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

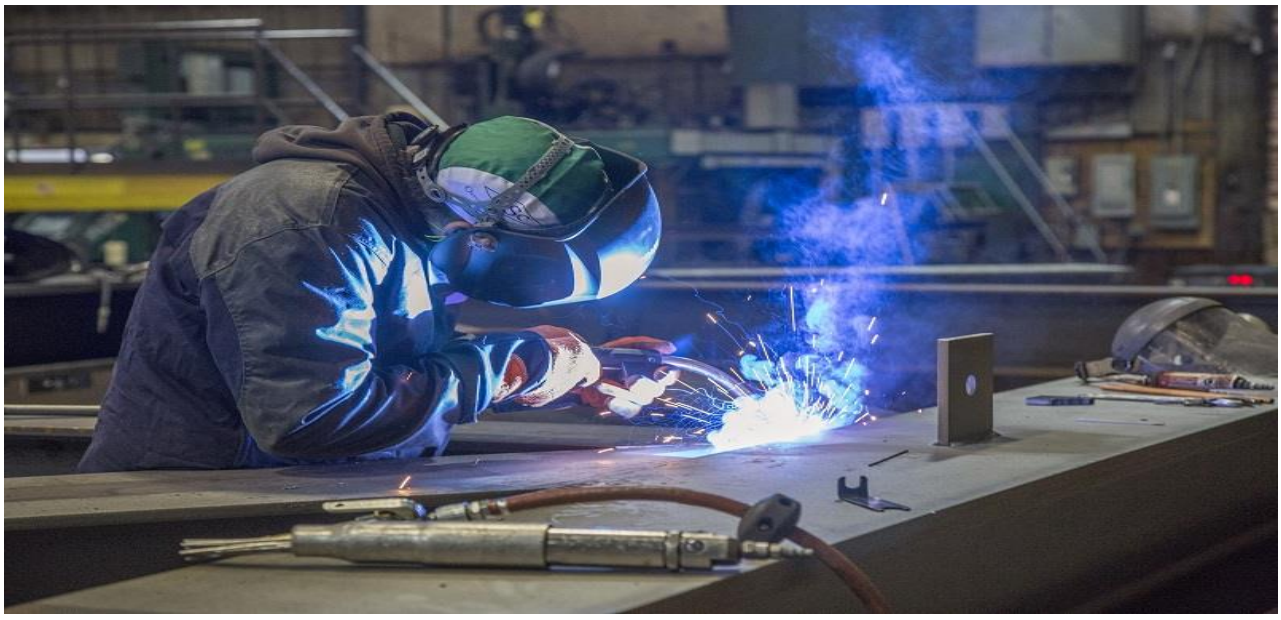
COMPETENCY BASED CURRICULUM

WELDER (STRUCTURAL)

(Duration: One Year)
Revised in July 2022

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL- 3



SECTOR – CAPITAL GOODS AND MANUFACTURING

Directorate General of Training

WELDER (STRUCTURAL)

(Engineering Trade)

(Revised in July 2022)

Version: 2.0

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL- 3

Developed By

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CONTENTS

1. COURSE INFORMATION

During the one-year duration a candidate of Welder (Structural) is trained on subjects Professional Skill, Professional Knowledge and Employability Skills related to job role. In addition to this a candidate is entrusted to make/do project work and Extra Curricular Activities to build up confidence. 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 broad components covered under subject are as below:-

In one year duration the trainees will be able to join MS sheet by Gas, join SMAW welding in different positions; perform straight, bevel & circular cutting on MS plate by Oxy-acetylene cutting process. Perform different type of MS pipe joints by Gas welding (OAW);weld different types of MS pipe joints on structural pipes by SMAW; weld Stainless steel, Cast iron, Aluminum and Brass by OAW .Perform brazing on MS sheets, Arc gauging on MS plate, perform plasma cutting; perform fillet welding on M.S plates 1F,2F,3F,4F& 5F positions by SMAW; perform Full penetration Single "V" butt joint on MS plates in 1G,2G,3G &4G position adapting root Inspection and clearance by D.P test. Perform welding of M.S,S.S and Aluminium sheets, M.S tubes (square butt T,Y,K joints) by GTAW in down hand position with root Inspection by D.P test; perform bending, straightening and edge planning for fabrication of structures; perform Double bevel butt joint on dissimilar thickness MS Flats in down hand positions by SMAW with root Inspection by D.P test and back gouging and adapting standard welding sequence; perform welding of pipe joints in different positions; perform Lap, T , Corner joints on GMAW and Flux Cored Arc welding process on M.S in down hand position; perform Automatic Submerged Arc Welding machine; Manufacture simple structures with L angles, I section and channel sections using welding fixture by SMAW; Correct distortion by cold &hot method adapting skip welding & back step welding method for controlling distortion; fabricate pipe/cone on M.S. sheet by SMAW; prepare weld test specimen as per a standard; carry out Inspection & Testing.

Professional Knowledge subject is simultaneously taught in the same fashion to apply cognitive knowledge while executing task. In addition components like Physical properties of engineering materials, different types of iron, properties and uses, Heat & Temperature are also covered under theory part.

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 variantsand Apprenticeship Training Scheme (ATS) are two pioneer schemes of DGT for strengthening vocational training.

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

Broadly candidates need to demonstrate that they are able to:

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

2.2 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 take admission in diploma course in notified branches of Engineering by lateral entry.
- 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 oneyear:-

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

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 DGTfrom 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, DGTas 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 the basis for setting question papers for final assessment. The examiner during final examination will also check** the 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 the assessment. Due consideration should be given while assessing for teamwork, avoidance/reduction of scrap/wastage and disposal of scrap/waste as per procedure, behavioral attitude, sensitivity to the 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) assessmentsare to be preserved until forthcoming examination for audit and verification by examining 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. • A fairly good level of neatness and consistency in the finish. • Occasional support in completing the project/job.
(b) Marks in the range of 75%-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 more than 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. • A high level of neatness and consistency in the finish. • Minimal or no support in completing the project.

3. JOB ROLE

Welder (Structural)while gas welding, fuses metal parts viz. M.S,S.S, Brass & Aluminium sheets and Cast Iron plates together using welding rod and oxygen acetylene flame. Examines parts to be welded, cleans portion to be joined, holds them together by some suitable device and if necessary makes narrow groove to direct flow of molten metal to strengthen joint. Selects correct type and size of welding rod, fluxes nozzle etc. and tests welding, torch. Wears dark glasses and other protective devices while welding. Releases and regulates valves of oxygen and acetylene cylinders to control their flow into torch. Ignites torch and regulates flame gradually. Preheats joints as required.Applies flux as required for welding Aluminium and Cast Iron. Guides flame along joint and heats it to melting point, simultaneously melting welding rod and spreading molten metal along joint shape, size etc. Makes Square butt, lap, Tee, Corner and Single Vee but joints by Gas welding.Rectifies defects if any.

Welder (Structural) while gas cutting, cuts metal to required shape and size by gas flame either manually or by machine. Examines material to be cut and marks it according to instruction of specification. Makes necessary connections and fits required size of nozzle in welding torch. Releases and regulates flow of gas in nozzle, ignites and adjusts flame. Guides flame by hand or machine along cutting line at required speed and cuts metal to required size.

Welder (Structural) while gas brazing, joints metal parts by heating using flux and filler rods. Cleans and fastens parts to be joined face to face by wire brush. Apply flux on the joint and heats by Oxy acetylene welding torch to melt filler rods into joint. Allows it to cool down. welding or joining two or more metals together using resistive heat caused by changing electromagnetic fields. Check for induction welded joints for clean joint.

Welder (Structural) while Shielded Metal Arc welding (SMAW) on plates fuses metals using arc-welding power source and electrodes. Examines parts to be welded, cleans them and sets joints together with clamps or any other suitable device. Starts welding power source and regulates current according to material and thickness of welding. Connect one lead to part to be welded, selects required type of electrode and clamps other lead to electrode holder. May join parts first at various points for holding at specified angles, shape, form and dimension by tack welding. Establish arc between electrode and joint and maintain it throughout the length of the joint. . Makes Square butt, lap, Tee, Corner and Single Vee but joints by Shielded Metal Arc Welding.Rectifies defects if any by Arc gouging and re-welding.

Welder (Structural) while fitting and Welding Structural assembles Examines drawings and other specifications, cuts steel plates and angle iron using power shear or flame cutting equipment, checks parts to be fitted together, aligns members in position with suitable fasteners to ensure

that members fit together properly preparatory to permanent erection of structures at site and fits together various parts of heavystructures in workshop according to drawings under instructions of structural Engineer. Checks alignment of members to ensure accuracy of fit. Weld the assemblies by specified welding process. May bend or otherwise shape plates and assemble structural members.

Welder (Structural) while welding M.S plates by Gas Metal Arc Welding (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 CO_2 gas Cylinder, regulator and flow meter.Connects preheater,selects suitable wire electrode, feed it to welding GMA Welding torch through wire feeder. Selects contact tip gas nozzle and fit in to the GMA welding torch. Preheats joints as required. Starts the Constant Voltage GMA welding machine, sets suitable welding voltage & wire feed speed and shielding gas flow, produces arc between work piece and continuously fed wire electrode. Melts the metal and deposit weld beads on the surface of metals or joins Mild steel metal to a requires quality minimizing distortion and avoiding weld defects. Maintains inter pass temperature as required. Makes Lap,T and Corner joint welding in down hand well position. Takes precautionary measures such as wearing hand gloves & leg pads, suitable helmet with correct weld filter glass and protecting eyes from harm full electric arc. Inspects the weld by visual and Liquid Penetrant test and rectifies defects if any. May weld with Flux cored Arc Welding wire also.

Welder (Structural) while welding M.S plates by Gas Metal Arc Welding (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 CO_2 gas Cylinder, regulator and flow meter.Connects preheater. Selects suitable wire electrode, feed it to welding GMA Welding torch through wire feeder. Selects contact tip gas nozzle and fit in to the GMA welding torch. Preheats joints as required. Starts the Constant Voltage GMA welding machine, sets suitable welding voltage & wire feed speed and shielding gas flow, produces arc between work piece and continuously fed wire electrode. Melts the metal and deposit weld beads on the surface of metals or joins Mild steel metal to a requires quality minimizing distortion and avoiding weld defects. Maintains inter pass temperature as required. Makes Lap, T and Corner joints but joints by Gas Metal Arc Welding on plates in down hand welding.Takes precautionary measures such as wearing hand gloves & leg pads, suitable helmet with correct weld filter glass and protecting eyes from harm full electric arc. Inspects the weld by visual and Liquid Penetrant test and rectifies defects if any.

Welder (Structural) while welding M.S, SS, Aluminium sheets and M.S pipes by Gas Tungsten Arc Welding (GTAW) also known as Tungsten Inert Gas shielded Arc Welder (TIG welder) reads

fabrication drawing, examines parts to be welded, cleans them and sets joints with clamps or any other suitable device. Selects suitabletungsten electrode, grinds the edges and fit in to the GTA welding torch. Selects gas nozzle and fit in to the GTA welding torch. Selects suitable filler rods and cleans them. Connects work piece with earth cable, Connects the machine with Inert gas Cylinder, regulator and flow meter. Preheats joints as required. Starts the Constant current GTA welding machine, sets suitable welding current and inert gas flow, produces 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 or joins metal pieces such as Steel, Stainless steel, Aluminiun, to a required quality minimizing distortion and avoiding weld defects Takes precautionary measures such as wearing hand gloves, selecting suitable helmet with correct weld filter glass and protecting eyes from harm full electric arc.

Welder (Structural)while welding M.S plates by Automatic Submerged Arc Welding (SAW) load the electrode wire spool and feed the electrode through the contact tip. Set the welding parameters. Fill the granular flux on the Hooper. Prepare the work pieces and set and align it on the welding table. Start the SAW machine and weld the plates together. Inspect the weld to ensure quality.

Reference NCO-2015:

(i) 7212.0100 – Welder, Gas
(ii) 7212.0200 – Welder, Electric
(iii) 7212.0300 – Welder, Machine
(iv) 7212.0400 – Gas Cutter
(v) 7212.0500 – Brazer

Reference NOS:

i) CSC/N0204
ii) CSC/N0201
iii) CSC/N0207
iv) CSC/N0212
v) CSC/N0303
vi) CSC/N0209
vii) CSC/N0205
viii) CSC/N0211

4. GENERAL INFORMATION

Name of the Trade	**WELDER (STRUCTURAL)**
Trade Code	DGT/1123
NCO - 2015	7212.0100, 7212.0200, 7212.0300, 7212.0400, 7212.0500
NOS Covered	CSC/N0204, CSC/N0201, CSC/N0207, CSC/N0212, CSC/N0303, CSC/N0209, CSC/N0205, CSC/N0211
NSQF Level	Level-3
Duration of Craftsmen Training	One year (1200 Hours + 150 hours OJT/Group Project)
Entry Qualification	Passed 8thclass examination
Minimum Age	14 years as on 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 (Structural) Trade	B.Voc/Degree in Mechanical/ Metallurgy/ Production Engineering/ Mechatronics from AICTE/UGC recognized university with one year experience in relevant field. OR 03 years Diploma in Mechanical and allied 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 (Structural)" 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 Calculation & Science	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 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 Mechanical group (Gr-I) trades categorized under Engg. Drawing'/ D'man Mechanical / D'man Civil' with three years' experience. **Essential Qualification:** Regular / RPL variants of National Craft Instructor Certificate (NCIC) in relevant trade **OR** Regular / RPL variants of NCIC in RoDA / D'man (Mech /civil) 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 with short 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 OUTCOME (TRADE SPECIFIC)

1. Join MS sheets by Gas welding in different positions following safety precautions. (NOS: CSC/N0204)
2. Join MS plates by SMAW in different positions. (NOS: CSC/N0204)
3. Perform straight, bevel & circular cutting on MS plate by Oxy-acetylene cutting process. (NOS: CSC/N0201)
4. Perform different type of MS pipe joints by Gas welding (OAW). (NOS: CSC/N0204)
5. Weld different types of MS pipe joints by SMAW. (NOS: CSC/N0204)
6. Weld Stainless steel, Cast iron, Brass & Aluminum by OAW. (NOS: CSC/N0204)
7. Perform Arc gauging on MS plate. (NOS: CSC/N0204)
8. Perform Plasma Arc cutting. (NOS: CSC/N0207)
9. Perform fillet welding on M.S plates up to 1F, 2F, 3F, 4F & 5F positions by SMAW. (NOS: CSC/N0204)
10. Perform Full penetration Single "V" butt joint on MS plates in 1G,2G,3G &4G position adapting root Inspection and clearance by D.P test. (NOS: CSC/N0204)
11. Perform welding of M.S, S.S and Aluminium sheets, M.S tubes (square butt T,Y,K joints) by GTAW in down hand position. (NOS: CSC/N0212)
12. Perform bending, straightening and edge planning for fabrication of structures. (NOS: CSC/N0303)
13. Perform Double bevel butt joint on dissimilar thickness MS Flats in down hand positions by SMAW with root Inspection by D.P test and back gouging and with root Inspection by D.P test and back gouging and adapting skip welding & back step welding method for controlling distortion. (NOS: CSC/N0204)
14. Perform welding of pipe joints in different positions by SMAW. (NOS: CSC/N0204)
15. Perform Lap, T, Corner joints on GMAW and Flux Cored Arc welding process on M.S in down hand position. (NOS: CSC/N0209, CSC/N0205)
16. Perform Automatic Submerged Arc Welding. (NOS: CSC/N0211)
17. Manufacture simple structures with L angles, I section and channel sections using welding fixture by SMAW. (NOS: CSC/N0204)
18. Fabrication of pipe/cone on M.S. sheet by SMAW. (NOS: CSC/N0204, CSC/N0303)
19. Prepare a Weld test specimen as per a standard and carry out testing. (NOS: CSC/N0204)
20. Carry out non destructive testing of welds. (NOS: CSC/N0204)
21. Read and apply engineering drawing for different application in the field of work. (NOS: CSC/N9401)

22. 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

LEARNING OUTCOMES	ASSESSMENT CRITERIA
1. Join MS sheets by Gas welding in different positionsfollowing safety precautions.(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.
	Setting up the tacked joint in specific position.
	Deposit the weld following proper welding technique and safety aspect.
	Carry out visual inspection to ascertain quality weld joint.
2. Join MS plates by SMAW in different positions. (NOS: CSC/N0204)	Plan and select the type & size of electrode, welding current, type of edge preparation etc. as per requirement.
	Prepare, set and tack the pieces as per drawing.
	Set up the tacked pieces in specific position.
	Deposit the weld maintaining appropriate arc length, electrode angle, welding speed, weaving technique and safety aspects.
	Clean the welded joint thoroughly.
	Carry out visual inspection for appropriate weld joint.
	Inspect the weld using DPT/MPT.
3. Perform straight, bevel & circular cutting on MS plate by Oxy-acetylene cutting process. (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.
	Perform the straight and bevel cutting operation maintaining proper techniques and all safety aspects.
	Perform the circular cutting operation by using profile cutting machine maintaining proper techniques and all safety aspects
	Clean the cutting burrs and inspect the cut surface for soundness of cutting.
4. Perform different type of MS pipe joints by Gas welding (OAW).(NOS:	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.

CSC/N0204)	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. Weld different types of MS pipe joints by SMAW. (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 welding current for welding.
	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. Weld Stainless steel, Cast iron, Brass & Aluminum by OAW. (NOS: CSC/N0204)	Plan and prepare the pieces for welding.
	Select the type and size of filler rod and flux, size of nozzle, gas pressure, preheating method and temperature as per requirement.
	Set and tack plates as per drawing.
	Deposit the weld maintaining appropriate technique and safety aspects.
	Cool the welded joint by observing appropriate cooling method. Use post heating as per requirement.
	Clean the joint and inspect the weld for its uniformity and different types of surface defects.
7. Perform Arc gauging on MS plate.(NOS: CSC/N0204)	Make Square Butt & Lap joint on M.S. sheet 2 mm thick by brazing.
	Make Single "V" butt joint C.I. plate 6mm thick in flat position.
	Plan and select the size of electrode for Arc gouging.
	Arc gouging on MS plate 10 mm thick.
	Select the polarity and current as per requirement.
	Perform gouging adapting proper gouging technique.
	Clean and check to ascertain the required stock removed.
8. Perform Plasma Arc cutting. (NOS: CSC/N0207)	Plan and mark on MS plate surface for straight/bevel cutting.
	Set the plasma cutting machine
	Set the marked plate properly on cutting table.
	Perform the Plasma cutting on M.S plate by Plasma cutting maintaining proper techniques and all safety aspects.
	Clean the cutting burrs and inspect the cut surface for soundness of cutting.
9. Perform fillet welding on	Prepare, set and tack the pieces as per drawing.

M.S plates up to 1F,2F,3F,4F& 5F positions by SMAW. (NOS: CSC/N0204)	Set up the tacked pieces in 1F,2F,3F,4F& 5F position.
	Deposit the weld maintaining appropriate arc length, electrode angle, welding speed, weaving technique and safety aspects.
	Clean the welded joint thoroughly.
	Carry out visual inspection for appropriate weld joint.
	Inspect the weld using DPT/MPT.
	Prepare, set and tack the pieces as per drawing.
10. Perform Full penetration Single "V" butt joint on MS plates in 1G,2G,3G &4G position adapting root Inspection and clearance by D.P test. (NOS: CSC/N0204)	Prepare, set and tack the pieces as per drawing.
	Set up the tacked pieces in specific position.
	Deposit the root pass weld maintaining appropriate arc length, electrode angle, welding speed, and safety aspects.
	Clean and inspect the weld using DPT.
	Deposit the intermediate and cover pass welds maintaining appropriate arc length, electrode angle, welding speed, weaving technique and safety aspects.
	Carry out visual inspection for appropriate weld joint
11. Perform welding of M.S,S.S and Aluminium sheets, M.S tubes (square butt T,Y,K joints) by GTAW in down hand position. (NOS: CSC/N0212)	Plan and prepare M.S,SS, Aluminium sheets as per the drawing.
	Plan and prepare M.S tube for square buttjoint as per the drawing.
	Plan and prepare the development templatesfor each type of pipe joints.
	Mark and development.
	Set up the A.C GTAW machine and set upwelding current.
	Select the suitable filler rods, Gas nozzle,Tungsten electrode.
	Grind the edge of Tungsten electrode.
	Set and tack the Aluminium pieces.
	Deposit the weld on Aluminium sheetsmaintaining proper technique and safetyaspects.
	Set up the D.C GTAW machine and set upwelding current.
	Select the suitable filler rods, Gas nozzle,Tungsten electrode.
	Set and tack the M.S and S.S sheets
	Deposit the weld on M.S and S.S sheetsmaintaining proper technique and safetyaspects.
	Set up and tack weld the pipe joints byGTAW.
	Deposit the weld M.S tube maintainingproper technique and safety aspects.
	Inspect the welded joints visually for poorpenetration, uniformity of bead and surfacedefects.
12. Perform bending,	Bend plates & pipe by using plate/pipe bending machine.
	Bend pipes to different angles and shapes by using Pipe bending

straightening and edgeplanning for fabrication of structures. (NOS: CSC/N0303)	machine
	Straighten plates by hammering (cold straightening)
	Straighten plates by heating and hammering (hot straightening).
13. PerformDouble bevel butt joint on dissimilar thickness MS Flats in down hand positions by SMAW with root Inspection by D.P test and back gouging and with root Inspection by D.P test and back gouging and adapting skip welding & back step welding method for controlling distortion. (NOS: CSC/N0204)	Plan and prepare the pieces for welding as per drawing.
	Select the Electrode as per requirement.
	Set and tack plates as per drawing.
	Deposit the root pass maintaining appropriate technique and safety aspects.
	Clean the joint and inspect the root pass weld for its uniformity and different types of surface defects using D.P test.
	Back gouge and grind the surface.
	Inspect the root for any defect using D.P test.
	Deposit the intermediate and cover passes adapting skip welding & back step welding method for controlling distortion.
	Inspect the welded joints visually for poor penetration, uniformity of bead and surface defects.
14. Perform welding of pipe joints in different positions by SMAW. (NOS: CSC/N0204)	Plan and prepare the development templates for Elbow and T joints of pipe.
	Plan and prepare the development templates for Y and K joints of pipe.
	Mark and cut the MS pipe as per development.
	Select the suitable SMAW electrode.
	Set and tack weld the pipes.
	Weld Elbow and T joints on MS pipes by SMAW in flat position
	Weld K and y joint on M.S. pipe by SMAW in Horizontal positions
	Inspect the welded joints visually for poor penetration, uniformity of bead and surface defects.
15. Perform Lap, T, Corner joints on GMAW and Flux Cored Arc welding process on M.S in down hand position. (NOS: CSC/N0209, CSC/N0205)	Set GMAW machine, select size of CO_2 welding/Flux cored Arc welding electrode wire, welding voltage, gas flow rate, wire feed rate as per requirement.
	Prepare, set and tack weld the pieces as per drawing.
	Deposit the weld adapting proper welding technique and safety aspects.
	Carry out visual inspection to ensure quality of welded joint.
	Inspect the weld and rectify the effects if any

16. Perform Automatic Submerged Arc Welding. (NOS: CSC/N0211)	Set Automatic Submerged Arc Welding machine suitable electrode wire and set the parameters.
	Fill the SAW flux in the Hooper
	Prepare set work pieces as per drawing.
	Start the Automatic Submerged Arc Welding machine and deposit the weld
	Carry out visual inspection to ensure quality of welded joint.
17. Manufacture simple structures with L angles, I section and channel sections using welding fixture by SMAW. (NOS: CSC/N0204)	Plan and prepare the pieces of L angles, I section and channel sections as per the drawing.
	Select the Electrode as per requirement.
	Select suitable welding fixture and clamp the pieces
	Tack weld pieces of L angles, I section and channel sections as per the drawing as per drawing.
	Deposit the root pass maintaining appropriate technique and safety aspects.
	Clean the joint and inspect the root pass weld for its uniformity and surface defects & rectify the defects if any.
	Deposit the intermediate and cover passes maintaining appropriate welding sequence
18. Fabrication of pipe/cone on M.S. sheet by SMAW. (NOS: CSC/N0204, CSC/N0303)	Plan and prepare the development templates for pipe/cone in M.S sheet.
	Mark and cut the sheets as per development.
	Roll or bend the plates to form pipe/cone and tack weld.
	Select the suitable SMAW electrode.
	Set and tack weld the pipes.
	Weld one side of pipe/cone by SMAW in flat position.
	Back ground up to sound weld metal.
	Weld the other side by SMAW in flat position.
	Inspect the welded joints visually and rectify the surface defect if any.
19. Prepare a Weld test specimen as per a standard and carry out testing. (NOS: CSC/N0204)	Prepare and weld a single -V- butt joint as per AWS D1.1.
	Prepare weld test specimens for tensile and bend tests
	Prepare a fillet weld by SMAW process
	Prepare a fillet test specimens for fillet break test and macro etch test.
	Test the specimens for tensile and bend test in the Tensile Testing Machine.

20. Carry out non destructive testing of welds. (NOS: CSC/N0204)	Inspect the welded joints by Liquid Penetrant testing.
21. 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.
22. 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 (STRUCTURAL)			
DURATION: ONE YEAR			
Week No.	**Reference Learning Outcome**	**Professional Skills (Trade Practical) With Indicative Hours**	**Professional Knowledge (Trade Theory)**
Professional Skill 25Hrs; Professional Knowledge 4Hrs	Join MS sheet by Gas welding in different positions following safety precautions. (NOS: CSC/N0204)	Induction training: 1. Familiarization with the Institute. 2. Importance of trade Training. 3. Machinery used in the trade. 4. Introduction to safety equipment and their use etc. 5. Hack sawing, filing square to dimensions. 6. Marking out on MS plate and punching. 7. Setting up of Arc welding machine & accessories and Striking an arc. 8. Setting of oxy-acetylene welding equipment, Lighting and setting of flame.	- General discipline in the Institute - Elementary First Aid. - Importance of Welding in Industry - Safety precautions in Shielded Metal Arc Welding, and Oxy-Acetylene Welding and Cutting. - Introduction and definition of welding. - Arc and Gas Welding Equipments, tools and accessories. - Various Welding Processes and its applications. - Arc and Gas Welding terms and definitions.
Professional Skill 22Hrs; Professional Knowledge 04Hrs	Join MS plates by SMAW in different positions. (Mapped NOS: CSC/N0204)	9. Fusion run without and with filler rod on MS sheet 2 mm thick in flat position. 10. Edge joint on MS sheet 2 mm thick in flat position without filler rod. 11. Marking and straight line cutting of MS plate. 10 mm thick by gas.	- Different process of metal joining methods: Bolting, riveting, soldering, brazing. - Types of welding joints and its applications. Edge preparation and fit up for different thickness. - Surface Cleaning

Professional Skill 184Hrs; Professional Knowledge 31Hrs	Perform straight, bevel & circular cutting on MS plate by Oxy-acetylene cutting process. (Mapped NOS: CSC/N0201)	12. Straight line beads on MS plate 10 mm thick in flat position. 13. Small prototype of power transmission tower (skelton) fabrication from MS rode of 0 4mm. 14. Square butt joint on M.S. sheet 2 mm thick in flat Position. 15. Fillet "T" joint on MS Plate 10 mm thick in flat position.	- Basic electricity applicable to arc welding and related electrical terms & definitions. - Heat and temperature and its terms related to welding - Principle of arc welding. And characteristics of arc. - Common gases used for welding & cutting, flame temperatures and uses. - Types of oxy-acetylene flames and uses. - Oxy-Acetylene Cutting Equipment principle, parameters and application.
		16. Bevelling of MS plates 10 mm thick. By gas cutting. 17. Open corner joint on MS sheet 2 mm thick in flat Position. 18. Fillet lap joint on M.S. plate 10 mm thick in flat position.	- Arc welding power sources: Transformer, Rectifier and Inverter type welding machines and its care & maintenance. - Advantages and disadvantages of A.C. and D.C. welding machines.
		19. Triangular beam fabrication from 8mm & 4mm dia. MS rode with GMAW length 3 feet. 20. Fillet "T" joint on M S she et 2 mm thick in flat position. 21. Open Corner joint on MS plate 10 mm thick in flat position.	- Welding positions as per EN & ASME: flat, horizontal, vertical and over head position. - Weld slope and rotation. - Welding symbols as per BIS & AWS.
		22. Fillet Lap joint on MS sheet 2 mm thick in flat position. 23. Single "V" Butt joint on M S plate 12 mm thick in flat position (1G).	- Arc length - types - effects of arc length. - Polarity: Types and applications.
		24. Square Butt joint on M.S. sheet. 2 mm thick in	- Calcium carbide uses and

		Horizontal position. 25. Straight line beads and multi layer practice on M.S. Plate 10 mm thick in Horizontal position. 26. F "T" 10 mm thick in Horizontal position.	hazards. - Acetylene gas properties. - Acetylene gas, Flash back arrestor
		27. Fillet Lap joint on M.S. sheet 2 mm thick in horizontal position. 28. Fillet Lap joint on M.S. plate 10 mm thick in horizontal position.	- Oxygen gas and its properties - Charging process of oxygen and acetylene gases - Oxygen and Dissolved Acetylene gas cylinders and Color coding for different gas cylinders. - Gas regulators I & II stage and uses.
		29. Fusion run with filler rod in vertical position on 2mm thick M.S sheet. 30. Square Butt joint on M.S. sheet. 2 mm thick in vertical position. 31. Single Vee Butt joint on M.S. plate 12 mm thick in horizontal position (2G).	- Oxy acetylene gas welding Systems (Low pressure and High pressure). Difference between gas welding blow pipe(LP & HP) and gas cutting blow pipe - Gas welding techniques. Rightward and Leftward techniques.
		32. Weaved bead on M.S Plate 10mm in vertical position. 33. Fillet "T" joint on M.S sheet 2 mm thick in vertical position. 34. F "T" 10 mm thick in vertical position.	- Arc blow - causes and methods of controlling. - Distortion in arc & gas welding and methods employed to minimize distortion - Arc Welding defects, causes and Remedies.
Professional Skill 19 Hrs; Professional Knowledge	Perform different type of MS pipe joints by Gas welding (OAW). (NOS: CSC/N0204)	35. Structural pipe welding butt joint on MS pipe 0 50 and 3mm WT in 1G position. 36. Fillet Lap joint on M.S. Plate 10 mm in vertical position.	- Specification of pipes, various types of pipe joints, pipe welding positions, and procedure. - Difference between pipe

04Hrs			welding and plate welding.
Professional Skill 117Hrs; Professional Knowledge 23Hrs	Weld different types of MS pipe joints by SMAW. (Mapped NOS: CSC/N0204)	37. Open Corner joint on MS plate 10 mm thick in vertical position. (10hrs.) 38. Pipe welding - Elbow joint on MS pipe 0 -50 and 3mm WT.	- Pipe development for Elbow joint, "T" joint, Y joint and branch joint - Uses of Manifold system
		39. Pipe welding "T" joint on MS pipe 0 - 50 and 3mm WT. 40. Single "V" Butt joint on MS plate 12 mm thick in vertical position (3G).	- Gas welding filler rods, specifications and sizes. - Gas welding fluxes - types and functions. - Gas Brazing &Soldering : principles, types fluxes & uses - Gas welding defects, causes and remedies.
		41. Pipe welding 45 ° angle joint on MS pipe 0-50 and 3mm WT. 42. Straight line beads on M.S. plate 10mm thick in over head position.	- Electrode : types, functions of flux, coating factor, sizes of electrode - Effects of moisture pick up. - Storage and baking of electrodes.
		43. Pipe Flange joint on M.S plate with MS pipe 050 mm X 3mm WT. 44. Fillet "T" 10 mm thick in over head position.	- Weldability of metals, importance of pre heating, post heating and maintenance of inter pass temperature.
		45. Pipe welding butt joint on MS pipe 0-50 and 5 mm WT. in 1G position. 46. Fillet Lap joint on M.S. plate 10 mm thick in overhead position.	- Welding of low, medium and high carbon steel and alloy steels.
		47. Single "V" Butt joint on MS plate 10mm thick in overheadposition(4G). 48. Pipe butt joint on M.S. pipe 0-50mm WT 6mm (1G Rolled).	- Stainless steel: types- weld decay and weldability.
Professional Skill 24Hrs;	Weld Stainless steel, Cast iron,	49. Square Butt joint on S.S. sheet. 2 mm thick in flat	- Brass - types - properties

Professional Knowledge 04Hrs	Aluminium and Brass by OAW. (NOS:CSC/N0204)	position. 50. Square Butt joint on S.S. Sheet 2 mm thick in flat position. 51. Square Butt joint on Brass sheet 2 mm thick in flat position.	and welding methods. - Copper - types - properties and welding methods.
Professional Skill 25Hrs; Professional Knowledge 08Hrs	Perform Arc gauging on MS plate. (NOS: CSC/N0204)	52. Square Butt & Lap joint on M.S. sheet 2 mm thick by brazing.Single "V" butt joint C.I. plate 6mm thick in flat position. 53. Arc gouging on MS plate 10 mm thick.	- Aluminum properties and weldability, Welding methods - Arc cutting & gouging,
		54. Square Butt joint on Aluminium sheet. 3 mm thick in flat position. Bronze welding of cast iron (Single "V" butt joint) 6mm thick plate.	- Cast iron and its properties types. - Welding methods of cast iron.
Professional Skill 18Hrs; Professional Knowledge 04Hrs	Perform plasma arc cutting. (Mapped NOS: CSC/N0207)	55. Setting up Gas cutting equipment and cutting MS Flats to required size.	- Outline of the subjects to be covered - Importance of structural welding - Welding processes - brief description, Classification and application - Welding terms and definitions
Professional Skill 118Hrs; Professional Knowledge 23Hrs	Perform fillet welding on M.S plates 1F,2F,3F,4F& 5F positions by SMAW. (Mapped NOS: CSC/N0204)	56. Setting up SMAW Welding equipment and making straight and weaving bead on MS in all positions.Practice on plasma cutting.Practice on gouging techniques.	- Principles of Oxy-Acetylene Cutting and equipments required. - Principles of shielded metals arc welding, its advantages and limitations. - Types of weld joints.
		57. Weld joint preparation for fillet weld (Cutting to size, fit up, tack weld etc.). 58. Fillet, Lap and T joint on MS flat by SMAW, position - 1F.	- Basic Electricity applicable to welding - Arc welding power source AC / DC - advantages and

			disadvantages - Types of metal and their characteristics. - Classification of steel and their Weldability. - Heat affected zone and requirement for pre-heating and maintaining inter pass temperature.
		Weld joint preparation for fillet welds (cutting to size, fit up, tack weld etc.).Fillet, lap and T joint on MS flat by SMAW position - 2F.	- Welding symbols and their importance - Welding positions and necessity of positional welding. - Weld joint edge preparation. - Welding procedure and techniques -Tack welding, root run welding, intermediate and cover pass welding, cleaning, checking etc.
		59. Weld joint preparation for fillet welds (cutting to size, fit up, tack weld etc.).Fillet, lap and T joint on MS flat by SMAW, position - 3F.	- Welding tools and accessories - Arc and its characteristics - Polarity types and application - Arc length - Welding fixtures and clamps
		60. Weld joint preparation for fillet welds (cutting to size, fit up, tack weld etc.) 61. Fillet, lap and T joint on MS flat by SMAW position - 4F.	- Coated electrodes - Types, description. - Standard size and length of electrodes. - Selection of electrodes and coating factor. - Electrode storage and necessity of backing.
		62. Weld joint preparation for pipe fillet welding.	- Effect of Heat on Weldments.

		63. Pipe to pipe fillet weld on MS pipes by SMAW, position -5F.	- Welding distortion and stresses.
Professional Skill 75 Hrs; Professional Knowledge 12Hrs	Perform Full penetration Single "V" butt joint on MS plates in 1G,2G,3G &4G position adapting root Inspection and clearance by D.P test. (Mapped NOS: CSC/N0204)	64. Weld joint preparation for plate groove welding.Full penetration Single "V"butt joint on MS Flat by SMAW in 1G Positions.Root pass welding & LPI testing.Cover pass welding &inspection.	- Methods of controlling distortion by various methods. - Methods of relieving stress on Weldments. - Advantages of welded structures over riveted structures
		65. Weld joint preparation for plate groove welding.Full penetration Single "V"butt joint on MS Flat by SMAW in 2G Positions.Root pass welding & LPI testing.Cover pass welding & inspection.	- Types of Steel sections / forms used in structural fabrication and their standard sizes - Importance of structural welding and workmanship - Necessity of Qualifying welders, welding operators and tack welders - Necessity of Qualifying the welding procedure - Positions of test plates for filter welds and groove welds
		66. Full penetration single "V" butt joint on MS Flat by SMAW in 3G Positions. 67. MS Flat by SMAW in 4G Positions. 68. Root pass welding & LPI testing. 69. Cover pass welding & inspection.	- Types of Fillet welded and groove welded joints on statically loaded structures. - Types of fillet welded and groove welded joints on dynamically loaded structures
Professional Skill 19Hrs; Professional Knowledge 04Hrs	Perform welding of MS, SS and Aluminium sheets, M.S tubes (square butt T,Y,K joints) by GTAW in down hand position.	70. Setting up GTAW welding equipment and making beading practice on MS in down hand position. 71. Square butt joint on M.S Sheet in down hand position.	- GTAW equipments - Advantages of GTAW Welding process - Power source types AC/DC - Types of polarity and application

	(Mapped NOS: CSC/N0212)		
Professional Skill 55 Hrs; Professional Knowledge 12Hrs	Perform bending, straightening and edge planning for fabrication of structures. (Mapped NOS: CSC/N0303)	72. Suare butt joint on S.S Sheet in down hand position. 73. Square butt joint on Aluminium in down hand position.	- Tungsten electrode, types, sizes and uses - Types of shielding gases - Preparation for TIG Welding under drift conditions - Necessity of back purging
		74. M.S square butt Tube (Square or rectangular) welding.	- Types of Tubular structures used on structural fabrication
		75. T,Y,K tube(Square or rectangular) joints by TIG welding.	- Development of templates for marking and preparation of pipe elbow, - T, Y and K joints (Similar and dissimilar diameter pipe connections)
Professional Skill 23Hrs; Professional Knowledge 04Hrs	Perform Double bevel butt joint on dissimilar thickness MS Flats in down hand positions by SMAW with root Inspection by D.P test and back gouging and with root Inspection by D.P test and back gougingand adapting skip welding & back step welding method for controlling distortion. (Mapped NOS: CSC/N0204)	76. Double bevel butt joint on MS Flats in dissimilar thickness in down hand positions by SMAW. Root Inspection. Back Gouging. Adopting weld sequence for controlling distortion.	- Types of welding defects - Causes and remedy.
Professional Skill 19Hrs;	Perform welding of pipe joints in different positions	77. Pipe Elbow and T joints on MS pipes by SMAW in flat position. (10hrs.)	- Procedure of rectifying, weld defects -Gouging methods , grinding, testing

Professional Knowledge 04Hrs	by SMAW. (Mapped NOS: CSC/N0204)	78. Pipe Y and K connection on M.S. pipe by SMAW, positions – Horizontal.	with die penetrant, pre-heating and re welding
Professional Skill 18Hrs; Professional Knowledge 04Hrs	Perform Lap, T, Corner joints on GMAW and Flux Cored Arc welding process on M.S in down hand position. (Mapped NOS: CSC/N0209, CSC/N0205)	79. Practice on C02 welding and Flux Cored Arc Welding.	- Introduction to GMAW, Flux cored arc welding - Advantages - Power source - Wire feeder - Electrode wires - shielding gases - Types of metal transfer and welding parameters.
Professional Skill 18Hrs; Professional Knowledge 04 Hrs	Perform Automatic Submerged Arc Welding machine. (Mapped NOS: CSC/N0211)	80. Practice on Automatic Submerged ArcWelding machine.	- Introduction to Submerged arcwelding (SAW). Advantage,limitation, Equipment and operating conditions.
Professional Skill 25 Hrs; Professional Knowledge 05 Hrs	Manufacture simple structures with L angles, I section and channel sections using welding fixture by SMAW. (Mapped NOS: CSC/N0204)	81. Manufacturing of simple structures with L angles, I section and channel sections using welding fixture by SMAW.Correction of distortion by cold &hot.Manufacturing of structures using M.S. Flat by SMAW. 82. Adapting skip welding & back step welding method for controlling distortion.	- Procedure of structural fabrication. - Planning for structural members, marking and edge preparation, assembling, tack welding, measurement of weldment size, root pass welding, inspection of root pass welding, making cover pass and Inspection & Testing etc. - Inspection and testing of weldments. - Visual inspection kits and Gauges
Professional Skill 18Hrs; Professional Knowledge 04 Hrs	Fabricate pipe/cone on M.S. sheet by SMAW. (Mapped NOS: CSC/N0204, CSC/N0303)	83. Fabrication of pipe/cone on M.S. sheet bySMAW.	- Non-destructive testing methods - Structural welding codes andstandards - Writing procedure for WPS and PQR

			- Requirement for qualification in different codes
Professional Skill 18Hrs; Professional Knowledge 04Hrs	Prepare weld test specimen as per a standard. Carry out non destructive testing of welds. (Mapped NOS: CSC/N0204)	84. Weld test specimen - preparation as per standardInspection & Testing.	- Qualification procedure under variouscodes. - Different tests and inspection involved in qualification.
Engineering Drawing: 40 Hrs.			
Professional Knowledge ED- 40 hrs	Read and apply engineering drawing for different application in the field of work. (NOS: CSC/N9401)	**ENGINEERING DRAWING:** - 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 welding 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	**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	

	science in the field of study. (NOS: CSC/N9402)	- 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 inwww.bharatskills.gov.in./ dgt.gov.in

ANNEXURE-I

LIST OF TOOLS AND EQUIPMENT			
WELDER (STRUCTURAL) (For Batch of 20 Candidates)			
Sl. No.	**Name of the Tool &Equipment**	**Specification**	**Quantity**
A. TRAINEES TOOLS KIT			
1.	Welding helmet fiber		21(20 +1) Nos.
2.	Welding hand shield fiber		21(20 +1) Nos.
3.	Chipping hammer with metal handle	250 Grams	21(20 +1) Nos.
4.	Chisel cold flat	19 mm x 150 mm	21(20 +1) Nos.
5.	Centre punch	9 mm x 127 mm	21(20 +1) Nos.
6.	Dividers	200 mm	21(20 +1) Nos.
7.	Stainless steel rule (engraved)	300mm	21(20 +1) Nos.
8.	Scriber	150 mm double point	21(20 +1) Nos.
9.	Flat Tongs	350mm long	21(20 +1) Nos.
10.	Hack saw frame fixed	300 mm	21(20 +1) Nos.
11.	File half round bastard	300 mm	21(20 +1) Nos.
12.	File flat	350 mm bastard	21(20 +1) Nos.
13.	Hammer ball pane	1 kg with handle	21(20 +1) Nos.
14.	Tip Cleaner (for gas welding torch)		21(20 +1) Nos.
15.	Try square	150 mm.	21(20 +1) Nos.
B. GENERAL MACHINERY SHOP OUTFIT			
16.	Spindle key (O_2, CO_2, C_2H_2, Ar)		2 nos. for each 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.	H.P. Welding torch with	5 nozzles	2 sets
26.	Oxygen Gas Pressure regulator double stage		2 no.
27.	Acetylene Gas Pressure regulator double stage		2 no.
28.	CO2 Gas pressure regulator, with flow meter		2 set
29.	Argon Gas pressure regulator with flow meter		2 set
30.	Metal rack	182 cm x 152 cm x 45 cm	1 no.
31.	First Aid box		1 no.
32.	Steel lockers	with 8 Pigeon holes	2 nos.
33.	Steel almirah / cupboard		4 nos.
34.	Black board and easel with stand		1 no.
35.	Flash back arrester (torch mounted)		4 pairs
36.	Flash back arrester (cylinder mounted)		4 pairs
37.	Auto Darkening Welding Helmet		5 nos.
C. GENERAL INSTALLATION			
38.	Welding Transformer with all accessories	400A , OCV 60 - 100 V, 60% duty cycle	1 sets
39.	Welding Transformer or Inverter based welding machine with all accessories	300A , OCV 60 - 100 V, 60% duty cycle	1 sets
40.	D.C Arc welding rectifiers set with all accessories	400 A. OCV 60 -100 V, 60% duty cycle	1 sets
41.	GMAW welding machine 400A capacity with air cooled torch, Regulator, Gas pre-heater, Gas hose and Standard accessories		1 set
42.	AC/DC GTAW welding machine with water cooled torch 300 A, Argon regulator, Gas hose, water circulating system and standard accessories.		1set
43.	Air Plasma cutting equipment with all accessories, capacity to cut 12 mm clear cut		01 set
44.	Air compressor 8 Bar to 10 Bar double stage tank mounted		01 no.
45.	Power shearing machine		01 no.
46.	Portable abrasive cut-off machine		01 set
47.	Pug cutting machine Capable of cutting Straight & Circular with all accessories		01 set
48.	Pedestal grinder fitted with coarse and medium grain size grinding wheels dia.	300 mm	2no.
49.	Bench grinder fitted with fine grain size silicon carbide green grinding wheel	dia. 150 mm	1no.
50.	AG 4 Grinder		24nos.
51.	Suitable Arc welding table with positioner		6nos.
52.	Trolley for cylinder (H.P. Unit)		2nos.
53.	Hand shearing machine	capacity to cut 6 mm sheets and flats	1no.

54.	Power saw machine	450 mm.	1 no.
55.	Portable drilling machine	(Cap. 6 mm)	2 no.
56.	Oven, electrode drying 0 to 250°C, 10 kg capacity	Min. depth 450-500 mm	1 no.
57.	Work bench	340x120x75 cm with 4 bench vices of 150 mm jaw opening	5 sets
58.	Oxy Acetylene Gas cutting blow pipe		2 sets
59.	Oxygen, Acetylene Cylinders		2 each
60.	CO_2 cylinder		2no
61.	Argon gas cylinder		2no
62.	Anvil 24 sq. inches working area with stand		1 no.
63.	Swage block (16x16x16 inch)	Weight 50 Kg	1 no.
64.	Fire buckets with stand		4 nos.
65.	Universal Testing Machine		1 set
66.	Fire extinguishers	foam type and CO_2 type	1no.
67.	Suitable gas cutting table		1 no.
68.	Welding Simulators for SMAW/GTAW/GMAW		1 each (Optional)
D. LIST OF CONSUMABLE			
69.	Leather Hand Gloves	350 mm.	21 pairs
70.	Cotton hand Gloves	200 mm.	21 pairs
71.	Leather Apron leather		21 pairs
72.	S.S Wire brush	5 rows and 3 rows	21 nos. each
73.	Leather hand sleeves	400 mm	21 pairs.
74.	Safety boots for welders	Size 7,8,9,10	21 pairs.
75.	Leg guards leather		21 pairs.
76.	Rubber hose clips	1/2"inch	21 nos.
77.	Rubber hose oxygen	8 mm dia X 10 Mts long as per BIS	2 nos.
78.	Rubber hose acetylene	8 mm dia X 10 Mts long as per BIS	2 nos.
79.	Arc welding cables multi cored copper	600 amp as per BIS	45 mts. each
80.	Arc welding single coloured glasses	108 mm x 82 mm x 3 mm. DIN 11A &12 A	42 nos.
81.	Arc welding plain glass	108 mm x 82 mm x 3 mm.	68 nos.
82.	Gas welding Goggles with Colour glass 3 or 4A DIN	Light dark color	42 nos.
83.	Safety goggles plain bubble face shield	clear	42 nos.
84.	Spark lighter		6 nos.
85.	AG 4 Grinding wheels		50 nos.
86.	AG 4 Cutting wheels		100 nos.
87.	Die penetrant testing kit		1 set
88.	S.S tape 5 meters flexible in case		5 no.

89.	Electrode holder	600 amps	6 nos.
90.	Earth clamp	600A	6 nos.

sABBREVIATIONS

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 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


कौशलं बलम्