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

COMPETENCY BASED CURRICULUM

WELDER (GMAW & GTAW)

(Duration: One Year)

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL: 2.5

SECTOR – CAPITAL GOODS AND MANUFACTURING

CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE

Kolkata-700091

WELDER (GMAW & GTAW)

(Engineering Trade)

(Revised in August 2025)

Version: 3.0

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL: 2.5

Developed By

CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE

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

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1. COURSE INFORMATION

During the one-year duration of "Welder (GMAW & GTAW)" trade, a candidate is trained on Professional Skill, Professional Knowledge, Engineering Drawing and Employability Skill related to job roles. In addition to this, a candidate is entrusted to undertake project work, extracurricular activities and on-the-job training to build up confidence. The broad components covered under Professional Skill subject are as below: -

Trainee learns about elementary first aid, firefighting, environment regulation and housekeeping etc. Performs joining of MS sheet by Gas welding in different positions, Joins MS plates by SMAW in different positions, performs straight, bevel & circular cutting on MS plate by Oxy-acetylene cutting process. The trainee leans joining of different types of MS pipe by Gas welding (OAW), SMAW. The Trainee sets up GMAW/ GTAW plant and weld M.S, S.S and Aluminum sheets in all positions, performs Arc gouging on MS plate, joins MS/ Aluminum /SS sheets/plates by GMAW, GTAW& FCAW process in various positions using different modes of metal transfer. Cuts ferrous and non-ferrous metal using plasma Arc cutting. The trainee tests welded joint by visual inspection Dye penetrant & Magnetic particle testing methods.

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. In addition to above components the core skills components viz., employability skills are also covered. These core skills are essential skills which are necessary to perform the job in any given situation.

2. TRAINING SYSTEM

2.1 GENERAL

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

Welder (GMAW & GTAW) trade under CTS is one of the courses delivered nationwide through network of ITIs. The course is of one year duration. It mainly consists of Domain area and Core area. In the Domain area (Trade Theory & Practical) imparts professional skills and knowledge, while 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 Welder and will progress further as Senior Welder, 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
3	Employability Skills	120
Total		**1200**
On the Job Training (OJT)/ Group Project *		150
Optional Courses**		240
Grand Total		**1590**

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

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

2.4 ASSESSMENT & CERTIFICATION

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

a) The **Continuous Assessment (Internal)** during the period of training will be done by **Formative assessment method** by testing for assessment criteria listed against learning outcomes. The training institute have to maintain individual trainee portfolio as detailed in assessment guideline. The marks of internal assessment will be as per the formative assessment template provided on www.cstaricalcutta.gov.in or www.bharatskills.gov.in

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

assessment criteria will be 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 percentage for Trade Practical and Formative assessment are 60% & for all other subjects is 33%.

2.4.2 ASSESSMENT GUIDELINE

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking 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 Occupational Safety, Health and Environment (OSHE) and self-learning attitude are to be considered while assessing competency.

Assessment will be evidence based comprising some of the following:

- Job carried out in labs/workshop
- Record book/ daily diary
- Answer sheet of assessment
- Viva-voce
- Progress chart
- Attendance and punctuality
- Assignment
- Project work
- Computer based multiple choice question examination
- Practical Examination

Evidences and records of internal (Formative) assessments are to be preserved until forthcoming examination for audit and verification by examining body. The following marking pattern to be adopted for formative assessment:

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

3. JOB ROLE

Brief Description of Job Roles:

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

Welder Electric; 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.

Gas Cutter; cuts metal to require shape and size by gas flame either manually or by machine. Examines material to be cut and marks it according to instruction of specification. Makes necessary connections and fits required size of nozzle in 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 (GMAW& GTAW) while doing Gas Tungsten Arc welding (GTAW) also known as Tungsten Inert Gas (TIG) welding reads fabrication drawing, examines parts to be welded, cleans them and sets joints with clamps or any other suitable device. Selects suitable tungsten electrode, grinds the edges and fit in to the GTA 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. Starts the constant current GTA welding machine, sets suitable welding current & polarity and inert gas flow. Establish arc through across a column of highly ionized inert gas between work piece and Tungsten electrode. Melts the metal and deposit weld beads on metal surfaces by passing the suitable filler rod in to the weld puddle. Joins Steel, Stainless steel & Aluminum sheets and Aluminum & SS tubes.

Welder (GMAW & GTAW) while doing Gas Metal Arc welding also known as MIG/MAG Welding, reads fabrication drawing, examines parts to be welded, cleans them and sets joints with clamps or any other suitable device. Connects work piece with earth cable. Connects the machine with suitable gas Cylinder, regulator and flow meter. Connects preheater when CO2 is used as shielding gas. 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 metal pieces such as Steel, Stainless steel and Aluminum metals. Also, will do mixed shielding gas welding. May experience with tubular wire welding called Flux Cored Arc Welding (FCAW)

Plan and organize assigned work and detect & resolve issues during execution in his own work area within defined limit. Demonstrate possible solutions and agree tasks within the team. Communicate with required clarity and understand technical English. Sensitive to environment, self-learning and productivity.

Reference NCO-2015:

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

Reference NOS:

i) CSC/N9539
ii) CSC/N9537
iii) CSC/N9542
iv) CSC/N9540
v) CSC/N9541
vi) CSC/N9547
vii) CSC/N9548
viii) CSC/N9549
ix) CSC/N9543
x) CSC/N9545
xi) CSC/N9401
xii) CSC/N9402

4. GENERAL INFORMATION

Name of the Trade	**Welder (GMAW & GTAW)**
Trade Code	DGT/1061
NCO - 2015	7212.0100, 7212.0200, 7212.0300, 7212.0400
NOS Covered	CSC/N9539, CSC/N9537, CSC/N9542, CSC/N9540, CSC/N9541, CSC/N9547, CSC/N9548, CSC/N9549, CSC/N9543, CSC/N9545, CSC/N9401, CSC/N9402
NSQF Level	Level-2.5
Duration of the Trade	One year
Entry Qualification	Passed 8th class examination
Minimum Age	14 years as on first day of academic session.
Eligibility for PwD	LD, LC, DW, AA, DEAF, HH
Unit Strength (No. Of Student)	20 (There is no separate provision of supernumerary seats)
Space Norms	100 sq. m
Power Norms	16 KW
Instructors Qualification for	
1. Welder (GMAW & GTAW) Trade	B.Voc/Degree in Mechanical / Metallurgy / Production Engineering/ Mechatronics from AICTE/UGC recognized university/ college with **one year of teaching or industry experience** in the welding with GMAW & GTAW field. OR 03 years Diploma in Mechanical/ Metallurgy/ Production Engineering/ Mechatronics from AICTE/ recognized board of technical education with **two years of teaching or industry experience** in the welding with GMAW & GTAW field. OR NTC/ NAC passed in "Welder" Trade with **three years' of teaching or industry experience** in welding with GMAW & GTAW field. **<u>Essential Qualification</u>:** Regular/ RPL variants of National Craft Instructor Certificate (NCIC) in Welder trade under DGT. ***NOTE: Out of two Instructors required for the unit of 2(1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications.***
2. Workshop Calculation & Science	B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with **one-year of teaching or industry experience.** **OR**

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

5. LEARNING OUTCOME

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

5.1 LEARNING OUTCOMES:

Sl. No.	NOS CODE	Learning Outcome	Duration		
			Practical	Theory	Total
1.	CSC/N9539	Perform joining of MS sheet by Gas welding in different positions following safety precautions.	40	5	45
2.	CSC/N9537	Join MS plates by SMAW in different positions and cutting on MS plate by Oxy-acetylene cutting process.	160	35	195
3.	CSC/N9540	Perform different types of MS pipe joints by Gas welding (OAW).	50	10	60
4.	CSC/N9542	Weld different types of MS pipe joints by SMAW.	60	15	75
5.	CSC/N9540	Use the mixed shielding gas for GMAW/GTAW.	110	25	135
6.	CSC/N9540	Setup GMAW / GTAW plant and weld M.S, S.S and Aluminum sheets in all positions.	25	5	30
7.	CSC/N9541	Perform Arc gouging on MS & CI plate.	25	5	30
8.	CSC/N9547	Join MS/ Aluminum /SS sheets/plates by GMAW in various positions using different modes of metal transfer technique.	25	5	30
9.	CSC/N9547	Welding metals by FCAW process.	35	10	45
10.	CSC/N9548	Join Aluminum & Stainless-Steel sheets by GTAW in different position.	170	40	210
11.	CSC/N9549	Weld pipe joints by GTAW.	65	10	75
12.	CSC/N9543	Cut ferrous and non-ferrous metal using plasma Arc cutting.	25	5	30
13.	CSC/N9545	Test welded joint by visual inspection, Dye penetrant & Magnetic particle testing methods.	25	5	30
14.	CSC/N9540	Practice SMAW/GMAW/GTAW process to perform cladding operation on corrosion/ erosion prone materials.	25	5	30
15.	CSC/N9401	Read and apply engineering drawing for different application in the field of work.		30	30
16.	CSC/N9402	Demonstrate basic mathematical concept		30	30

		and principles to perform practical operations. Understand and explain basic science in the field of study.			
Employability Skills				**120**	**120**
Grand Total			**840**	**360**	**1200**

6. ASSESSMENT CRITERIA

LEARNING OUTCOMES	ASSESSMENT CRITERIA
1. Perform joining of MS sheet by Gas welding in different positions following safety precautions. (NOS: CSC/N9539)	• Plan and select the nozzle size, working pressure type of flame, filler rod as per requirement. • Prepare, set and tack the pieces as per drawing. • 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 and cutting on MS plate by Oxy-acetylene cutting process. (NOS: CSC/9537)	• 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 different type of MS pipe joints by Gas welding (OAW). (NOS: CSC/N9540)	• Plan and prepare the development for a specific type of pipe joint. • Mark and cut the MS pipe as per development. • Select the size of filler rod, size of nozzle, working pressure etc. • Set and tack the pieces as per drawing. • Deposit the weld bead maintaining proper technique and safety aspects. • Inspect the welded joint visually for poor penetration, uniformity of bead and surface defects.
4. Weld different types of MS pipe joints by SMAW. (NOS: CSC/N9542)	• Plan and prepare the development for a specific type of pipe joint. • Mark and cut the MS pipe as per development. • Select the electrode size and 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.

5. Use the mixed shielding gas for GMAW/GTAW. (NOS: CSC/N9540)	• 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).
6. Setup GMAW/ GTAW plant and weld M.S, S.S and Aluminum sheets in all positions. (NOS: CSC/N9540)	• Select the welding machine, as per requirement. • Connect the torch/welding gun to the machine. • Connect the earth cable to the welding table. • Set the welding current & Voltage. • Set the wire feed rate. • Set the gas flow rate.
7. Perform Arc gouging on MS & CI plate. (NOS: CSC/9541)	• 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 /Aluminum/SS sheets/plates by GMAW in various positions using different modes of metal transfer technique. (NOS: CSC/N9547)	• 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 Test (DPT)/Magnetic particle Test (MPT).
9. Welding of metals by FCAW process. (NOS: CSC/N9547)	• 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 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).

10. Join Aluminum & Stainless-Steel sheets by GTAW in different position. (NOS: CSC/N9548)	• 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.
11. Weld pipe joints by GTAW. (NOS: CSC/N9549)	• Plan and prepare development or edge preparation for specific type of pipe joint. • Mark and cut the MS pipe as per development. • Select the type of welding current, size and type of tungsten electrode, size of nozzle, gas flow rate and welding current as per requirement. • Set and tack the piece as per drawing. • Deposit the weld bead maintaining proper technique and safety aspects. • Inspect the welded joint visually for root penetration, bead uniformity and surface defects.
12. Cut ferrous and nonferrous metal using plasma Arc cutting. (NOS: CSC/N9543)	• Plan and mark on Ferrous/Nonferrous metal plates surface for plasma cutting. • Select the torch/nozzle size, current and working pressure of gas as per requirement. • Set the marked plate properly on cutting table. • Perform the cutting operation by adapting proper techniques and safety aspects. • Clean and inspect the cut surface for quality of cutting.
13. Test welded joint by visual inspection, Dye penetrant & Magnetic particle testing methods. (NOS: CSC/N9545)	• Plan and select the job and clean the surface thoroughly. • Select the appropriate testing methods. • Perform testing of welded joints adapting standard operating procedure. • Accept/reject the job based on test result.
14. Practice SMAW/GMAW/GTAW process to perform cladding operation on corrosion/ erosion prone materials. (NOS: CSC/N9540)	• Plan for process for cladding. • Practice hard facing of MS plates with SS using - single/multi-layer • Practice cladding of MS plates with SS using - single/multi-layer • Inspect the job and record the process

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 & analyse 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 - WELDER (GMAW & GTAW)			
DURATION: ONE YEAR			
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
Professional Skill 40 Hrs.; Professional Knowledge 05 Hrs.	1. Perform joining of 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. Introduction to safety equipment and their use etc. 4. Hack sawing, filing square to dimensions. Marking out on MS plate and punching. 5. Setting up of SMAW/ MMAW equipment & accessories and striking an arc.	• 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 Equipment, tools and accessories. • Various Welding Processes and its applications. • Arc and Gas Welding terms and definitions.
Professional Skill 160 Hrs.; Professional Knowledge 35 Hrs.	2. Join MS plates by SMAW in different positions and cutting on MS plate by Oxy-acetylene cutting process.	6. Straight line beads on M.S. plate 8/10 mm thick in flat position. 7. Weaved bead on M. S plate 8/10 mm thick in flat position. 8. Square butt joint on M.S. sheet 2 mm thick in flat Position. 9. Fillet "T" joint on M. S. Plate 8/10 mm thick in flat position. 10. Beveling of MS plates 8/10 mm thick by gas cutting. 11. Open corner joint on MS sheet 2 mm thick in flat Position. 12. Fillet lap joint on M.S. plate 8/10 mm thick in flat position.	• Basic electricity applicable to SMAW and related electrical terms & definitions. • Heat and temperature and its terms related to welding • Principle of arc welding. And characteristics of arc. • Calcium carbide uses and hazards. • Types of oxy-acetylene flames and uses. • Oxy-Acetylene Cutting Equipment principle, parameters and application. • Arc welding power sources: Transformer, Rectifier and Inverter

		13. Chair fabrication without hand rest, with square pipe of 25mm width 1 mm WT (GMAW/GTAW machine) 14. Fillet "T" joint on MS sheet 2 mm thick in flat position. 15. Open Corner joint on MS plate 8/10 mm thick in flat position. 16. Fillet Lap joint on MS sheet 2 mm thick in flat position. 17. Single "V" Butt joint on MS plate 10/12 mm thick in flat position (1G). 18. Square Butt joint on M.S. sheet. 2 mm thick in Horizontal position. 19. Straight line beads and multi-layer practice on M.S. Plate 8/10 mm thick in Horizontal position. 20. Fillet "T" 8/10 mm thick in Horizontal position. 21. Small stool fabrication with 25mm square pipe of Width 1 mm & dimension 300mm x225 mm x225mm (GMAW/GTAW process). 22. Fillet "T" joint on M.S sheet 2 mm thick in vertical position. 23. Fillet "T" 8/10 mm thick in vertical position.	type welding machines and its care & maintenance. • Advantages and disadvantages of A.C. and D.C. welding machines. • Welding positions as per EN, ISO & ASME: flat, horizontal, vertical and overhead position. • Weld slope and rotation. • Welding symbols as per ISO & AWS. • Arc length - types - effects of arc length. • Polarity: Types and applications. • Acetylene gas properties. • Acetylene gas Flash back arrestor • Arc blow - causes and methods of controlling. • Distortion in arc welding and methods employed to minimize distortion • Arc Welding defects, causes and Remedies.
Professional Skill 50 Hrs.; Professional Knowledge 10 Hrs.	3. Perform different types of MS pipe joints by Gas welding (OAW).	24. Structural pipe welding butt joint on MS pipe Ø 50 and 3mm WT in 1G position. 25. Fillet Lap joint on M.S. Plate 8/10 mm in vertical position. 26. Open Corner joint on MS	• Specification of pipes, various types of pipe joints, pipe welding positions, and procedure. • Difference between pipe welding and plate welding.

		plate 8/10 mm thick in vertical position. 27. Pipe welding - Elbow joint on MS pipe Ø 50 and 3mm WT. 28. Pipe welding "T" joint on MS pipe Ø 50 and 3mm WT. 29. Single "V" Butt joint on M S plate 10/12 mm thick in vertical position (3G).	• Pipe development for Elbow joint, "T" joint, Y joint and branch joint • Uses of Manifold system
Professional Skill 60 Hrs.; Professional Knowledge 15 Hrs.	4. Weld different types of MS pipe joints by SMAW.	30. Pipe welding 45 ° angle joint on MS pipe Ø 50 and 3mm WT. 31. Straight line beads on M.S. plate 8/10mm thick in overhead position. 32. Pipe Flange joint on M.S plate with MS pipe Ø 50 mm X 3mm WT. 33. Fillet "T" 8/10 mm thick in overhead position. 34. Pipe welding butt joint on MS pipe Ø 50- and 5-mm WT. in 1G position. 35. Fillet Lap joint on M.S. plate 8/10 mm thick in overhead position. 36. Single "V" Butt joint on MS plate 8/10mm thick in overhead position (4G). 37. Pipe butt joint on M. S. pipe Ø 50 mm WT 6mm (1G Rolled).	• Electrode: types, functions of flux, coating factor, sizes of electrode. • Effects of moisture pick up. • Storage and baking of electrodes. • Weldability of metals, importance of pre heating, post heating and maintenance of inter-pass temperature. • Welding of low, medium and high carbon steel and alloy steels. • Effects of alloying elements on steel • Stainless steel: types-weld decay and weldability.
Professional Skill 110 Hrs.; Professional Knowledge 25 Hrs.	5. Use the mixed shielding gas for GMAW/GTAW.	38. Familiarization with the machinery used in the trade. 39. Introduction to safety equipment and their use etc. 40. Setting up of GMAW welding machine & accessories. 41. Straight line beads on MS plate by GMAW welding.	• Different modes of metal transfer in GMAW. • Outline of the subjects to be covered. • Safety precautions pertaining to GTAW & GMAW. • Introduction to GMAW – equipment – accessories. • Various names of the process. (MIG-MAG/ CO2 WELDING, FCAW).

		42. Lap joint on MS plate by GMAW welding in down hand position. 43. Open corner joint on MS plate in down hand position. 44. "T" joint on MS sheet in flat position. 45. "T" joint on MS sheet in horizontal position. 46. "T" joint on MS sheet in vertical position. 47. "T" joint on MS sheet in overhead position. 48. Single "V' butt joint by CO_2 welding in down hand position. 49. Single "V' butt joint by Argo shield welding in flat position (Gas: Argon and CO_2 mixture).	• Advantages & Limitations. • Power source & accessories Wire Feed unit. • Effect of heat input and other process parameters on welded joint. • Trouble shooting in MIG welding. • shielding gases and their mixture used in GMAW process • Welding Gun & its parts. • Modes of metal transfer in GMAW –(Dip, Globular, spray & pulsed transfer). • Flux cored arc welding. • Welding wire types and specification.
Professional Skill 25 Hrs.; Professional Knowledge 05 Hrs.	6. Setup GMAW / GTAW plant and weld M.S., S.S. and Aluminum sheets in all recognized positions.	50. Square Butt joint on S.S. sheet 2 mm thick in flat position. 51. Square Butt joint on S.S. Sheet 2 mm thick in flat position. 52. Square Butt joint on aluminum sheet 2 mm thick in flat position.	• Aluminum - types - properties and welding methods. • SS - types - properties and welding methods.
Professional Skill 25 Hrs.; Professional Knowledge 05 Hrs.	7. Perform Arc gouging on MS & CI plate.	53. Square Butt & Lap joint on M.S. sheet 2 mm thick. 54. Single "V" butt joint C.I. plate 6mm thick in flat position by SMAW. 55. Perform arc gouging on MS plate 8/10 mm thick.	• Arc cutting & gouging,
Professional Skill 25 Hrs.; Professional Knowledge 05 Hrs.	8. Join MS/ Aluminum /SS sheets/plates by GMAW in various positions using different modes of metal transfer technique.	56. Square Butt joint on Aluminum sheet. 3 mm thick in flat position. 57. cast iron welding (Single "V" butt joint) 6mm thick plate. 58. Straight line beads on Aluminum plate by GMAW welding.	• Cast iron and its properties types. • Welding methods of cast iron. • Types of welds defects, causes and remedy in GMAW process. • Knowledge of pulsed

		59. Single "V' and fillet joint on Aluminum plate. 60. Performing weld joints using pulsed MIG welding (GMAW-P).	MIG welding.
Professional Skill 35 Hrs.; Professional Knowledge 10 Hrs.	9. Welding of metals by FCAW process.	61. Straight line beads on MS plate by Flux cored Arc welding (FCAW). 62. Single "V' joint by Flux cored Arc welding. 63. Straight line beads on MS plate by FCAW. 64. Lap & Square butt and T joint on MS sheet.	• Trouble shooting in FCAW. • Data and Tables related to FCAW using CO2 as shielding gas. • Reading of Welding procedure specifications (WPS). • Reading of Procedure Qualification Record (PQR)
Professional Skill 170 Hrs.; Professional Knowledge 40 Hrs.	10. Join Aluminum & Stainless-Steel sheets by GTAW in different position.	65. Setting up GTAW welding plant and establishing the arc. 66. Beading practice on MS sheet by GTAW. 67. Square butt joint on MS in down hand position. 68. Open corner joint on MS sheet in down hand position. 69. Lap joint on MS sheet in down hand position. 70. Tee joint on MS sheet in down hand position. 71. Lap joint on MS sheet in Horizontal position. 72. Square butt joint on MS sheet in Horizontal position. 73. Square butt joint on MS sheet in Vertical position. 74. Lap & Tee joint on MS sheet in Vertical position. 75. Square butt joint on MS sheet in overhead position. 76. Beading practice on SS sheet. 77. Square butt joint on SS sheet by TIG in flat	• Introduction to GTAW. • Equipment& accessories. • Advantages & Limitations. • Power source - Types, polarity and application • Tungsten electrode, Types, sizes, and uses. • shielding gases and their mixture used in GTAW process • Welding- consumables in GTAW. • Types & Specifications as per ISO & AWS • Tables & data relating to TIG welding. • Different type of weld joints- plates & pipes. • Edge preparation of plates & pipes. • Fitting of joint plates for TIG Welding. • Advantages of root pass welding of pipes by TIG welding • Types of welds defects, causes and remedy in GTAW process. • Mechanism of increasing penetration by using

		position. 78. Open corner joint on SS sheet by TIG in flat position. 79. Square butt joint on SS sheet in Vertical position. 80. Lap joint on SS sheet in vertical position. 81. Tee joint on SS sheet in Vertical position. 82. Square butt joint welding of SS sheet with back purging Technique. 83. A-TIG (Activated flux TIG welding) 84. Performing weld joints using pulsed TIG (P-TIG).	Activated flux coating on the faying surface. • Knowledge of pulsed TIG welding.
Professional Skill 65 Hrs.; Professional Knowledge 10 Hrs.	11. Weld pipe joints by GTAW.	85. Beading practice on Aluminum sheet by GTAW. 86. Square butt joint on Aluminum sheet by GTAW in flat position. Open corner joint on Aluminum sheet in flat position. 87. Square butt joint on Aluminum sheet in Vertical position. Single V butt joint on Aluminum sheet by TIG. 88. Square butt joint on Tube welding practice on M.S. & S.S tube/conduit metals in rolled position. Square butt joint on Tube welding practice on Aluminum in rolled position.	• Purging: Importance, Method. • Weldability of metals. • Preheating and Post heating • Distortion and methods of control.
Professional Skill 25 Hrs.; Professional Knowledge 05 Hrs.	12. Cut ferrous and nonferrous metal using plasma Arc cutting.	89. Plasma cutting of SS sheets & Aluminum plates. Dimensional inspection of weldments. 90. Weld test specimen preparation.	• Plasma welding principles, Equipment, power source, parameter settings, Advantages & limitations • Plasma cutting principles and advantages.

		91. Visual inspection of weldments.	
Professional Skill 25 Hrs.; Professional Knowledge 05 Hrs.	13. Test welded joint by visual inspection, Dye penetrant & Magnetic particle testing methods.	92. Visual inspection. 93. Dye penetrant test. 94. Magnetic particle testing. 95. Ultrasonic testing.	• Inspection & testing of weldments • Visual inspection methods • Inspection kits - universal gauge, Fillet gauge, etc. • Non-destructive Testing methods, PT, MPT, UT & RT • Destructive testing - Bend test & tensile test.
Professional Skill 25 Hrs.; Professional Knowledge 05 Hrs.	14. Practice SMAW/ GMAW/ GTAW process to perform cladding operation on corrosion/ erosion prone materials.	96. Hard facing/ cladding of MS plates with SS using GMAW- Single layer cladding 97. Hard facing/ cladding of MS plates with SS using GMAW- Multi-layer cladding	• Difference between cladding and hard facing • Setting different welding process parameters to obtain good bonding of cladding material with the substrate.
Engineering Drawing			
Professional Knowledge ED- 30 Hrs.	15. Read and apply engineering drawing for different application in the field of work.	- 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			
Professional Knowledge	16. Demonstrate basic mathematical concept and	- Unit, Fractions - Square root, Ratio and Proportions, Percentage - Material Science	

WC – 30 Hrs.	principles to 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 Employability Skills is provided separately in www.cstaricalcutta.gov.in / www.bharatskills.gov.in / www.dgt.gov.in.

ANNEXURE-I

LIST OF TOOLS AND EQUIPMENT			
WELDER (GMAW & GTAW) (For Batch of 20 Candidates)			
Sl. No.	**Name of the Tool &Equipment**	**Specification**	**Quantity**
A. TRAINEES TOOLS KIT			
1.	Welding helmet fibre		20+1 Nos.
2.	Welding hand shield fibre		20+1 Nos.
3.	Chipping Hammer with metal handle	250 grams	20+1 Nos.
4.	Chisel cold flat	19 mmx 150 mm	20+1 Nos.
5.	Centre punch	9mm x 127 mm	20+1 Nos.
6.	Dividers	200 mm	20+1 Nos.
7.	Stainless steel Rule	300 mm	20+1 Nos.
8.	Scriber	150 mm	20+1 Nos.
9.	Tongs flat	350 mm	20+1 Nos.
10.	Hacksaw frame fixed	300mm	20+1 Nos.
11.	File half round bastard	300 mm	20+1 Nos.
12.	File flat	350 mm bastard	20+1 Nos.
13.	Hammer ball peen	1 Kg with handle	20+1 Nos.
14.	Try square	6''	20+1 Nos.
15.	Tip Cleaner		20+1 Nos.
16.	Vernier caliper	Digital upto 300 mm	2 nos.
17.	Micrometer	Digital upto 0-25 mm	2 nos.
18.	Thermal gun/ temperature measuring gun		2 nos.
B. GENERAL MACHINERY SHOP OUTFIT			
19.	Wire cutter	For MIG welding	6 nos.
20.	Spindle key	For welding plant	8 Nos. (2 for each type of gas)
21.	Screw Driver	300mm blade and 250 mm blade	1 each
22.	Number punch	6 mm	2 set
23.	Letter punch	6 mm	2 set
24.	Magnifying glass	100 mm. dia.	2 Nos.
25.	Universal/ Cambridge Weld measuring gauge		2 Nos.
26.	Spanner D.E.	6 mm to 32mm	2 sets
27.	C-Clamps	10 cm and 15 cm	2 each
28.	Hammer sledge double faced 4 kg		2 No.
29.	S.S tape 5 meters flexible in case		5 No.
30.	H.P. Welding torch	with 5 nozzles	2 sets
31.	Oxygen Gas Pressure regulator double stage		2 Nos.

32.	Acetylene Gas Pressure regulator double stage		2 Nos.
33.	Pre-heater	For GMAW	2 Nos.
34.	CO_2 Gas pressure regulator, with flow meter		2 set
35.	Argon Gas pressure regulator with flow meter		2 set
36.	Metal rack	182 cm x 152 cm x 45 cm	1 No.
37.	First Aid box		1 No.
38.	Steel lockers with 8 Pigeon holes		2 Nos.
39.	Steel almirah / cupboard		4 Nos.
40.	Black board and easel with stand		1 No.
41.	Flash back arrester (torch mounted)		4 pairs
42.	Flash back arrester (cylinder mounted)		4 pairs
C. GENERAL INSTALLATION			
43.	AC Welding Transformer with all accessories	400A, OCV 60 - 100 V, 60% duty cycle	2 sets
44.	Welding Transformer or Inverter based welding machine with all accessories	300A, OCV 60 - 100 V, 60% duty cycle	2 sets
45.	D.C Arc welding rectifiers set with all accessories	400 A. OCV 60 -100 V, 60% duty cycle	1 set
46.	GMAW welding machine 400A capacity with air cooled torch, Regulator, Gas preheater, Gas hose and Standard accessories		2 set
47.	AC/DC GTAW welding machine with water cooled torch, Argon regulator, Gas hose, water circulating system and standard accessories.	torch 300 A	2 set
48.	Air Plasma cutting equipment with all accessories, capacity to cut 25 mm clear cut		1 set
49.	Air compressor suitable for air plasma cutting system		1 No.
50.	Auto Darkening Welding Helmet		5 nos.
51.	Portable abrasive cut-off machine		1 No.
52.	Pug cutting machine Capable of cutting Straight & Circular with all accessories		1 set
53.	Pedestal grinder fitted with coarse and medium grain size grinding wheels	dia. 300 mm	2 No.
54.	Bench grinder fitted with fine grain size silicon carbide green grinding wheel	dia. 150 mm	2 nos.
55.	AG 4 Grinder		4 Nos.
56.	Suitable gas welding table with fire bricks		2 Nos.
57.	Suitable Arc welding table with positioner		9 Nos.
58.	Trolley for cylinder (H.P. Unit)		2 Nos.
59.	Hand shearing machine capacity to cut 6		1 No.

	mm sheets and flats		
60.	Power saw machine	18''	1 No.
61.	Portable drilling machine	Cap. 6 mm	2 No.
62.	Oven, electrode drying min. depth 450-500mm	0 to 250°C, 10 kg capacity	1 No.
63.	Work bench	340x120x75 cm with 4 bench vices of 150 mm jaw opening	5 sets
64.	Oxy Acetylene Gas cutting blow pipe		2 sets
65.	Oxygen, Acetylene Cylinders		#2 each
66.	CO_2 cylinder 30kg to 45 kg capacity		#2 Nos.
67.	Argon gas cylinder	7 m^3 or 10 m^3	#2 Nos.
68.	Anvil	24 sq. inches working area with stand	1 No.
69.	Swage block	16x16x16 inch	1 No.
70.	Magnetic particle testing Kit		1 set
71.	Fire extinguishers (foam type and CO2 type)		1 No.
72.	Fire buckets with stand		4 nos.
73.	Suitable gas cutting table		1 No.
74.	Simulators for MR (Mixed reality)/ VR (Virtual reality)	SMAW/ GTAW/GMAW	02 sets
75.	Modern Welding Booth with welding positioner	With fume extractor and manipulator	04 nos.
76.	Master Welding Booth with welding positioner	With fume extractor and manipulator	01 no.
77.	Ultrasonic testing machine with accessories and different probs	Standard	01 sets
D. LIST OF CONSUMABLES			
78.	Leather Hand Gloves	14 "	21 Pairs
79.	Masking tape	2.5”	5 nos.
80.	Cotton hand gloves	8 "	21 pairs
81.	Leather hand sleeves	16 "	21 pairs
82.	Leg guards leather		21 pairs
83.	Leather Apron		21 Nos.
84.	Gas welding Goggles with filter glass	3A or 4A DIN	21 Nos.
85.	Wire brush (M.S & SS) 5 rows and 3 rows		21 Nos. each
86.	Spark lighter /cup lighter for welding purpose only		6 Nos.
87.	Safety boots for welders	Size 7,8,9,10	21 pairs
88.	Bubble face shield clear with rubber band		21 Nos.
89.	AG 4 Grinding wheels		50 nos.
90.	Welding rubber hose, oxygen and acetylene 8 mm dia. As per BIS		30 mtr each
91.	Rubber hose clips ½ inch		20 nos.
92.	Arc welding filter glasses DIN 9A 11 A &	108 mm x 82 mm x 3 mm	20 each

	13 A		
93.	Plain glasses for helmets	108 mm x 82 mm x 3 mm	40nos
94.	AG 4 cutting wheels		100 nos.
95.	Electrode holder	600 amps	6 Nos.
96.	Earth clamp	600A	6 Nos.
97.	Die penetrant testing kit		1 set
98.	Hexa Blade		6 Nos
D. CLASS ROOM FURNITURE FOR TRADE THEORY			
99.	Instructor's table and Chair (Steel)		1 set
100.	Students chairs with writing pads		20 Nos.
101.	White board	1200mm X 900 mm	1 No.
102.	Instructor's laptop with latest configuration pre-loaded with operating system and MS Office package.		1No.
103.	Desktop with latest configuration		1No.
104.	LCD projector with screen/ interactive board		1 No.
105.	Process, Inspection & codes DVD/ CDs.		1 set each (optional)

Note:

1. Internet facility is desired to be provided in the class room.
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 Contributors

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

ANNEXURE-III

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


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