness of metal. - Surface Cleaning
Professional Skill 20 Hrs.; Professional Knowledge 05 Hrs.	2.b) Set the SMAW machine and perform different type of joints on MS in different position observing standard procedure. *[different types of joints- Fillet (T-joint, lap & Corner), Butt (Square & V); different position - 1F, 2F, 3F,4F, 1G, 2G, 3G, 4G]*	SMAW-02 SMAW-03	11. Perform straight line beads on M.S. plate 10 mm thick in flat position. 12. Perform weaved bead on M. S plate 10mm thick in flat position.	- Basic electricity applicable to arc welding and related terms & definitions. - Heat and temperature and its terms related to welding - Principle of arc welding and characteristics of arc.

Professional Skill 25 Hrs.; Professional Knowledge 05 Hrs.	3. Set the oxy-acetylene cutting plant and perform different cutting operations on MS plate. *[Different cutting operation – Straight, Bevel, circular]*	OAGC-01 OAGC-02 OAGC-03 OAGC-04 OAGC-05	13. Setting up of oxy-acetylene gas cutting plant 14. Make straight cuts (freehand) 15. Mark and straight line cut of MS plate 10 mm thick by gas cutting process (accuracy within ± 2mm). 16. Bevel MS plates 10 mm thick, cutting regular geometrical shapes and irregular shapes, making chamfers by gas cutting. 17. Mark and perform radial cuts, cutting out holes using oxy-acetylene gas cutting. 18. Identify cutting defects viz., distortion, grooved, fluted or ragged cuts; poor draglines; rounded edges; tightly adhering slag.	- Common gases used for gas welding and gas cutting. - Oxy-Acetylene Cutting process: its principle, equipments, parameters and application.
Professional Skill 126 Hrs.; Professional Knowledge 34 Hrs.	1.c) Set the gas plant and join MS sheet in different position following safety precautions. *[Different position: - 1F, 2F, 3F, 1G, 2G, 3G.]*	OAW-04 SMAW-04 OAW-05	19. Square butt joint on M.S. sheet 2 mm thick in flat Position. **(1G)** 20. Fillet “T” joint on M.S. Plate 10 mm thick in flat position. **(1F)** 21. Open outside corner joint on MS sheet 2 mm thick in flat Position **(1F)**	- Arc welding power sources: Transformer, Generator, Rectifier and Inverter type machines. - Working principle and care & maintenance of each type of machine. - Advantages and disadvantages of A.C. and D.C. machines.

	2.c) Set the SMAW machine and perform different type of joints on MS in different position observing standard procedure. *[different types of joints- Fillet (T-joint, lap & Corner), Butt (Square & V); different position - 1F, 2F, 3F,4F, 1G, 2G, 3G, 4G]*	SMAW-05 OAW-06 SMAW-06	22. Fillet lap joint on M.S. plate 10 mm thick in flat position. **(1F)** 23. Fillet "T" joint on MS sheet 2 mm thick in flat position. **(1F)** 24. Open outside corner joint on MS plate 8/10 mm thick in flat position. **(1F)**	- Welding positions as per EN, ISO & ASME: flat, horizontal, vertical and overhead position. - Weld slope and rotation. - Welding symbols as per ISO & AWS.
		OAW-07 SMAW-07 I&T-01	25. Fillet Lap joint on MS sheet 2 mm thick in flat position**. (1F)** 26. Single "V" Butt joint on MS plate 10 mm thick in flat position **(1G)**. 27. Testing of weld joints by visual inspection of welds by using weld gauges.	- Arc length – importance – types – effects of arc length. - Polarity: Importance – types and applications. - Weld quality inspection - Appearance of good and defective weld. - Weld gauges & their uses.
		OAW-08 SMAW-08 SMAW-09	28. Square Butt joint on M.S. sheet. 2 mm thick in Horizontal position. **(2G)** 29. Straight line beads and multi-layer practice on M.S. Plate 8/10 mm thick in Horizontal position. 30. Fillet "T" joint on M.S. plate 8/10 mm thick in Horizontal position**. (2F)**	- Acetylene gas: its properties and generation. - Calcium carbide: its production, uses and precautions to avoid hazards.
		OAW-09 SMAW-10	31. Fillet Lap joint on M.S. sheet 2 mm thick in horizontal position **(2F)** 32. Fillet Lap joint on M.S. plate 10 mm thick in horizontal position. **(2F)**	- Oxygen gas: its properties and generation. - Oxygen cylinder: features, charging process in cylinder.

				- DA cylinder: features, charging process in cylinder. - Gas Welding Regulator: functions, types, and working principle of single and double stage Gas regulators.
		OAW-10 OAW-11 SMAW-11 SMAW-12	33. Fusion run with filler rod in vertical position on 2mm thick M.S sheet. 34. Square Butt joint on M.S. sheet. 2 mm thick in vertical position (3G) 35. Open square butt joint on M.S. plate 5 mm thick in horizontal position **(2G)**. 36. Single Vee Butt joint on M.S. plate 10/12 mm thick in horizontal position **(2G)**.	- Gas welding blow pipe: functions, types, construction and working principle of HP & LP blow pipe. Difference between them. - Oxy-acetylene welding flame: types, features, and uses. - Oxy acetylene gas welding Systems: HP & LP. Acetylene gas generation by water to carbide & carbide to water type generator. - Gas welding techniques: Rightward and Leftward technique.
		OAW-12 SMAW- 13	37. Fillet “T” joint on M.S sheet 2 mm thick in vertical position. **(3F)** 38. Straight line beads practice on M.S. Plate 8/10 mm thick in Vertical (up) position. 39. Weaved beads practice on M.S. Plate 8/10 mm	- Arc blow – causes, effects and methods of controlling arc blow. - Distortion in arc & gas welding: causes and types. - Methods employed to minimize distortion - Arc welding defects: external and internal,

		SMAW- 14	thick in Vertical (up) position. 40. Fillet "T" joint on M.S. plate 10 mm thick in vertical position. **(3F)**	causes and remedies of each defect.
Professional Skill 85 Hrs.; Professional Knowledge 05 Hrs.	2.d) Set the SMAW machine and perform different type of joints on MS in different position observing standard procedure. *[different types of joints- Fillet (T-joint, lap & Corner), Butt (Square & V); different position - 1F, 2F, 3F,4F, 1G, 2G, 3G, 4G]* 4. Perform in different types of MS pipe joints by Gas (OAW). *[Different types of MS pipe joints – Butt, Elbow, T-joint, angle (45°) joint, flange joint]*	SMAW-15 SMAW-16 OAW-15 SMAW-17 SMAW-18	41. Fillet Lap joint on M.S. Plate 10 mm in vertical position. **(3F)** 42. Open outside corner joint on MS plate 10 mm thick in vertical position. **(2F)** 43. Pipe "T" joint on MS pipe Ø 50 and 3mm WT. **(1F)** 44. Single "V" Butt joint on MS plate 10/12 mm thick in vertical position (3G). 45. Straight line beads on M.S. plate 6 to 10 mm thick in overhead position.	- Specification of pipes, various types of pipe joints, positions in pipe welding and procedure. - Difference between pipe and plate welding. - Pipe development for Elbow joint, "T" joint, Y joint and branch joint - Brief use of Manifold system. - Gas welding filler rods, specifications and sizes. - Gas welding fluxes – types and functions. - Gas Brazing & Soldering: principles, types of fluxes & uses - Gas welding defects, causes and remedies - Electrode: types, functions of flux, coating factor, size & specifications of electrode. - Effects of moisturized electrode. - Coding of MMAW electrode by different standard.

				- Storage and baking of electrodes.
Professional Skill 55 Hrs.; Professional Knowledge 05 Hrs.	2.e) Set the SMAW machine and perform different type of joints on MS in different position observing standard procedure. *[different types of joints- Fillet (T-joint, lap & Corner), Butt (Square & V); different position - 1F, 2F, 3F,4F, 1G, 2G, 3G, 4G]* 5. Set the SMAW machine and perform in different types of MS pipe joints by SMAW. *[Different types of MS pipe joints – Butt, Elbow, T-joint, angle (45°) joint, flange joint]*	SMAW-19 SMAW-20 SMAW-21 SMAW-22 SMAW-23 SMAW-24 AG-01	46. Pipe Flange joint on M.S plate with MS pipe Ø 50 mm X 3mm WT **(1F)** 47. Fillet "T" joint on M.S. plate 10 mm thick in overhead position. **(4F)** 48. Pipe butt joint on MS pipe Ø 50 mm and 5 mm WT. in 1G position. 49. Fillet Lap joint on M.S. plate 10 mm thick in overhead position. **(4F)**. 50. Single "V" Butt joint on MS plate 10mm thick in overhead position **(4G)** 51. Pipe butt joint on M. S. pipe Ø 50 mm WT 6 mm (**1G** Rolled). 52. Arc gouging on MS plate 10 mm thick.	- Weldability of metals, importance of pre-heating, post heating and maintenance of inter-pass temperature. - Weldability of low, medium and high carbon steel and alloy steels. - Stainless steel: types, weldability & weld decay. - Arc cutting & gouging
Professional Skill 30 Hrs.;	6.a) Choose appropriate process and perform joining	OAW-17 SMAW -25	53. Butt joint of copper pipe ½ inch by gas brazing process.	- Induction/ gas brazing of copper tubes.

Professional Knowledge 12 Hrs.	of different types of metals and check its correctness. *[appropriate process – OAW, SMAW; Different metal – SS, CI, Brass, Aluminum]*	OAW-18	54. Square Butt joint on S.S. Sheet 2 mm thick in flat position. **(1G)** 55. Corner/T joint of copper pipe of ½ inch and of length 75 mm	- Brass: types – properties and methods of welding. - Copper: types – properties and methods of welding. - Brazing of cutting tools.
Professional Skill 28 Hrs.; Professional Knowledge 02 Hrs.	6.b) Choose appropriate process and perform joining of different types of metals and check its correctness. *[appropriate process – OAW, SMAW; Different metal – SS, CI, Copper Aluminum]* 7. Demonstrate arc gauging operation to rectify the weld joints.	OAW-19 SMAW-26	56. Square Butt & Lap joint on SS sheet 2 mm thick by brazing in flat position. 57. Single "V" butt joint on C.I. plate 6mm thick in flat position. **(1G)**	- Cast iron: its properties, types and methods of welding cast iron.
Professional Skill 22 Hrs.; Professional Knowledge 11 Hrs.	6.c) Choose appropriate process and perform joining of different types of metals and check its correctness.	OAW-20 OAW-21	58. Square Butt joint on Aluminium sheet. 3 mm thick in flat position. 59. Brazing of cast iron (Single "V" butt joint) 6mm thick plate.	- Aluminium: its properties and weldability, methods of welding aluminium.

	[appropriate process – OAW, SMAW; Different metal – SS, CI, Brass, Aluminum]			
Professional Skill 28 Hrs.; Professional Knowledge 02 Hrs.	8. Test welded joints by different methods of testing. *[different methods of testing- Dye penetration test, Magnetic particle test, Nick break test, Free band test, Fillet fracture test]*	I&T-02 I&T-03 I&T-04 I&T-05 I&T-06	60. Test Dye penetrant. 61. Test Magnetic particle. 62. Test Free bend. 63. Test Fillet fracture. 64. Test Ultrasonic.	- Inspection of welding: Necessity, methods of inspection before – during – after welding. - Classification of destructive and NDT methods. - Knowledge of common DT & NDT. - Cost economy and estimation.
Professional Skill 129 Hrs.; Professional Knowledge 36 Hrs.	9. Set GMAW machine and perform in different types of joints on MS sheet/plate by GMAW in various positions by dip/ spray/ globular mode of metal transfer. *[different types of joints- Fillet (T-joint, lap, Corner), Butt (Square & V);*	GMAW- 01 GMAW - 02	65. Introduction to GMAW plant, safety equipments and their use. 66. Setting up of GMAW machine & accessories and striking an arc. 67. Depositing straight line beads on M.S Plate using different metal transfer technique. 68. Fillet weld – "T" joint on M.S plate 10mm thick in flat position by Dip/ Spray transfer. **(1F)**	- Safety precautions in Gas Metal Arc and Gas Tungsten Arc. - Introduction to GMAW -equipment – accessories. - Various other names of the process. (MIG/MAG/CO_2.)

	various positions- 1F, 2F, 3F,4F, 1G, 2G, 3G]	GMAW -03 GMAW -04 GMAW -05	69. Fillet weld – Lap joint on M.S. sheet 3mm thick in flat position by Dip transfer. **(1F)** 70. Fillet weld – "T" joint on M.S. sheet 3mm thick in flat position by Dip transfer. **(1F)** 71. Fillet weld – corner joint on M.S. sheet 3mm thick in flat position by Dip transfer. **(1F)**	- Advantages of GMAW over SMAW, limitations and applications - Process variables of GMAW.
		GMAW -06 GMAW -07	72. Butt weld – Square butt joint on M.S sheet 3mm thick in flat position by Dip transfer. **(1G)** 73. Butt weld – Single "V" butt joint on M.S plate 8/10 mm thick by Dip/ Spray transfer in flat position. **(1G)**	- Wire feed system – types – care and maintenance. - wires used in GMAW, standard diameter and codification as per AWS.
		GMAW -08 GMAW -09	74. Fillet weld – "T" joint on M.S plate 8/10 mm thick in Horizontal position by different metal transfer. **(2F)** 75. Fillet weld – corner joint on M.S plate 8/10 mm thick in Horizontal position by different metal transfer. **(2F)**	- Name of shielding gases used in GMAW and its applications. - Flux cored arc welding – description, advantage, filler wires, coding as per AWS.
		GMAW -10	76. Fillet weld – "T" joint on M.S. sheet 3mm thick in Horizontal	- Edge preparation of various thicknesses of metals for GMAW.

		GMAW -11	position by Dip transfer. **(2F)** 77. Fillet weld – corner joint on M.S. sheet 3mm thick in Horizontal position by Dip transfer. **(2F)**	- GMAW defects, causes and remedies
		GMAW -12 GMAW -13	78. Fillet weld – "T" joint on M.S plate 8/10 mm thick in vertical position by different metal transfer. **(3F)** 79. Fillet weld – corner joint on M.S plate 8/10 mm thick in vertical position by different metal transfer. **(3F)**	- Heat input and techniques of controlling heat input during welding. - Heat distribution and effect of faster cooling - Pre heating & Post Weld Heat Treatment - Use of temperature indicating crayons. -
		GMAW -14 GMAW -15	80. Fillet weld – Lap joint on M.S. sheet 3mm thick in vertical position by Dip transfer. **(3F)** 81. Fillet weld – corner joint on M.S. sheet 3mm thick in vertical position by Dip transfer. **(3F)**	
		GMAW -16 GMAW -17	82. Fillet weld – Lap and "T" joint on M.S sheet 3mm thick in overhead position by Dip transfer. **(4F)** 83. Tee Joints on MS Pipe Ø 60 mm OD x 3 mm WT 1G position – Arc constant (Rolling)	- Submerged arc process – principles, equipment, advantages and limitations - Introduction of pulse MIG

		GMAW -18 GMAW -19	84. Depositing bead on S.S. sheet in flat position. 85. Butt joint on Stainless steel 2 mm thick sheet in flat position by Dip transfer.	- Thermit process- types, principles, equipment, Thermit mixture types and applications. - Use of backing strips and backing bars
Professional Skill 101 Hrs.; Professional Knowledge 19 Hrs.	10. Set the GTAW plant and perform in different types of joints on different metals in different position by GTAW and check correctness of the weld. *[different types of joints- Fillet (T-joint, lap, Corner), Butt (Square & V); different metals- MS, Aluminium, Stainless Steel; different position- 1F & 1G]*	GTAW -01 GTAW -02	86. Depositing bead on Aluminium sheet 2 mm thick in flat position. 87. Square butt joint on Aluminium sheet 1.6mm thick in flat position.	- GTAW process - brief description. Difference between AC and DC, equipment, polarities and applications. - Power sources for GTAW - AC & DC
		GTAW -03 GTAW -04	88. Fillet weld – "T" joint on Aluminium sheet 1.6 mm thick in flat position. **(1F)** 89. Fillet weld – Outside corner joint on Aluminium sheet 2 mm thick in flat position. **(1F)**	- Tungsten electrodes – types & uses, sizes and preparation - GTAW Torches- types, parts and their functions - GTAW filler rods and selection criteria. - Introduction of pulse TIG
		GTAW -05	90. Butt weld - square butt joint on Stainless steel sheet 1.6 mm thick in flat position with purging gas **(1G)**	- Edge preparation and fit up. - GTAW parameters for of different thickness of metals
		GTAW -06	91. Fillet weld – "T" joint on Stainless steel sheet 1.6 mm thick in flat position. **(1F)**	- Argon / Helium gas properties – uses. - GTAW Defects causes and remedies.
Professional Skill 11 Hrs.;	11.a) Perform Aluminium & MS pipe joint by	GTAW -07	92. Pipe butt joint on Aluminium pipe Ø 50	- Friction welding – process, equipment and application.

Professional Knowledge 04 Hrs.	GTAW in flat position.		mm x 3 mm WT in Flat position. **(1G)**	- Laser Beam Welding (LBW).
Professional Skill 12 Hrs.; Professional Knowledge 03 Hrs.	11.b) Perform Aluminium & MS pipe joint by GTAW in flat position. 12. Set the Plasma Arc cutting machine and cut ferrous & non-ferrous metals.	GTAW -08 PAC-01	93. "T" Joints on MS Pipe Ø 50 mm OD x 3 mm WT, position – Flat **(1F)** 94. Straight and profile cutting on ferrous and non ferrous	- Air plasma cutting (PAC) process – equipments and principles of operation. - Types of Plasma arc, advantages and applications.
Professional Skill 13 Hrs.; Professional Knowledge 02 Hrs.	13. Set the resistance spot machine and join MS & SS sheet.	RW-01 RW-02	95. Lap joint on Stainless steel sheet by Resistance Spot Welding. 96. Lap joint on MS sheets by Resistance Spot Welding.	- Resistance process - types, principles, power sources and parameters. - Applications and limitations.
Professional Skill 43 Hrs.; Professional Knowledge 02 Hrs.	14. Perform joining of different similar and dissimilar metals by brazing operation as per standard procedure. *[different similar and dissimilar metals- Copper, MS, SS]*	OAW-22 OAW-23	97. Square butt joint on copper sheet 2mm thick in flat position. **(1G)** 98. "T" joint on Copper to MS sheet 2mm thick in flat position by Brazing **(1F)**	- Metalizing – types of metalizing principles. - Manual Oxy – acetylene powder coating process- principles of operation and applications
		OAW-24 OAW-25	99. Silver brazing on S.S. Sheet with copper sheet ("T" joint). 100. Silver brazing on copper Bell-mount joint.	- Reading of assembly drawing - Procedure Specification (WPS) and Procedure Qualification Record (PQR)

Professional Skill 26 Hrs.; Professional Knowledge 04 Hrs.	15. Repair Cast Iron machine parts by selecting appropriate welding process. (OAW, and SMAW] 16. Hard facing of alloy steel components / MS rod by using hard facing electrode.	OAW - 26 SMAW-27 SMAW (HF)-01 SMAW (HF)-02	101. Repair of broken C.I. machine parts by oxy-acetylene welding with C.I. filler rod and bronze filler rod. 102. Repair of broken C.I. machine parts by C.I. electrode. 103. Hard facing on MS/ carbon steel sheet. 104. Hard facing on MS single and multi-layer.	- Hard facing/ surfacing necessity, surface preparation, various hard facing alloys and advantages of hard facing. Plastic machine with hot air gun and Thermoplastic materials: Polypropylene (PP) Polyethylene (PE) Polyvinylchloride (PVC)
Professional Skill 10 Hrs.; Professional Knowledge 05 Hrs.	17. Fix the green welding simulator providing safe and controlled environment, select the joint design- the type of edge Preparation- welding position & set the process parameters for Virtual welding exercises.	GWS-1	105. Demonstrate how to set and fix the green welding simulator.	- Fundamentals of Green welding simulator. Trainees learn the basics of welding including safety procedures, equipment operation and welding techniques.
		GWS-2	106. Perform the programming on the simulator control unit for welding process (SMAW/GMAW/GTAW) and welding joint, position & type of edge preparation.	- Joint Design, welding position and type of edge Preparation - used in Virtual processes (Green Welding).
		GWS-3	107. Perform the setting of Parameters for Virtual welding exercises.	- Welding parameters for SMAW/ GMAW/ GTAW such as current, voltage, speed, work angle and electrode distance.

				- Explain how to optimize them for different welding tasks.
Professional Skill 10 Hrs.; Professional Knowledge 05 Hrs.	18. Perform repetitive virtual practice, take real-time feedback-offer advanced analysis & perform progress tracking with assessment.	GWS-4	108. Perform Butt joints, lap joints and T-joints exercises multiple times, developing muscle memory and improving their welding skills.	- Explain the core of the simulator in virtual welding techniques in a realistic 3D environment without the hazards of real welding.
		GWS-5	109. Perform how to take the feedback on each module of welding. 110. Demonstrate among the trainees about the effects of each technique performed. 111. Analyze the weld quality to learn and adjust their techniques to achieve desired results.	- Benefits of Green Welding Simulators such as Cost-effective, Safety, Efficiency, Accessibility and Environmental Sustainability. - Explain the simulators use augmented reality to overlay virtual welding information onto real-world objects, creating a hybrid training experience.
		GWS-6	112. Perform simulator's typically track and provide for automated assessment of weld quality and record personalized feedback.	- Virtual Environments: Explain simulators offer a variety of virtual environments, such as a factory setting, allowing trainees to practice in different scenarios.
Engineering Drawing				
Professional Knowledge ED - 30 Hrs.	19. Read and apply engineering drawing for	- Introduction to Engineering Drawing and Drawing Instruments; Conventions Sizes and layout of drawing sheets Title Block, its position and content		

	different application in the field of work.	Drawing Instrument - Free hand drawing of; Geometrical figures and blocks with dimension Transferring measurement from the given object to the free hand sketches. Free hand drawing of hand tools and measuring tools. - Lines Types and applications in drawing - Drawing of Geometrical figures; Angle, Triangle, Circle, Rectangle, Square, Parallelogram. Lettering & Numbering – Single Stroke, double stroke, inclined - Reading of dimension and Dimensioning Practice. - Reading of fabrication drawing, sectional view of different types of Joints. Sectional view of different pipe joints - Symbolic representation different symbols used in the related trades Reading of Job Drawing of related trades.
Workshop Calculation & Science		
Professional Knowledge WC- 30 Hrs.	20. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.	- Unit, Fractions - Square root, Ratio and Proportions, Percentage - Material Science - Mass, Weight, Volume and Density - Heat & Temperature and Pressure - Basic Electricity - Mensuration - Trigonometry

SYLLABUS FOR CORE SKILLS
1. Employability Skills (Common for all CTS trades) (120 Hrs.)

Learning outcomes, assessment criteria, syllabus and Tool List of Employability Skills is provided separately in www.cstaricalcutta.gov.in / www.bharatskills.gov.in / www.dgt.gov.in.

ANNEXURE-I

LIST OF TOOLS AND EQUIPMENT			
WELDER (For batch of 20 Candidates)			
S No.	**Name of the Tools& Equipment**	**Specification**	**Quantity**
A. TRAINEES TOOL KIT (For each additional unit trainees tool kit Sl. 1-15 is required additionally)			
1.	Helmet fiber		20+1 Nos.
2.	Hand shield fiber		20+1 Nos.
3.	Chipping hammer	with metal handle 250 Grams	20+1 Nos.
4.	Chisel cold	flat 19 mm x 150 mm	20+1 Nos.
5.	Centre punch	9 mm x 127 mm	20+1 Nos.
6.	Dividers	200 mm	20+1 Nos.
7.	Stainless steel rule	300mm	20+1 Nos.
8.	Scriber	150 mm double point	20+1 Nos.
9.	Flat Tongs	350mm long	20+1 Nos.
10.	Hack saw frame	fixed 300 mm	20+1 Nos.
11.	File half round	bastard 300 mm	20+1 Nos.
12.	File flat	350 mm bastard	20+1 Nos.
13.	Hammer ball pane	1 kg with handle	20+1 Nos.
14.	Tip Cleaner		20+1 Nos.
15.	Try square	6”	20+1 Nos.
16.	Vernier caliper	Digital upto 300 mm	2 nos.
17.	Micrometer	Digital upto 0-25 mm	2 nos.
18.	Thermal gun/ temperature measuring gun		2 nos.
B. INSTRUMENTS AND GENERAL SHOP OUTFIT - For 2 (1+1) units no additional items are required			
TOOLS & EQUIPMENT			
19.	Wire cutter	For MIG welding	6 nos.
20.	Spindle key	For welding plant	8 Nos. (2 for each type of gas)
21.	Screw Driver	300mm blade and 250 mm blade	1 each
22.	Number punch	6 mm	2 set
23.	Letter punch	6 mm	2 set
24.	Magnifying glass	100 mm dia.	2 Nos.

25.	Universal/ Cambridge Weld measuring gauge		2 Nos.
26.	Spanner D.E.	6 mm to 32mm	2 sets
27.	C-Clamps	10 cm and 15 cm	2 each
28.	Hammer sledge	double faced 4 kg	2 No.
29.	S.S tape	5 meters flexible in case	5 No.
30.	H.P. torch	with 5 nozzles	2 sets
31.	Oxygen Gas Pressure regulator	double stage	2 Nos.
32.	Acetylene Gas Pressure regulator	double stage	2 Nos.
33.	Pre-heater	For GMAW	2 Nos.
34.	CO_2 Gas pressure regulator	with flow meter	2 set
35.	Argon Gas pressure regulator	with flow meter	2 set
36.	Metal rack	182 cm x 152 cm x 45 cm	1 No.
37.	First Aid box		1 No.
38.	Steel lockers	with 8 Pigeon holes	3 Nos.
39.	Steel almirah / cupboard		4 Nos.
40.	Black board and easel with stand		1 No.
41.	Flash back arrester (torch mounted)		4 pairs
42.	Flash back arrester (cylinder mounted)		4 pairs
43.	Multiangle magnetic clamp set	Metal base (18x10x10 cm)	one
GENERAL SHOP OUTFIT			
44.	AC welding Transformer	with all accessories (400A, OCV 60–100 V, 60% duty cycle)	4 sets
45.	Transformer (or) Inverter based machine (IGBT)	with all accessories (300A, OCV 60 – 100 V, 60% duty cycle)	2 sets
46.	DC rectifiers set with all accessories	(400 A. OCV 60 – 100 V, 60% duty cycle)	2 sets
47.	GMAW machine	400A capacity with air cooled torch, Regulator, Gas pre-heater, Gas hose and Standard accessories	2 sets
48.	AC/DC GTAW machine	with water cooled torch 300 A, Argon regulator, Gas hose, water circulating system and standard accessories.	2 sets
49.	Air Plasma cutting equipment	with all accessories, capacity to cut 12 mm clear cut	1 set

50.	Air compressor suitable for above air plasma cutting system.	Two stage compressor 15KW	1 No.
51.	Auto Darkening Helmet		5Nos.
52.	Spot machine	15 KVA with all accessories	1 set
53.	Portable gas cutting machine (PUG)	capable of cutting Straight & Circular with all accessories	1 set
54.	Pedestal grinder fitted with coarse and medium grain size grinding wheels	300 mm dia.	2 No.
55.	Bench grinder fitted with fine grain size silicon carbide green grinding wheel	150 mm dia.	2 nos.
56.	AG 4 Grinder		4 Nos.
57.	Suitable gas table	with fire bricks	2 Nos.
58.	Suitable Arc table	with positioner	6 Nos.
59.	Trolley for cylinder (H.P. Unit)		2 Nos.
60.	Hand shearing machine capacity	cut 6 mm sheets and flats	1 No.
61.	Power saw machine	18'' or blade size 450 mm	1 No.
62.	Portable drilling machine	(Cap. 6 mm)	1 No.
63.	Oven, electrode drying	0 to 350°C, 10 kg capacity, depth 450mm to 500 mm, intake capacity 10 kg	1 No.
64.	Work bench	340x120x75 cm with 4 bench vices of 150 mm jaw opening	4 sets
65.	Oxy Acetylene Gas cutting blow pipe		2 sets
66.	Oxygen, Acetylene Cylinders **		2 each
67.	CO_2 cylinder **		2 Nos.
68.	Argon gas cylinder **		2 Nos.
69.	Anvil 24 sq. inches working area with stand		1 No.
70.	Swage block 5048	Cast iron 16x16x16 inch	1 No.
71.	Magnetic particle testing Kit #		1 set
72.	Fire extinguishers (foam type and CO_2 type)		1. No.
73.	Fire buckets with stand		4 Nos.
74.	Portable abrasive cut-off machine		1 No.
75.	Suitable Gas cutting table		1 No.

76.	Simulators for MR (Mixed reality)/ VR (Virtual reality)	SMAW/ GTAW/GMAW	02 sets
77.	Water cooled induction / Brazing machine	200-250 Amp., induction coil length 3 inch and 2.5 inch	1
78.	Plastic machine with hot air gun	temp. display, variable temp., PE, PP & PVC sheet or pipe control with stand. Accessories.	1
79.	Swaging and flooring tool kit 45^0 tubing	1/8 to ¾ inch	
80.	Modern Welding Booth with welding positioner	With fume extractor and manipulator	04 nos.
81.	Master Welding Booth with welding positioner	With fume extractor and manipulator	01 no.
82.	Ultrasonic testing machine with accessories and different probs	Standard	01 sets
C. CONSUMABLE			
83.	Leather Hand Gloves	14”	20 pairs
84.	Masking tape	2.5”	5 nos.
85.	Cotton hand Gloves	8”	20 pairs
86.	Leather Apron leather		20 Nos.
87.	S.S Wire brush	5 rows and 3 rows	20 Nos. each
88.	Leather hand sleeves	16”	20 pairs
89.	Safety boots for welders	Size 7,8,9,10	20pairs
90.	Leg guards leather		20pairs
91.	Rubber hose clips	½"	20 Nos.
92.	Rubber hose oxygen	8 mm dia X 10 Mtr. long as per BIS	2 Nos.
93.	Rubber hose acetylene	8 mm dia X 10 Mtr. long as per BIS	2 Nos.
94.	Arc cables multi cored copper	400/ 600 amp as per BIS	45 mts. each
95.	Arc single-coloured glasses	108 mm x 82 mm x 3 mm. DIN 11A &12 A	34 Nos.
96.	Arc plain glass	108 mm x 82 mm x 3 mm.	68 Nos.
97.	Gas Goggles	with Colour glass 3 or 4A DIN	34 Nos.
98.	Safety goggles plain		34 Nos.
99.	Spark lighter	CUP lighter for	6 Nos.
100.	AG 4 Grinding wheels		50 Nos.
101.	Earth clamp	600A	6 Nos.
102.	Electrode holder	600 amps	6 Nos.

103.	Die penetrant testing kit		1 set
104.	Anti spatter spray can	100 to 300 ml	5 Nos.
105.	GMAW Torch nozzle tip	Size 0.8, 1.0, 1.2 (in mm)	5 Nos. each
106.	TIG torch ceramic nozzle	Size 3,4,5,6,8	4 Nos. each
107.	Tungsten electrode	1.0, 1.6, 2.0 (in mm), length 150 mm	5 Nos. each
108.	Brass filler wire	1.0mm, 2.0 mm	
109.	AG4 cutting wheels		100 Nos.
110.	CCMS filler wire	1.0 mm	4 Kg
111.	Brass filler wire	1.0 mm	4 Kg
112.	Copper filler wire	1.0 mm	4 Kg
113.	Flux for Brass		500 Gram
114.	Flux for Copper		500 Gram
D. CLASS ROOM FURNITURE FOR TRADE THEORY			
115.	Instructor's table and Chair (Steel)		1 set
116.	Students chairs with writing pads		20 Nos.
117.	White board	size 1200 mm X 900 mm	1 No.
118.	Instructor's laptop with latest configuration pre-loaded with operating system and MS Office package.		1 No.
119.	Desktop with latest configuration		1 No.
120.	LCD projector with screen/ interactive board		1 No.
121.	Process, Inspection & codes DVD/ CDs.		1 set each (optional)

Note:

1. *** Optionally Gas cylinders can also be hired as and when required.*
2. *# One machine per institute irrespective of number of units of trade is necessary.*
3. *Internet facility should be available in classroom*

Annexure – II

The DGT sincerely acknowledges contributions of the Industries, State Directorates, Trade Experts, Domain Experts, trainers of ITIs, NSTIs, faculties from universities and all others who contributed in revising the curriculum. Special acknowledgement is extended by DGT to the following expert members who had contributed immensely in this curriculum.

List of Contributors			
S No.	**Name & Designation Mr./ Ms.**	**Organization**	**Remarks**
1.	T. Ragulan, Director	CSTARI, Kolkata	Chairman
2.	Brindaban Das, DD/HOO	CSTARI, Kolkata	Member
3.	Bipul Nandi, Instructor	DECT. Assam	Member
4.	Swapan Kumar Mukhopadhyaya	M/S Quadra Consulting Kolkata	Member
5.	Tapan Kumar Hazra, Instructor	Govt ITI Gariahat	Member
6.	Raja Mondal, Deputy Manager	B.B.J Construction Co. LTD	Member
7.	Mrinmoy Maity, Asst. Manager	B.B.J Construction Co. LTD	Member
8.	Sandip Mazumder, Instructor (WL)	Govt ITI Tollygunge	Member
9.	Sunil Kumar Mondal, Supervisor	Govt ITI Howrah Homes	Member
10.	C. Stalin, Training Officer	NSTI Bhubaneswar Odisha	Member
11.	Rituraj Bose, Hony. Secretary General	The Indian Institute of Welding, Kolkata	Member
12.	Prof. Dr. Santanu Das, Chairman, Welding Education Committee	The Indian Institute of Welding, Kolkata	Member
13.	Dr. Arpan Kr. Mondal, Asst. Prof., ME	NITTTR Kolkata	Member
14.	Tapas Sen, Welding Trainer	R.J. Industries	Member
15.	Asok Das Gupta, Ex SSE/CLW	Chittaranjan Locomotive Works	Member
16.	Bidesh Adhikary, Welder Trainer	Quadra Consulting Kolkata	Member
17.	Subhankar Rana T.O.	NSTI, Howrah	Member
18.	Archana Singh, ADT	CSTARI, Kolkata	Member
19.	Akhilesh Pandey, A.D.	CSTARI, Kolkata	Member
20.	Sk. Altaf Hossain, A. D	CSTARI, Kolkata	Member
21.	Murari Barui, A. D.	CSTARI, Kolkata	Member
22.	B. K. Nigam, T.O.	CSTARI, Kolkata	Member
23.	B. Biswas, T.O.	CSTARI, Kolkata	Member
24.	P. K. Bairagi, T.O.	CSTARI, Kolkata	Member
25.	Pradip Biswas, Jr. D/Man	CSTARI, Kolkata	Member
26.	Hemant Kujur Jr. D/Man	CSTARI, Kolkata	Member

27.	Debasis Pani, A. D.	NSTI (W), Agartala	Member
28.	Rahul Priyadarshi Dy. Director	CD-Section, DGT Kaushal Bhawan, New Delhi	Member
29.	Dharm Nath Sharma Asst. Director	NSTI BANGALORE	Member

ANNEXURE-III

ABBREVIATIONS	
CTS	Craftsmen Training Scheme
ATS	Apprenticeship Training Scheme
CITS	Crafts Instructor Training Scheme
DGT	Directorate General of Training
MSDE	Ministry of Skill Development and Entrepreneurship
NTC	National Trade Certificate
NAC	National Apprenticeship Certificate
NCIC	National Craft Instructor Certificate
LD	Locomotor Disability
CP	Cerebral Palsy
MD	Multiple Disabilities
LV	Low Vision
HH	Hard of Hearing
ID	Intellectual Disabilities
LC	Leprosy Cured
SLD	Specific Learning Disabilities
DW	Dwarfism
MI	Mental Illness
AA	Acid Attack
PwD	Person with disabilities


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