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

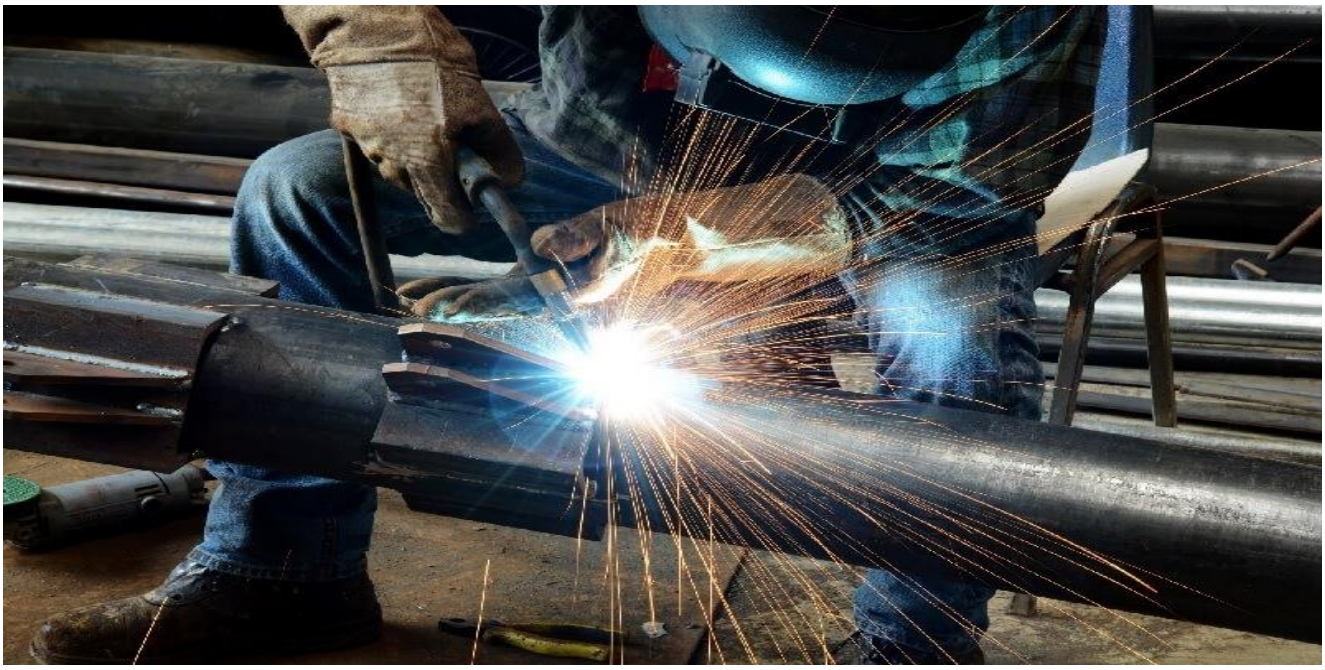
COMPETENCY BASED CURRICULUM

WELDER (WELDING & INSPECTION)

(Duration: One Year)

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL- 2.5



SECTOR – CAPITAL GOODS AND MANUFACTURING

Directorate General of Training

WELDER (WELDING & INSPECTION)

(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 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 practical part starts with basic welding work viz. gas welding, arc gauging etc. and performing different testing methods viz. bend test, tensile test, impact test, dye penetrant inspection etc. The broad components covered under Professional Skill subject are as below:

The practical part starts with basic welding and the candidate is imparted training on viz., Welding (Gas & Arc), pipe joints, MS sheet / plate joints which leads to multi-skilling. The safety aspects cover components like OSH&E, PPE, Fire extinguisher, First Aid etc. Perform visual inspection of metal by using different methods like bend test, tensile test, hardness test, impact test etc. The learner does practical of surface defects inspection by dye penetrant inspection, sub surface inspection by magnetic particle testing method, interprets radiographic films of weldments and prepares reports after welding inspection.

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.

Projects 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

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

Welder (Welding & Inspection) trade under CTS is 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 DGT which 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 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 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) assessments are 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, Gas; fuses metal parts together using welding rod and oxygen acetylene flame. Examines parts to be welded, cleans portion to be joined, holds them together by some suitable device and if necessary, makes narrow groove to direct flow of molten metal to strengthen joint. Selects correct type and size of welding rod, nozzle etc. and tests welding, torch. Wears dark glasses and other protective devices while welding. Releases and regulates valves of oxygen and acetylene cylinders to control their flow into torch. Ignites torch and regulates flame gradually. A guide flame along joint and heats it to melting point, simultaneously melting welding rod and spreading molten metal along joint shape, size etc. and rectifies defects if any. May join part at various spots to prevent distortion of shape, form dimension etc. May preheat materials like cast iron prior to welding. May also weld by other gases such as argon coal etc.

Welder, Electric; Arc Welder fuses metals using arc-welding apparatus and electrodes (welding material). Examines parts to be welded, cleans them and sets joints together with clamps or any other suitable device. Starts generator or transformer (welding apparatus and regulates current according to material and thickness of welding. Clamps one lead (insulated wire carrying current from generator) to part to be welded, selects required type of electrode and clamps it to holder connected with other lead). Generates sparks between electrode and joint, simultaneously guiding and depositing melting electrode uniformly for welding. Takes precautionary measures such as wearing rubber gloves, holding welding screen of dark glass etc. May join parts first at various points for holding at specified angles, shape, form and dimension.

Welder, Machine; operates gas or electric welding machine to joint metal parts by fusion. Sets machine for operation by igniting burners and adjusting flames or by switching on current. Regulates flow of gas or current and adjusts machine according to material to be welded. Checks cooling system and adjusts movement of conveyor, if any. Feeds material to be welded with either one by one or in batch according to type of machine and welds them by pressing paddle, or by automatic arrangements. May use fixtures or other suitable devices for mass production work is designated as SPOT WELDER, FLASH WELDER, etc. according to machine and type of work done.

Gas Cutter; Flame Cutter 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. Mounts template and sets machine to cut to specifications. Makes necessary connections and fits required size of nozzle or burner in welding torch. Releases and regulates flow of gas in nozzle or burner, ignites and adjusts flame. Guides flame by hand or machine along cutting line at required speed and cuts metal to required size. May use oxyacetylene or any other appropriate gas flame.

Brazer; fuses metal parts by heating using flux and fillings. Cleans and fastens parts to be joined face to face by wire, by seaming or by any other suitable means and prepares paste of flux and fillings. Applies it to joint and hearts in furnace or by torch to melt filling into joint. Allows it to

cool down. welding or joining two or more metals together using resistive heat caused by changing electromagnetic fields. Examines induction welded joints and cleans them by filing, buffing etc.

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/N0212
iv) CSC/N0207
v) ISC/N9405
vi) CSC/N0209
vii) CSC/N0603
viii) CSC/N9401
ix) CSC/N9402

4. GENERAL INFORMATION

Name of the Trade	**WELDER (WELDING & INSPECTION)**
Trade Code	DGT/1098
NCO - 2015	7212.0100, 7212.0200, 7212.0300, 7212.0400, 7212.0500
NOS Covered	CSC/N0204, CSC/N0201, CSC/N0212, CSC/N0209, CSC/N0207, ISC/N9405, CSC/N0603, 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 8thclass 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 (Welding & Inspection) 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/ 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. NTC/ NAC passed in "Welder" Trade with 3 years' experience in relevant trade. **Essential Qualification:** 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 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 from DGT institutes. (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 from DGT institutes.
5. Minimum Age for Instructor	21 Years
List of Tools and Equipment	As per Annexure – I

5. LEARNING OUTCOME

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

5.1 LEARNING OUTCOMES:

1. Perform joining of MS sheet by Gas welding in different positions following safety precautions. (NOS: CSC/N0204)
2. Join MS plate 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 types 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. Join Aluminium & Stainless Steel sheets by GTAW in different position. (NOS: CSC/N0212)
7. Perform Arc gauging on MS plate. (NOS: CSC/N0207), NOS: CSC/N0212)
8. Join MS sheets/ plates by GMAW in various positions using different modes of metal transfer. (NOS: CSC/N0209)
9. Perform visual inspection / testing of welded joint. (NOS: CSC/N0209)
10. Perform destructive Inspection of metal by using different methods like, Bend test, tensile test, hardness test and Impact test etc. (NOS: CSC/N0209)
11. Perform surface defects inspection by Dye penetrant Inspection. (NOS: CSC/N0209)
12. Perform sub surface inspection by Magnetic particle testing method. (NOS: CSC/N0209)
13. Perform sub surface inspection by Ultrasonic Flaw detector of weldments. (NOS: ISC/N9405)
14. Perform Interpretation of Radiographic films of weldments. (NOS: CSC/N0603)
15. Read and apply engineering drawing for different application in the field of work. (NOS: CSC/N9401)
16. 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. Perform joining ofMS sheets by Gas welding in different positions following 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. JoinMS 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 types of MS pipe joints by Gas welding (OAW). (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. 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. Join Aluminum &Stainless Steel sheets by GTAW in different position. (NOS: CSC/N0212)	Select power source as per material, size and type of Tungsten electrode, welding current, gas nozzle size, gas flow rate and filler rod size as per requirement.
	Prepare, set and tack the pieces as per drawing.
	Set up the tacked joint in specific position.
	Deposit the weld by adapting proper welding 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).
	Identify the materials and measuring instruments.
	Carry out butt & fillet welds on sheet metals.
	Mark on plates on structural sections- I, L, C etc.
	Perform gas cutting of MS plate, I section and channels profile cutting.
	Perform root run welding by using backing strip.
	Install GTAW welding plant.
	Carry out beading by TIG.
	Carry out square butt and corner joint on MS by TIG.
	Perform butt, T and corner joint on SS sheet.
	Carry out straight line beads on MS plate by CO2 welding.
	Carry out lap T and corner joint on MS plate by CO2 welding.
	Carry out single V –butt joint by CO2 welding.
	Develop pipe weld joint and fit up on elbow and T-joint.
	Perform pipe joint root welding by TIG.
7. Perform Arc gauging on MS plate. (NOS: CSC/N0207, CSC/N0212)	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. Join MS sheets/ plates by GMAW in various positions using different modes of metal transfer. (NOS: CSC/N0209)	Select size of electrode wire, welding voltage, gas flow rate, wire feed rate as per requirement.
	Prepare, set and tack the pieces as per drawing.
	Set up the tacked joint in specific position.
	Deposit the weld adapting proper welding technique and safety aspects.
	Carry out visual inspection to ensure quality of welded joint.
	Inspect the weld using Dye-penetration (DPT)/Magnetic particle Test (MPT).

9. Perform visual inspection of welded joint. (NOS: CSC/N0209)	Clean the welded joint thoroughly.
	Carry out visual inspection to ascertain quality of weld joint.
	Locate and mark out visual defects if any for repair.
	Record the observation in the Inspection report.
10. Perform destructive Inspection of metal by using different methods like, Bend test, tensile test, hardness test and Impact test etc. (NOS: CSC/N0209)	Cut the welded joint to the required size.
	Prepare the specimen according to the testing method.
	Test with the DT method.
	Record the observation in the Inspection report.
11. Perform surface defects inspection by Dye penetrant Inspection. (NOS: CSC/N0209)	Clean the welded joint thoroughly.
	Carry out visual inspection to ascertain quality of weld joint.
	Locate and mark out visual defects if any for repair.
	Record the observation in the Inspection report.
12. Perform sub surface inspection by Magnetic particle testing method. (NOS: CSC/N0209)	Clean the welded joint thoroughly.
	Carry out visual inspection to ascertain quality weld joint.
	Select the appropriate testing methods.
	Perform testing of welded joints adapting standard operating procedure.
	Accept/reject the job based on test result.
13. Perform sub surface inspection by Ultrasonic Flaw detector of weldments. (NOS: ISC/N9405)	Clean the welded joint thoroughly.
	Carry out visual inspection to ascertain quality weld joint.
	Select the appropriate testing methods.
	Perform testing of welded joints adapting standard operating procedure.
	Use correct angle probes as per metals and its density.
	Save the graph image for reference.
	Accept/reject the job based on test result.
14. Interpret Radio graphic films of weldment. (NOS: CSC/N0603)	Clean the welded joint thoroughly.
	Carry out visual inspection to ascertain quality weld joint.
	Select the appropriate testing methods.
	Accept/reject the job based on test result.
15. 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.

16. 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 FOR WELDER (WELDING & INSPECTION) TRADE			
DURATION: ONE YEAR			
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
Professional Skill 67 hrs; Professional Knowledge 12 hrs	Perform joining MS sheet by Gas welding in different positions following safety precautions.	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.	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.
		7. Setting up of Arc welding machine & accessories and striking an arc. (10hrs.) 8. Setting of oxy-acetylene welding equipment, Lighting and setting of flame.	Introduction and definition of welding. Arc and Gas Welding Equipment, tools and accessories. Various Welding Processes and its applications. Arc and Gas Welding terms and definitions.
		9. Fusion run without and with filler rod on M.S. 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 etc. Types of welding joints and its applications. Edge preparation and fit up for different thickness. Surface Cleaning.
Professional Skill 117Hrs; Professional Knowledge 19Hrs	Join MS plate by SMAW in different positions.	12. Straight line beads on M.S. plate 10 mm thick in flat position. 13. Weaved bead on M.S. plate 10mm 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.

		14. Square butt joint on M.S. sheet 2 mm thick in flat Position. 15. Fillet "T" joint on M.S. Plate 10 mm thick in flat position.	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. Beveling 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. Test the hardness of job no. 21, 22, 23 with rock well hardness testing machine. 20. Fillet "T" joint on M S sheet 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 overhead 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 Horizontal position. (6 hrs.) 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.	Calcium carbide uses and hazards. Acetylene gas properties Acetylene gas and Flash back arrestor.
Professional Skill 70Hrs; Professional Knowledge 12Hrs	Perform straight, bevel & circular cutting on MS plate by Oxy-acetylene cutting process.	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. Single stage & double stage Gas regulators and uses.
		29. Fusion run with filler rod in	Oxy acetylene gas welding

		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).	Systems (Low pressure and High pressure). Difference between gas welding blow pipe (LP & HP) and gas cutting blowpipe. Gas welding techniques. Rightward and Leftward techniques.
		32. Test GMAW welded joints by DPT test and make the final report. 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 62Hrs; Professional Knowledge 12Hrs	Perform different types of MS pipe joints by Gas welding (OAW).	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 welding and plate welding.
		37. Open Corner joint on MS plate 10 mm thick in vertical position. 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. Manifold system and uses.
		39. Pip e welding "T" joint on MS pipe 0 5 0 and 3mm WT. 40. Single "V" Butt joint on M S p late 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.
Professional Skill 69Hrs; Professional Knowledge 14Hrs	Weld different types of MS pipe joints by SMAW.	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 0 50 mm X 3mm WT. 44. F "T"10 mm thick in over	Weldability of metals, importance of pre heating, post heating and maintenance of inter pass temperature.

		head position.	
		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 over head position.	Welding of low, medium and high carbon steel and alloy steels.
		47. Single "V" Butt joint on MS plate 10mm thick in over head position(4G). 48. Pipe butt joint on MS pipe ϕ 50mm WT 6mm (1G Rolled).	Stainless steel: types- weld decay and weldability.
Professional Skill 70Hrs; Professional Knowledge 12Hrs	Join Aluminum & Stainless Steel sheets by GTAW in different position. Perform Arc gauging on MS plate.	49. Square Butt joint on S.S. sheet. 2 mm thick in flat 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.	Brass - types - properties and welding methods. Copper - types - properties and welding methods.
		52. Square Butt & Lap joint on M.S. sheet 2 mm thick by brazing. 53. Single "V" butt joint C.I. plate 6mm thick in flat position. 54. Arc gouging on MS plate 10 mm thick.	Aluminum properties and weldability, welding methods. Arc cutting & gouging.
		55. Square Butt joint on Aluminium sheet. 3 mm thick in flat position. 56. 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 21Hrs; Professional Knowledge 05 Hrs	Join MS sheets/ plates by GMAW in various positions using different modes of metal transfer.	57. Handling of measuring instruments - Steel tape, Vernier Caliper, spirit level, micrometer, Try square, Plum bob etc. 58. Simple dimensional measurements using the appropriate instruments.	Outline of various subjects to be covered Quality and its definition Inspection methods. Measuring Instruments and least count Dimension report preparation Types of metals & characteristics Classification of steels.
Professional Skill 162 Hrs;	Join Aluminium & Stainless Steel sheets by GTAW in	59. Identification of materials.	Types of welding process Advantages & limitations Various types of welding

Professional Knowledge 31Hrs	different position.		power sources.
		60. Simple gas welding exercises on sheet metals (Butt & Fillet welds).	Welding parameters Different types of weld joints Gas welding principle and application Safety in welding and cutting.
		61. Lay out marking on plates. 62. Marking on structural sections - I, L, C etc. 63. Development marking for cylinders.	Marking with pantograph Gas cutting principles, basic CNC profile cutting. Different size and shape of rolled sections.
		64. Test GMAW welded joint by magnetic particle test method and make final test report as standard method.	Basic welding metallurgy (pre heating, post heating etc.) Welding symbol and its nomenclatures Effects of heat.
		65. Making square butt joint on MS sheet in down hand position by SMAW. 66. Making single V - Butt joint on MS sheet in down hand position by SMAW. 67. Use of backing strip for root runs welding.	Principle of Shielded metal Arc welding (SMAW) Function of flux and baking requirements Selection of electrodes and coating factors Different type of edge preparation. Welding procedure - Edge preparation and fit up, use of backing strips and bars, root run welding and cover pass welding.
		68. Setting up GTAW welding plant. Beading practicing by TIG Square butt and corner joint on M.S by TIG Butt, T and Corner joint on S.S sheet.	Introduction to GTAW welding TIG welding equipments Advantages of TIG welding process. Tungsten electrode, Types, sizes, and uses. Type of shielding gases Purging Methods Parameter setting.
		69. Setting up GMAW welding plant Straight line beads on MS plate by CO_2 welding Lap T & corner joint on MS plate by CO_2 welding Single V - Butt joint by CO_2 welding.	GMAW welding process Power source & accessories Wire Feed unit Modes of metal transfer - Dip, Globular, spray &pulsed transfer and its significance Welding wire types and specification & Parameter setting.
		70. Pipe weld joint development &fit up on elbow and T- joint.	Classifications of pipes and tubes Various types of pipe joints Development of pipe -

			elbow and T- joint.
		71. Pipe joint root welding by TIG.	Various equipments used for root pass cleaning Pipe bending Pipe welding procedure.
Professional Skill 18Hrs; Professional Knowledge 04Hrs	Perform visual inspection / testing of welded joint.	72. Visual Inspection of welds. 73. Application of weld gauge.	Types of Welding defects (Cracks, Inclusions, Incomplete penetration, Lack of fusion, Under cut, Burn through, Overlap etc.)
Professional Skill 39Hrs; Professional Knowledge 08Hrs	Perform destructive Inspection of metal by using different methods like, Bend test, tensile test, hardness test and Impact test etc.	74. Dimensional inspection of weldments using weld measuring gauges.	Causes for defects. Remedial measures Inspection methods.
		75. Hardness Testing. 76. Bend Testing of Weldments. 77. Tensile testing.	Mechanical Testing of Metals. Principles, Applications of - Hardness testing (Rockwell and Brinell) - Impact testing (Izod and Charpy) - Tensile testing and Bend Test.
Professional Skill 36Hrs; Professional Knowledge 08Hrs	Perform surface defects inspection by Dye penetrant Inspection.	78. Evaluation of welding defects using Dye penetrant testing method on plate.	Nondestructive Testing of Metals. Visual inspection Dye penetrant test - Principles - Advantages -Limitations - Types of Penetrants - Cleaners -Dwelling time.
		79. Evaluation of welding defects using Dye penetrant testing method on pipe.	Dye penetrant test (DPT) - Types of Penetrants -Cleaners - Dwelling time.
Professional Skill 18Hrs; Professional Knowledge 04Hrs	Perform sub surface inspection by Magnetic particle testing method.	80. Evaluation of welding defects using Magnetic Particle Testing method.	Magnetic Particle Test (MPT)- Principles - Advantages - Limitations -Types of Magnetation - Current requirements -Testing equipments - Indication and Interpretations.
Professional Skill 54Hrs; Professional Knowledge 13 Hrs	Perform sub surface inspection by Ultrasonic Flaw detector of weldments.	81. Ultrasonic Flaw detector- Setting & calibration.	Ultrasonic Testing (UT)- Principles - Advantage – Limitation.
		82. Ultrasonic Flaw detector- probe identification & application on pipes & plates.	Types of UT Waves - Attenuation - Types of Transducers - Couplants - Equipments and controls - Type of scans.
		83. Ultrasonic Flaw detector- application on weldments of various metals.	Measuring Techniques - Standard reference blocks. Contact Testing procedure - Indications and

			interpretations.
Professional Skill 37Hrs; Professional Knowledge 08Hrs	Perform Interpretation of Radiographic films of weldments.	84. Study of IIW / ASTM reference Radiograph.	Radiographic testing (RT) - Principles – Advantages. - Limitations - Basic Radiation Physics - X-Rays -Gama Rays - Radiation Sources - Types of Films -Film Processing.
		85. Interpretation of Radiographic films. 86. Preparation of welding inspection reports.	Radiographic Sensitivity - Image Quality indicators- Radiographic Techniques – Radiographic Interpretation and Evaluation - Radiation Hazard and Control. Certification methods for welding inspectors. Codes and standards for welding inspection. Welding procedure specifications (WPS) Procedure qualification Record (PQR).
Engineering Drawing: 40 Hrs.			
Professional Knowledge ED- 40 hrs	Read and apply engineering drawing for different application in the field of work.	**ENGINEERING DRAWING (40 hrs):** - 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	**WORKSHOP CALCULATION & SCIENCE (38 hrs):** - Unit, Fractions - Square root, Ratio and Proportions, Percentage - Material Science	

	perform practical operations. Understand and explain basic science in the field of study.	- 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 (WELDING & INSPECTION) (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	6"	21(20 +1) Nos.
B. GENERAL MACHINERY SHOP OUTFIT			
16.	Spindle key (O_2, CO_2, C_2H_2, Ar)		2 Nos. each gas
17.	Screw Driver	300mm blade and 250 mm blade	1 No. 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 each
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. Welding 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 (gas heater)		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.	Auto Darkening Welding Helmet		5 nos.
C. GENERAL INSTALLATION			
39.	Welding Transformer with all accessories	400A , OCV 60 - 100 V, 60% duty cycle	1 sets
40.	Welding Transformer or Inverter based welding machine with all accessories	300A , OCV 60 - 100 V, 60% duty cycle	1 sets
41.	D.C Arc welding rectifiers set with all accessories	400 A. OCV 60 -100 V, 60% duty cycle	1 sets
42.	GMAW welding machine 400A capacity with air cooled torch, Regulator, Gas preheater, Gas hose and Standard accessories		1 set
43.	AC/DC GTAW welding machine with water cooled torch 300 A, Argon regulator, Gas hose, water circulating system and standard accessories.		1set
44.	Air Plasma cutting equipment with all accessories	capacity to cut 12 mm clear cut	01 set
45.	Air compressor suitable for air plasma cutting system	02 stage compressor, 3-phase 3HP motor, pressure 8-10 bar, capacity 110-120 m^2/hr	01 no.
46.	Fillet weld gauge		8 Nos.
47.	Welding Simulators for SMAW/ GTAW/ GMAW		1 each (Optional)
48.	Pug cutting machine Capable of cutting Straight & Circular with all accessories		1 set
49.	Pedestal grinder fitted with coarse and medium grain size grinding wheels	dia. 300 mm	02 no.
50.	Bench grinder fitted with fine grain size silicon carbide green grinding wheel	dia. 150 mm	01 no.
51.	AG 4 Grinder		4 Nos.
52.	Suitable gas welding table with fire bricks		2 Nos.
53.	Suitable Arc welding table with positioner		6 Nos.
54.	Trolley for cylinder (H.P. Unit)		2 nos.
55.	Hand shearing machine	capacity to cut 6 mm sheets and flats	1 no.
56.	Power saw machine	18'' or 450 mm	1 no.
57.	Portable drilling machine (Cap. 6 mm)		2 no.
58.	Oven, electrode drying	0 to 250°C, 10 kg capacity, depth 450-500 mm	1 no.

59.	Work bench	340x120x75 cm with 4 bench vices of 150 mm jaw opening	5 sets
60.	Oxy Acetylene Gas cutting blow pipe		2 sets
61.	Oxygen, Acetylene Cylinders		2 each*
62.	CO_2 cylinder		2 No *
63.	Argon gas cylinder		2 No *
64.	Anvil 24 sq. inches working area with stand		1 no.
65.	Swage block		1 no.
66.	Fire extinguishers	foam type and CO_2 type	1 no.
67.	Fire buckets with stand		4 nos.
68.	Portable abrasive cut-off machine		1 no.
69.	IIW/ASTM reference radiographic standard for steel fusion welds		1 set
70.	Ultrasonic Flaw detector with accessories		1 set
71.	Rockwell hardness testing machine		1 set
72.	Universal Testing machine		Optional
73.	Suitable gas cutting table		1 No.
74.	Induction/Brazing welding machine with stand. Accessories with water cooling system and tank	250 – 300 amp	1
75.	Plastic welding machine for PE,PP and PVC with stand. accessories	Single phase	1
D. LIST OF CONSUMABLE			
76.	Leather Hand Gloves	14 "	21 pairs.
77.	Cotton hand Gloves	8"	21 pairs.
78.	Leather Apron leather		21 pairs.
79.	S.S Wire brush	5 rows and 3 rows	21 nos. each
80.	Leather hand sleeves	16"	21 pairs.
81.	Safety boots for welders	Sizes 7,8,9,10	21 pairs.
82.	Leg guards leather		21 pairs.
83.	Rubber hose clips	1/2"	21 nos.
84.	Rubber hose oxygen	8 mm dia. X 10 Mts. long as per BIS	2 nos.
85.	Rubber hose acetylene	8 mm dia. X 10 Mts. long as per BIS	2 nos.
86.	Arc welding cables multi cored copper	400/ 600 amp as per BIS	45 mts. each
87.	Arc welding single coloured glasses	108 mm x 82 mm x 3 mm. DIN 11A &12 A	42 nos.
88.	Arc welding plain glass	108 mm x 82 mm x 3 mm.	68 nos.
89.	Bubble face shield with adjustable head band	light dark in color	42 nos.
90.	Bubble face shield with adjustable head band	clear	42 nos.
91.	Spark lighter/cup lighter for welding		6 nos.
92.	AG 4 Grinding wheels		50 nos.
93.	AG 4 cutting wheels		100 nos.

94.	Power hacksaw blade (10 TPI)		05
95.	Earth clamp	600A	6 nos.
96.	Electrode holder	600 amps	6 Nos.
97.	Dye penetrant testing kit		1 set
98.	Magnetic particle testing Kit		1 set

Note: -

1. * Optionally Gas cylinders can also be hired as and when required
2. No additional items are required to be provided for unit or batch working in the Second shift except the items under trainee's tool kit and steel lockers.

ANNEXURE-II

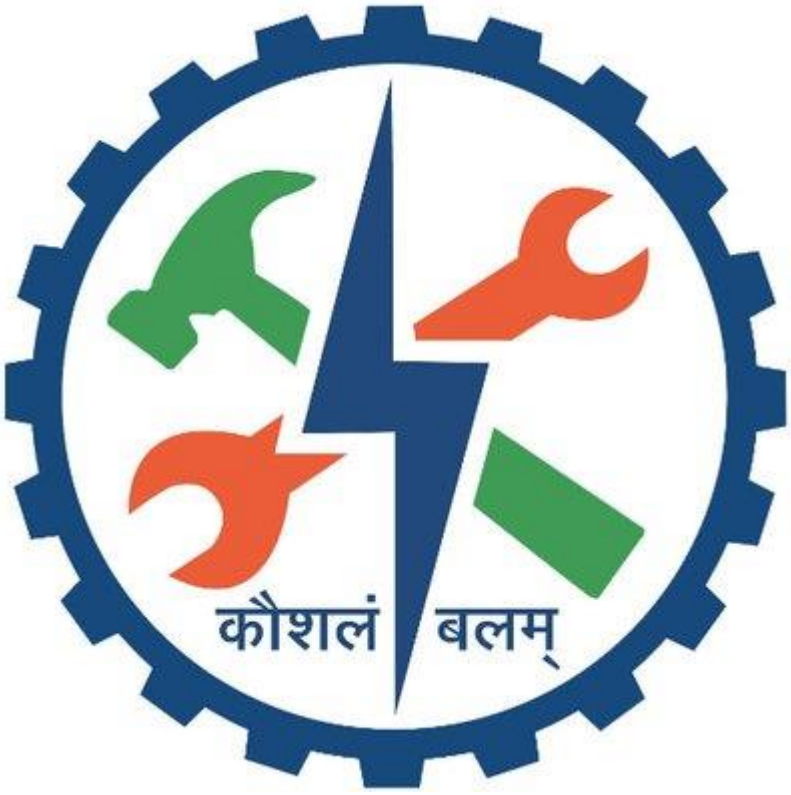
The DGT sincerely acknowledges contributions of the Industries, State Directorates, Trade Experts, Domain Experts, trainers of ITIs, NSTIs, faculties from universities and all others who contributed in revising the curriculum.

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

List of Expert members participated in preparation of course curriculum of Welder (Welding & Inspection) trade			
S No.	**Name & Designation Shri/Mr./Ms.**	**Organization**	**Remarks**
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.	NavneetArora	IIT, Roorkee	Member
9.	R. K. Sharma,Head	SDC, JBM Group, Faridabad	Member
10.	PuneetSinha, Deputy Director	MSME, New Delhi	Member
MENTOR			
11.	DeepankarMallick, DDG (C&P)	DGT HQ	Mentor
MEMBERS OF CORE GROUP			
12.	M Thamizharasan, JDT	CSTARI, Kolkata	Member
13.	M Kumaravel, DDT	FTI , Bangalore	Team Leader
14.	SushilKumar, DDT	DGTHq,	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, Ludhiyana	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 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
OAW	Oxy-Acetylene gas Welding
OAGC	Oxy-Acetylene Gas Cutting
F	Fitting
WT	Wall Thickness.
SMAW	Shielded Metal Arc welding
GTAW	Gas Tungsten Arc Welding
SAW	Submerged Arc Welding
GMAW	Gas Metal Arc Welding
MIG	Metal Inert Gas
PP	Polypropylene
PE	Polyethylene
PVC	Polyvinylchloride


कौशलं बलम्