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

Directorate General of Training

WELDER

(Engineering Trade)

(Revised in March 2023)

Version: 2.0

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL – 2.5

Developed By

Ministry of Skill Development and Entrepreneurship

Directorate General of Training

CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE

EN-81, Sector-V, Salt Lake City,

Kolkata – 700 091

www.cstaricalcutta.gov.in

CONTENTS

1. COURSE INFORMATION

During the one year duration a candidate is trained on subjects Professional Skill, Professional Knowledge and Employability Skills related to job role. 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 covers 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, Aluminium 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 need 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
5	Employability Skills	120
	Total	**1200**

Every year 150 hours of mandatory OJT (On the Job Training) at nearby industry, wherever not available then group project is mandatory.

On the Job Training (OJT)/ Group Project	150
Optional Courses (10th/ 12th class certificate along with ITI certification or add on short term courses)	240

Trainees of one-year or two-year trade can also opt for optional courses of up to 240 hours in each year for 10th/ 12th class certificate along with ITI certification, or, add on short term courses

2.4 ASSESSMENT &CERTIFICATION

The trainee will be tested for his 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.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 Controller of examinations, 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 percent for Trade Practical and Formative assessment is 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 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:

Performance Level	Evidence
(a) Marks in the range of 60 -75% to be allotted during assessment	
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/set standards. • A fairly good level of neatness and consistency in the finish • Occasional support in completing the project/job.
(b)Marks in the range of above75% - 90% to be allotted during assessment	
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
(c) Marks 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% accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • A high level of neatness and consistency in the finish. • Minimal or no support in completing the project.

3. JOB ROLE

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 of . 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, aluminium, high tensile and special steels, and other materials) in various profiles. This involve 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/N0204
ii) CSC/N0201
iii) CSC/N0209
iv) CSC/N0212
v) CSC/N0207
vi) CSC/N0206
vii) CSC/N9410
viii) CSC/N9411
ix) CSC/N9412
x) CSC/N9401
xi) 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/N0204, CSC/N0201, CSC/N0209, CSC/N0212, CSC/N0207, CSC/N0206, CSC/N9410, CSC/N9411, CSC/N9412, CSC/N9401, CSC/N9402
NSQF Level	Level – 2.5
Duration of Craftsmen Training	One year (1200 Hours + 150 hours OJT/Group Project)
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 experience in relevant field. **OR** 03 years Diploma in Mechanical/ Metallurgy/ Production Engineering/ Mechatronics from AICTE/ recognized technical board of education or relevant Advanced Diploma (Vocational) from DGT with two years experience in relevant field. **OR** NTC/NAC passed in the Trade of "Welder" with three years' experience in the relevant field. **<u>Essential Qualification</u>:** Relevant Regular / RPL variants of National Craft Instructor Certificate (NCIC) 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. However, both of them must possess NCIC in any of its variants.***
2. Workshop	B.Voc/Degree in Engineering from AICTE/UGC recognized

Calculation & Science	Engineering College/ university with one-year experience in the relevant field. **OR** 03 years Diploma in Engineering from AICTE / recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field. **OR** NTC/ NAC in any one of the engineering trades with three years' experience. **Essential Qualification:** Regular / RPL variants of National Craft Instructor Certificate (NCIC) in relevant trade **OR** Regular / RPL variants NCIC in RoDA or any of its variants under DGT
3. Engineering Drawing	B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with one-year experience in the relevant field. **OR** 03 years Diploma in Engineering from AICTE / recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field. **OR** NTC/ NAC in any one of the engineering/ Draughtsman group of trades with three years' experience. **Essential Qualification:** Regular / RPL variants of National Craft Instructor Certificate (NCIC) in relevant trade OR Regular/RPL variants NCIC in RoDA or any of its variants under DGT
4. Employability Skill	MBA/ BBA / Any Graduate/ Diploma in any discipline with Two years' experience with short term ToT Course in Employability Skills. (Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above) **OR** Existing Social Studies Instructors in ITIs withshort term ToT Course in Employability Skills.
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.

5.1LEARNING OUTCOMES (TRADE SPECIFIC)

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/N0204)*
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/N0204)*
3. Set the oxy- acetylene cutting plant and perform different cutting operations on MS plate. *[Different cutting operation – Straight, Bevel, circular] (NOS: CSC/N0201)*
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/N0204)*
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/N0204)*
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/N0204)*
7. Demonstrate arc gouging operation to rectify the weld joints. (NOS: CSC/N0204)
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/N0204)*
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/N0209)*
10. Set the GTAW machine and perform by GTAW in different types of joints on different metals in different position and check correctness of the weld. *[different types of joints- Fillet (T-joint, lap, Corner), Butt (Square & V) ; different metals- Aluminium, Stainless Steel; different position- 1F & 1G](NOS: CSC/N0212)*
11. Perform Aluminium & MS pipe joint by GTAW in flat position. *(NOS: CSC/N0212)*
12. Set the Plasma Arc cutting machine and cut ferrous & non-ferrous metals.*(NOS: CSC/N0207)*
13. Set the resistance spot machine and join MS & SS sheet. *(NOS: CSC/N0206)*

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)*
15. Repair Cast Iron machine parts by selecting appropriate welding process. (OAW, and SMAW] (NOS: CSC/N9411)
16. Hard facing of alloy steel components/ MS rod by using hard facing electrode. *(NOS:* CSC/N9412)
17. Read and apply engineering drawing for different application in the field of work. (NOS: CSC/N9401)
18. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: CSC/N9402)

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/N0204)*	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/N0204)*	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/N0201)*	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/N0204)*	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/N0204)*	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 for .
	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/N0204)*	Plan and prepare the pieces for .
	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/N0204)*	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/N0204)*	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	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.

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/N0209)*	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 machine and perform by GTAW in different types of joints on different metals in different position and check correctness of the weld. *[different types of joints- Fillet (T-joint, lap, Corner), Butt (Square & V) ; different metals- Aluminium, Stainless Steel; different position- 1F & 1G]* *(NOS: CSC/N0212)*	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/N0212)*	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/N0207)*	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/N0206)*	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.
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.
15. 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.
16. 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.

17. 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 47Hrs; Professional Knowledge 11Hrs	Set the gas plant and join MS sheet in different position following safety precautions. *[Different position: - 1F, 2F, 3F, 1G, 2G, 3G.]* 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]*		1. Demonstration of Machinery used in the trade. 2. Identification to safety equipment and their use etc. 3. Hack sawing, 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 in Industry - Safety precautions in Shielded Metal Arc , and Oxy-Acetylene and Cutting.
		OAW-01 SMAW-01	5. Setting of oxy-acetylene equipment, Lighting and setting of flame. 6. Perform fusion run without filler rod on MS sheet 2mm thick in flat position. 7. Setting up of Arc machine & accessories and striking an arc. 8. Deposit straight line bead on MS plate in flat position.	- Introduction and definition of . - Arc and Gas Equipments, tools and accessories. - Various Processes and its applications. - Arc and Gas terms and definitions.
Professional Skill 21Hrs; Professional Knowledge 05Hrs	Set the gas plant and join MS sheet in different position following safety precautions. *[Different position: - 1F, 2F, 3F,*	OAW-02 OAW-03	9. Depositing bead with filler rod on M.S. sheet 2 mm thick in flat position. 10. Edge joint on MS sheet 2 mm thick in flat	- Different process of metal joining methods: Bolting, riveting, soldering, brazing, seaming etc. - Types of joints and its applications. Edge

	1G, 2G, 3G.]		position without filler rod.	preparation and fit up for different thickness. - Surface Cleaning
Professional Skill 20Hrs; Professional Knowledge 05Hrs	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. Straight line beads on M.S. plate 10 mm thick in flat position. 12. Weaved bead on M. S plate 10mm thick in flat position.	- Basic electricity applicable to arc and related electrical terms &definitions. - Heat and temperature and its terms related to - Principle of arc. And characteristics of arc.
Professional Skill 23Hrs; Professional Knowledge 05Hrs	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 and make straight cuts (freehand) 14. Perform marking and straight line cutting of MS plate 10 mm thick by gas. Accuracy within ±2mm. 15. Beveling of MS plates 10 mm thick, cutting regular geometrical shapes and irregular shapes, cutting chamfers by gas cutting. 16. Marking and perform radial cuts, cutting out holes using oxy-acetylene gas cutting. 17. Identify cutting defects viz., distortion, grooved, fluted or ragged cuts; poor draglines; rounded	- Common gases used for & cutting, flame temperatures and uses. - Types of oxy-acetylene flames and uses. - Oxy-Acetylene Cutting Equipment principle, parameters and application.

		OAGC-06	edges; tightly adhering slag.	
Professional Skill 126Hrs; Professional Knowledge 31Hrs	Set the gas plant and join MS sheet in different position following safety precautions. *[Different position: - 1F, 2F, 3F, 1G, 2G, 3G.]* 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]*	OAW-04 SMAW-04 OAW-05	18. Square butt joint on M.S. sheet 2 mm thick in flat Position. **(1G)** 19. Fillet "T" joint on M.S. Plate 10 mm thick in flat position. **(1F)** 20. Open corner joint on MS sheet 2 mm thick in flat Position **(1F)**	- Arc power sources: Transformer, Rectifier and Inverter type machines and its care &maintenance. - Advantages and disadvantages of A.C. and D.C. machines
		SMAW-05 OAW-06 SMAW-06	21. Fillet lap joint on M.S. plate 10 mm thick in flat position. **(1F)** 22. Fillet "T" joint on MS sheet 2 mm thick in flat position. **(1F)** 23. Open Corner joint on MS plate 10 mm thick in flat position. **(1F)**	- positions as per EN &ASME: flat, horizontal, vertical and over head position. - Weld slope and rotation. - symbols as per BIS & AWS.
		OAW-07 SMAW-07 I&T-01	24. Fillet Lap joint on MS sheet 2 mm thick in flat position**. (1F)** 25. Single "V" Butt joint on MS plate 12 mm thick in flat position **(1G)**. 26. Testing of weld joints by visual inspection. 27. Inspection of welds by using weld gauges.	- Arc length – types – effects of arc length. - Polarity: Types and applications. - Weld quality inspection, common mistakes and appearance of good and defective welds - Weld gauges &its uses.
		OAW-08 SMAW-08	28. Square Butt joint on M.S. sheet. 2 mm thick in Horizontal position. **(2G)** 29. Straight line beads and multi layer practice on	- Calcium carbide uses and hazard. - Acetylene gas properties and flash back arrestor.

		SMAW-09	M.S. Plate 10 mm thick in Horizontal position. 30. Fillet "T" joint on M.S. plate 10 mm thick in Horizontal position**. (2F)**	
		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 and its properties, uses in . - Charging process of oxygen and acetylene gases - Oxygen and Dissolved Acetylene gas cylinders and Color coding for different gas cylinders. - Uses of single and double stage Gas regulators.
		OAW-10 OAW-11 SMAW-11	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. Single Vee Butt joint on M.S. plate 12 mm thick in horizontal position **(2G)**.	- Oxy acetylene gas Systems (Low pressure and High pressure). Difference between gas blow pipe(LP &HP) and gas cutting blow pipe - Gas techniques. Rightward and Leftward techniques.
		SMAW- 12 OAW-12 SMAW-13	36. Fillet "T" joint on M.S sheet 2 mm thick in vertical position. **(3F)** 37. Fillet "T" joint on M.S. plate 10 mm thick in vertical position. **(3F)**	- Arc blow – causes and methods of controlling. - Distortion in arc & gas and methods employed to minimize distortion - Arc defects, causes and Remedies.
Professional Skill 80 Hrs; Professional Knowledge	Set the SMAW machine and perform different type of joints on MS in different	OAW-13	38. Structural pipe butt joint on MS pipe Ø 50 and 3mm WT in 1G position.	- Specification of pipes, various types of pipe joints, pipe all positions, and procedure.

17Hrs	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] (Mapped NOS: CSC/N0204)* 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-14	39. Fillet Lap joint on M.S. Plate 10 mm in vertical position. **(3G)**	- Difference between pipe and plate.
		SMAW-15 OAW-14	40. Open Corner joint on MS plate 10 mm thick in vertical position. **(2F)** 41. Pipe - Elbow joint on MS pipe Ø 50 and 3mm WT. **(1G)**	- Pipe development for Elbow joint, "T" joint, Y joint and branch joint - Brief use of Manifold system
		OAW-15 SMAW-16	42. Pipe "T" joint on MS pipe Ø 50 and 3mm WT. **(1G)** 43. Single "V" Butt joint on MS plate12 mm thick in vertical position (3G).	- Gas filler rods, specifications and sizes. - Gas fluxes – types and functions. - Gas Brazing &Soldering : principles, types fluxes & uses - Gas defects, causes and remedies
		OAW-16 SMAW-17	44. Pipe 45 ° angle joint on MS pipe Ø 50 and 3mm WT. **(1G)** 45. Straight line beads on M.S. plate 10mm thick in over head position.	- Electrode: types, functions of flux, coating factor, size specifications of electrode. - Effects of moisture pick up. - Storage and baking of electrodes.
Professional Skill 61Hrs; Professional Knowledge 06Hrs	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]* Set the SMAW	SMAW-18 SMAW-19	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 over head position. **(4F)**	- Weldability of metals, importance of pre heating, post heating and maintenance of inter pass temperature.
		SMAW-20 SMAW-21	48. Pipe butt joint on MS pipe Ø 50 and 5 mm WT. in 1G position. 49. Fillet Lap joint on M.S. plate 10 mm thick in over head position. **(4G).**	- of low, medium and high carbon steel and alloy steels.

	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-22 SMAW-23	50. Single "V" Butt joint on MS plate 10mm thick inover head position**(4G)** 51. Pipe butt joint on M. S. pipe Ø 50mm WT 6mm (**1G** Rolled).	- Stainless steel types- weld decay and weldability.
Professional Skill 25 Hrs; Professional Knowledge 04Hrs	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]*	OAW-17 SMAW -24 OAW-18	52. Butt joint of copper pipe ½ inch by brazing process by induction machine 53. Square Butt joint on S.S. Sheet 2 mm thick in flat position. **(1G)** 54. Corner/T joint of copper pipe of ½ inch and of length 75 mm	- Induction, brazing of copper tubes. - Brass – types – properties and methods. - Copper – types – properties and methods. - Brazing cutting tools.
Professional Skill 21Hrs; Professional Knowledge 04Hrs	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]* Demonstrate arc gauging operation to rectify the weld joints.	OAW-19 SMAW-25 AG-01	55. Square Butt & Lap joint on M.S. sheet 2 mm thick by brazing in flat position. 56. Single "V" butt joint C.I. plate 6mm thick in flat position. **(1G)** 57. Arc gouging on MS plate 10 mm thick.	- Aluminium properties and weldability, methods - Arc cutting & gouging,
Professional Skill 20Hrs; Professional Knowledge 04Hrs	Choose appropriate process and perform joining of different types of metals and check its correctness. *[appropriate process*	OAW-20 OAW-21	58. Square Butt joint on Aluminium sheet. 3 mm thick in flat position.(10hrs) 59. Bronze of cast iron (Single "V" butt joint)	- Cast iron and its properties types. - Methods of cast iron. (04hrs)

	– OAW, SMAW; Different metal – SS, CI, Brass, Aluminium]		6mm thick plate (10hrs)	
Professional Skill 25 Hrs; Professional Knowledge 04Hrs	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. Dye penetrant test. 61. Magnetic particle test. 62. Nick- break test. 63. Free bend test. 64. Fillet fracture test.	- Types of Inspection methods - Classification of destructive and NDT methods - economics and Cost estimation.
Professional Skill 166Hrs; Professional Knowledge 32Hrs	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]*	GMAW- 01 GMAW - 02	65. Introduction to safety equipment and their use etc. 66. Setting up of GMAW machine & accessories and striking an arc. 67. Depositing straight line beads on M.S Plate. 68. Fillet weld – "T" joint on M.S plate 10mm thick in flat position by Dip 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.)
		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	- Advantages of GMAW over SMAW , limitations and applications - Process variables of GMAW.

			position by Dip transfer. **(1F)**	
		GMAW -06 GMAW -07	72. Butt weld – Square butt joint on M.S sheet 3mm thick in flat position **(1G)** 73. Butt weld – Single "V" butt joint on M.S plate 10 mm thick by Dip 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 10mm thick in Horizontal position by Dip transfer. **(2F)** 75. Fillet weld – corner joint on M.S plate 10mm thick in Horizontal position by Dip transfer. **(2F)**	- Name of shielding gases used in GMAW and its applications. - Flux cored arc – description, advantage, wires, coding as per AWS.
		GMAW -10 GMAW -11	76. Fillet weld – "T" joint on M.S. sheet 3mm thick in Horizontal position by Dip transfer. **(2F)** 77. Fillet weld – corner joint on M.S. sheet 3mm thick in Horizontal position by Dip transfer. **(2F)**	- Edge preparation of various thicknesses of metals for GMAW. - GMAW defects, causes and remedies
		GMAW -12 GMAW -13	78. Fillet weld – "T" joint on M.S plate 10mm thick in vertical position by Dip transfer. **(3F)** 79. Fillet weld – corner joint on M.S plate	- Heat input and techniques of controlling heat input during. - Heat distribution and effect of faster cooling

			10mm thick in vertical position by dip transfer. **(3F)**	
		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)**	- Pre heating & Post Weld Heat Treatment - Use of temperature indicating crayons.
		GMAW -16 GMAW -17	82. Fillet weld – Lap and "T" joint on M.S sheet 3mm thick inoverhead 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
		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, equipments, Thermit mixture types and applications. - Use of backing strips and backing bars
Professional Skill 80 Hrs; Professional Knowledge 14Hrs	Set the GTAW machine and perform by GTAW in different types of joints on different metals in different position and check correctness of the weld. *[different types of joints- Fillet (*	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 , equipments, polarities and applications. - Power sources for GTAW - AC &DC
		GTAW -03	88. Fillet weld – "T" joint	- Tungsten electrodes –

	T-joint, lap, Corner), Butt (Square & V) ; different metals- Aluminium, Stainless Steel; different position- 1F & 1G]	GTAW -04	89. Fillet weld – Outside corner joint on Aluminium sheet 2 mm thick in flat position. **(1F)**	types & uses, sizes and preparation - GTAW Torches- types, parts and their functions - GTAW fillerrods and selection criteria.
		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 remedy.
Professional Skill 20Hrs; Professional Knowledge 04Hrs	Perform Aluminium & MS pipe joint by GTAW in flat position.	GTAW -07	92. Pipe butt joint on Aluminium pipe Ø 50 mm x 3 mm WT in Flat position. **(1G)**	- Friction process- equipment and application - Laser beam (LBW).
Professional Skill 20Hrs; Professional Knowledge 03Hrs	Perform Aluminium & MS pipe joint by GTAW in flat position. 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 cutting on ferrous and non ferrous	- Plasma Arc (PAW) and cutting (PAC) process – equipments and principles of operation. - Types of Plasma arc, advantages and applications.
Professional Skill 20Hrs; Professional Knowledge 02Hrs	Set the resistance spot machine and join MS & SS sheet.	RW-01 RW-02	95. Lap joint on Stainless steel sheet by Resistance Spot. 96. MS sheets joining by Resistance Spot	- Resistance process -types, principles, power sources and parameters. - Applications and limitations.
Professional	Perform joining of	OAW-01	97. Square butt joint on	- Metalizing – types of

Skill 41Hrs; Professional Knowledge 10Hrs	different similar and dissimilar metals by brazing operation as per standard procedure. *[different similar and dissimilar metals- Copper, MS, SS]*	OAW-02	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 principles. - Manual Oxy – acetylene powder coating process- principles of operation and applications
		OAW-03 OAW-04	99. Silver brazing on S.S Sheet with copper sheet "T" joint. 100. Silver brazing on copper tube to tube.	- Reading of assembly drawing - Procedure Specification (WPS) and Procedure Qualification Record (PQR)
Professional Skill 24Hrs; Professional Knowledge 01Hrs	Repair Cast Iron machine parts by selecting appropriate welding process. (OAW, and SMAW] Hard facing of alloy steel components / MS rod by using hard facing electrode.	OAW - 05 SMAW-01 SMAW-02	101. Repair of broken C.I. machine parts by oxy-acetylene with C.I and bronze filler rod. 102. Repair of broken C.I machine parts by C.I. electrode. 103. Repair plastic broken parts or pipes by plastic machine. 104. Make a plastic tank with plastic sheet of PVC. Dimensions 150*100*100	- Hard facing/ surfacing necessity, surface preparation, various hard facing alloys and advantages of hard facing. - Plastic machine with hot air gun and plastic material: Polypropylene (PP) Polyethylene (PE) Polyvinylchloride (PVC)
Engineering Drawing: 40 Hrs.				
Professional Knowledge ED - 40 hrs.	Read and apply engineering drawing for different application in the field of work.	**<u>ENGINEERING DRAWING:</u>** - Introduction to Engineering Drawing and Drawing Instruments; Conventions Sizes and layout of drawing sheets Title Block, its position and content 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: 38 Hrs.		
Professional Knowledge WC- 38 hrs.	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.	**WORKSHOP CALCULATION &SCIENCE :** - 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 Core Skills subjects which is common for a group of trades, provided separately in www.bharatskills.gov.in/ dgt.gov.in

ANNEXURE-I

LIST OF TOOLS AND EQUIPMENT			
WELDER (For batch of 20Candidates)			
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.
B. INSTRUMENTS AND GENERAL SHOP OUTFIT - For 2 (1+1) units no additional items are required			
TOOLS & EQUIPMENT			
16.	Spindle key		8 Nos. (2 for each type of gas)
17.	Screw Driver	300mm blade and 250 mm blade	1 each
18.	Number punch	6 mm	2 set
19.	Letter punch	6 mm	2 set
20.	Magnifying glass	100 mm dia.	2 Nos.
21.	Universal Weld measuring gauge		2 Nos.
22.	Spanner D.E.	6 mm to 32mm	2 sets
23.	C-Clamps	10 cm and 15 cm	2 each
24.	Hammer sledge	double faced 4 kg	2 No.
25.	S.S tape	5 meters flexible in case	5 No.
26.	H.P. torch	with 5 nozzles	2 sets

27.	Oxygen Gas Pressure	regulator double stage	2 Nos.
28.	Acetylene Gas Pressure	regulator double stage	2 Nos.
29.	CO_2 Gas pressure regulator	with flow meter	2 set
30.	Argon Gas pressure regulator	with flow meter	2 set
31.	Metal rack	182 cm x 152 cm x 45 cm	1 No.
32.	First Aid box		1 No.
33.	Steel lockers	with 8 Pigeon holes	2 Nos.
34.	Steel almirah / cupboard		4 Nos.
35.	Black board and easel with stand		1 No.
36.	Flash back arrester (torch mounted)		4 pairs
37.	Flash back arrester (cylinder mounted)		4 pairs
38.	Multiangle magnetic clamp set	Metal base (18x10x10 cm)	one
GENERAL SHOP OUTFIT			
39.	Transformer	with all accessories (400A, OCV 60–100 V, 60% duty cycle)	1 set
40.	Transformer (or) Inverter based machine (IGBT)	with all accessories (300A, OCV 60 – 100 V, 60% duty cycle)	1 set
41.	D.C Arc rectifiers set with all accessories	(400 A. OCV 60 – 100 V, 60% duty cycle)	1 sets
42.	GMAW machine	400A capacity with air cooled torch, Regulator, Gas pre-heater, Gas hose and Standard accessories	1 set
43.	AC/DC GTAW machine	with water cooled torch 300 A, Argon regulator, Gas hose, water circulating system and standard accessories.	1 set
44.	Air Plasma cutting equipment	with all accessories, capacity to cut 12 mm clear cut	1 set
45.	Air compressor suitable for above air plasma cutting system.	Two stage compressor 15KW	1 No.
46.	Auto Darkening Helmet		5Nos.
47.	Spot machine	15 KVA with all accessories	1 set
48.	Portable gas cutting machine (PUG)	capable of cutting Straight &Circular with all accessories	1 set

49.	Pedestal grinder fitted with coarse and medium grain size grinding wheels	300 mm dia.	2 No.
50.	Bench grinder fitted with fine grain size silicon carbide green grinding wheel	150 mm dia.	1 No.
51.	AG 4 Grinder		4 Nos.
52.	Suitable gas table	with fire bricks	2 Nos.
53.	Suitable Arc table	with positioner	6 Nos.
54.	Trolley for cylinder (H.P. Unit)		2 Nos.
55.	Hand shearing machine capacity	cut 6 mm sheets and flats	1 No.
56.	Power saw machine	18'' or blade size 450 mm	1 No.
57.	Portable drilling machine	(Cap. 6 mm)	1 No.
58.	Oven, electrode drying	0 to 350°C, 10 kg capacity, depth 450mm to 500 mm,intake capacity 10 kg	1 No.
59.	Work bench	340x120x75 cm with 4 bench vices of 150 mm jaw opening	4 sets
60.	Oxy Acetylene Gas cutting blow pipe		2 sets
61.	Oxygen, Acetylene Cylinders **		2 each
62.	CO_2 cylinder **		2 Nos.
63.	Argon gas cylinder **		2 Nos.
64.	Anvil 24 sq. inches working area with stand		1 No.
65.	Swage block 5048	Cast iron 16x16x16 inch	1 No.
66.	Magnetic particle testing Kit #		1 set
67.	Fire extinguishers (foam type and CO_2type)		1. No.
68.	Fire buckets with stand		4 Nos.
69.	Portable abrasive cut-off machine		1 No.
70.	Suitable Gas cutting table		1 No.
71.	Simulators for SMAW/GTAW/GMAW		1 each (Optional)
72.	Water cooled induction / Brazing machine	200-250 Amp., induction coil length 3 inch and 2.5 inch	1
73.	Plastic machine with hot air gun	temp. display, variable temp., PE,PP& PVC sheet or pipe control with stand. Accessories.	1

74.	Swaging and flooring tool kit 45^0 tubing	1/8 to ¾ inch	
C. CONSUMABLE			
75.	Leather Hand Gloves	14”	20 pairs
76.	Cotton hand Gloves	8”	20 pairs
77.	Leather Apron leather		20 Nos.
78.	S.S Wire brush	5 rows and 3 rows	20 Nos. each
79.	Leather hand sleeves	16”	20 pairs
80.	Safety boots for welders	Size 7,8,9,10	20pairs
81.	Leg guards leather		20pairs
82.	Rubber hose clips	½"	20 Nos.
83.	Rubber hose oxygen	8 mm dia X 10 Mtr. long as per BIS	2 Nos.
84.	Rubber hose acetylene	8 mm dia X 10 Mtr. long as per BIS	2 Nos.
85.	Arc cables multi cored copper	400/ 600 amp as per BIS	45 mts. each
86.	Arc single coloured glasses	108 mm x 82 mm x 3 mm. DIN 11A &12 A	34 Nos.
87.	Arc plain glass	108 mm x 82 mm x 3 mm.	68 Nos.
88.	Gas Goggles	with Colour glass 3 or 4A DIN	34 Nos.
89.	Safety goggles plain		34 Nos.
90.	Spark lighter	CUP lighter for	6 Nos.
91.	AG 4 Grinding wheels		50 Nos.
92.	Earth clamp	600A	6 Nos.
93.	Electrode holder	600 amps	6 Nos.
94.	Die penetrant testing kit		1 set
95.	Anti spatter spray can	100 to 300 ml	5 Nos.
96.	GMAW Torch nozzle tip	Size 0.8, 1.0, 1.2 (in mm)	5 Nos. each
97.	TIG torch ceramic nozzle	Size 3,4,5,6,8	4 Nos. each
98.	Tungsten electrode	1.0, 1.6, 2.0 (in mm), length 150 mm	5 Nos. each
99.	Brass filler wire	1.0mm, 2.0 mm	
100.	AG4 cutting wheels		100 Nos.
101.	CCMS filler wire	1.0 mm	4 Kg
102.	Brass filler wire	1.0 mm	4 Kg
103.	Copper filler wire	1.0 mm	4 Kg
104.	Flux for Brass		500 Gram
105.	Flux for Copper		500 Gram
D. CLASS ROOM FURNITURE FOR TRADE THEORY			
106.	Instructor’s table and Chair (Steel)		1 set
107.	Students chairs with writing pads		20 Nos.

108.	White board	size 1200mm X 900 mm	1 No.
109.	Instructor's laptop with latestconfiguration pre-loaded with operating system and MS Office package.		1No.
110.	LCD projector with screen.		1No.
111.	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.*

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 Expert members contributed/ participated for finalizing the course curriculum of Welder trade held on 12.01.17 at CSTARI, Kolkata			
S No.	**Name & Designation Shri/Mr./Ms.**	**Organization**	**Remarks**
1.	DEEPANKAR MALLICK,DDG (Trg.)	DGT, MSDE, New Delhi	Chairman
2.	H. V. SAMVATSAR,Director	CSTARI, Kolkata	Secretary (Trade Committee)
3.	NIRMALYA NATH, Asst. Director of Trg.	CSTARI, Kolkata	Member cum Co-coordinator
4.	RAJENDRA PRASAD, Director	DTE, Uttar Pradesh	Member
5.	R. N. BANDYOPADHAYA, OSD	Paschim Banga Society For Skill Development, Kolkata	Member
6.	SUMANTA MODAK, General Manager (Works)	EVEREADY Industries Pvt. Ltd. (Representative of ***CII***)	Member
7.	S. D. SATISH CHANDRA, Manager (HR), Trg.	HAL – Koraput Division, Koraput, Odisha	Member
8.	SUMANTA CHATTERJEE, Addl. General Manager	BHEL, Power Sector ER	Member
9.	P. C. BHANDARI, Technical Advisor	J K Cement Ltd., Kanpur	Member
10.	SANJIT BHOWMICK, Asst. General Manager	Hindalco Industries Ltd., Belur Math, Howrah	Member
11.	DEBASHIS BHATTACHARYYA, JWM,/FTI	Rifle Factory, Ishapore, Ministry of Defence, Govt. India, WB	Member
12.	SATYABADI SATAPATHY, Training Officer	HAL – Koraput Division, Koraput, Odisha	Member
13.	PRABHAT SAMIR PAL, Jr. Manager	GRSE Ltd., Kolkata	Member
14.	JOYDEEP PAL MAJUMDER Asst. Work Manager	Rifle Factory, Ishapore, Ministry of Defence, Govt. India, WB	Member
15.	BHABANI PROSAD MONDAL CM/FTI	Rifle Factory, Ishapore, Ministry of Defence, Govt. India, WB	Member
16.	SUNIRMAL BASU,Asst. Inspecting Officer	Railway Workshop, Kanchrapara	Member

17.	K. L. KULI, Joint Director of Trg.	CSTARI, Kolkata	Member
18.	M. THAMIZHARASAN, Joint Director of Trg.	CSTARI, Kolkata	Member
19.	SANJAY KUMAR, Joint Director of Trg.	CSTARI, Kolkata	Member
20.	L. K. MUKHERJEE, Dy. Director of Trg.	CSTARI, Kolkata	Member
21.	U. K. MALLICK,Dy. Director	DTE&T, Odisha	Member
22.	N. R. PATTANAIK, Principal	Govt. ITI Balasore, Odisha	Member
23.	DEEPAK KUMAR,SSE/Drg./C&W	Railway Workshop, Kanchrapara	Member
24.	D. W. PATNE, Secretary	Association of Non Govt. ITI, Maharastra	Member
25.	VIVEK CHAUDHARI, Principal	Ujjwal ITI Nashirabad, Dist-Jalgoan, Maharastra	Member
26.	Fr. JOSE PADAMATTAM, Principal	Don Bosco Technical Institute, Park Circus	Member
27.	SWAMI GUNINDRANANDA, Superintendent	R. K. Mission Shilpayatan Belurmath, Howrah	Member
28.	TAPAS SENGUPTA, Instructor	ITI Howrah Homes	Member
29.	DEBIPROSHAD SARKAR, Instructor	ITI Howrah Homes	Member
30.	G. B. KOLAPATE, Instructor	Govt. ITI Andhari, Mumbai, Maharastra	Member
31.	H. B. KOSHTI, Craft Instructor	Govt. ITI Byculla, Mumbai - 400011	Member
32.	N. B. NARKAR,Craft Instructor	ITI Ambernath, Thane, Maharastra	Member
33.	PARTHA SARKAR, Jr. Engineer/Drawing (Mech.)	Railway Workshop, Kanchrapara	Member
34.	S. K. BHATTACHARYA, Instructor	STC/KPA, Eastern Railways, Kanchrapara	Member
35.	BIKASH CHAUDHURI, Instructor	Ramakrishna Mission Shilpayatan, Belur, Howah	Member
36.	SACHIN M. LAMSE, Instructor	ITI Aundh, Pune, Maharastra	Member
37.	SOMNATH B. SAPKAL, Instructor	ITI Anudh, Pune, Maharastra	Member
38.	K. K. PANIGRAHI, Instructor	Gun Shell Factory, Cossipore	Member
39.	TARAKNATH GARAI, Instructor	ITI Howrah Homes	Member
40.	SUDHANGSHU MUKHERJEE, Sr. Tech./Dy. CEE/KPN	Eastern Railway, Kanchrapara	Member
41.	S. N. TAMBATKAR, Craft Instructor	Govt. ITI, Adheri, Mumbai	Member

Sl. No.	Name & Designation Sh/Mr./Ms.	Organization	Mentor Council Designation
Members of Sector Mentor council			
1.	Dr. G. Buvanashekaran	AGM, WRI, Trichy - Chairman	Chairman
2.	Dr. K. Ashok kumar	AGM, BHEL, Trichy	Member
3.	Prof. Jyothi Mukhopadhya	IIT, Ahmedabad	Member
4.	B. Pattabhiraman	MD, GB Engineering, Tricgy	Member
5.	Dr. Rajeev Kumar	IIT, Mandi	Member
6.	Dr. Vishalchauhan	IIT, Mandi	Member
7.	D.K. Singh	IIT, Kanpur	Member
8.	Navneet Arora	IIT, Roorkee	Member
9.	R. K. Sharma	Head, SDC, JBM Group, Faridabad	Member
10.	Puneet Sinha	Deputy Director, MSME, New Delhi	Member
Mentor			
11.	Deepankar Mallick	Director of Training, DGE&T Hq,	Mentor
Members of Core Group			
12.	M Thamizharasan	JDT, CSTARI, Kolkata	Member
13.	M Kumaravel	DDT, FTI , Bangalore	Team Leader
14.	Sushil Kumar	DDT, DGE&T Hq,	Member
15.	S.P. Khatokar	T.O. ATI, Mumbai	Member
16.	V.L. Ponmozhi	TO, CTI, Chennai	Member
17.	D. Pani	TO, ATI, Howrah	Member
18.	Amar Singh	TO, ATI, Ludhiana	Member
19.	Gopalakrishnan	TO, NIMI, Chennai	Member
20.	Manjunatha B.S	JTO, GITI, K.G.F. Karnataka	Member
21.	Venugopal PC	ITI Chalakudi, Kerala	Member

ABBREVIATIONS

CTS	Craftsmen Training Scheme
ATS	Apprenticeship Training Scheme
CITS	Craft Instructor Training Scheme
DGT	Directorate General of Training
MSDE	Ministry of Skill Development and Entrepreneurship
NTC	National Trade Certificate
NAC	National Apprentice 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
SMAW	Shielded Metal Arc
OAW	Oxy-Acetylene Gas
OAG C	Oxy-Acetylene Gas Cutting
GMAW	Gas Metal Arc
GTAW	Gas Tungsten Arc
PAC	Plasma Arc Cutting
RW	Resistance
OAW	Oxy-Acetylene Gas
OAG C	Oxy-Acetylene Gas Cutting
I&T	Inspection & Testing
WT	Wall Thickness.
PP	Polypropylene
PE	Polyethylene
PVC	Polyvinylchloride


कौशलं बलम्