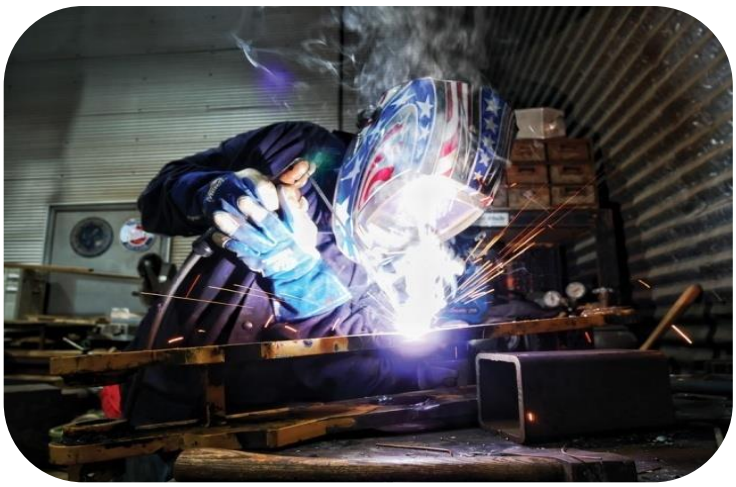
WELDER

NSQF LEVEL – 5



SECTOR- CAPITAL GOODS & MANUFACTURING

COMPETENCY BASED CURRICULUM

CRAFT INSTRUCTOR TRAINING SCHEME (CITS)

GOVERNMENT OF INDIA
Ministry of Skill Development & Entrepreneurship
Directorate General of Training
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
EN-81, Sector-V, Salt Lake City, Kolkata – 700091

WELDER

(Engineering Trade)

Also applicable for “Welder (GMAW & GTAW)”, “Welder (Pipe)”, “Welder (Structural)”, “Welder (Fabrication & Fitting)” and “Welder (Welding & Inspection)” Trades

SECTOR –CAPITAL GOODS & MANUFACTURING

(Revised in 2023)

Version 2.0

CRAFT INSTRUCTOR TRAINING SCHEME (CITS)

NSQF LEVEL – 5

Developed By

Government of India
Ministry of Skill Development and Entrepreneurship

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1. COURSE OVERVIEW

The Craft Instructor Training Scheme is operational since inception of the Craftsmen Training Scheme. The first Craft Instructor Training Institute was established in 1948. Subsequently, 6 more institutes namely, Central Training Institute for Instructors (now called as National Skill Training Institute (NSTI)), NSTI at Ludhiana, Kanpur, Howrah, Mumbai, Chennai and Hyderabad were established in 1960 by DGT. Since then the CITS course is successfully running in all the NSTIs across India as well as in DGT affiliated institutes viz. Institutes for Training of Trainers (IToT). This is a competency based course for instructors of one year duration. “Welder” CITS trade is applicable for Instructors of “Welder”, “Welder (GMAW & GTAW)”, “Welder (Pipe)”, “Welder (Structural)”, “Welder (Fabrication & Fitting)” and “Welder (Welding & Inspection)” Trades under CTS.

The main objective of Craft Instructor training programme is to enable Instructors explore different aspects of the techniques in pedagogy and transferring of hands-on skills so as to develop a pool of skilled manpower for industries, also leading to their career growth & benefiting society at large. Thus promoting a holistic learning experience where trainee acquires specialized knowledge, skills & develops attitude towards learning & contributing in vocational training ecosystem.

This course also enables the instructors to develop instructional skills for mentoring the trainees, engaging all trainees in learning process and managing effective utilization of resources. It emphasizes on the importance of collaborative learning & innovative ways of doing things. All trainees will be able to understand and interpret the course content in right perspective, so that they are engaged in & empowered by their learning experiences and above all, ensure quality delivery.

2. TRAINING SYSTEM

2.1 GENERAL

CITS courses are delivered in National Skill Training Institutes (NSTIs) & DGT affiliated institutes viz., Institutes for Training of Trainers (IToT). For detailed guidelines regarding admission on CITS, instructions issued by DGT from time to time are to be observed. Further complete admission details are made available on NIMI web portal http://www.nimionlineadmission.in. The course is of one-year duration. It consists of Trade Technology (Professional skills and Professional knowledge), Training Methodology and Engineering Technology/ Soft skills. After successful completion of the training programme, the trainees appear in All India Trade Test for Craft Instructor. The successful trainee is awarded NCIC certificate by DGT.

2.2 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.	**Trade Technology**	
	Professional Skill (Trade Practical)	480
	Professional Knowledge (Trade Theory)	270
2.	**Training Methodology**	
	TM Practical	270
	TM Theory	180
	Total	**1200**

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

3	On the Job Training (OJT)/ Group Project	150
4	Optional Course	240

Trainees can also opt for optional courses of 240 hours duration.

2.3 PROGRESSION PATHWAYS

- Can join as an Instructor in a vocational training Institute/ technical Institute.
- Can join as a supervisor in Industries.

2.4 ASSESSMENT & CERTIFICATION

The CITS trainee will be assessed for his/her Instructional skills, knowledge and attitude towards learning throughout the course span and also at the end of the training program.

a) The Continuous Assessment(Internal) during the period of training will be done by **Formative Assessment Method** to test competency of instructor with respect to assessment criteria set against each learning outcomes. The training institute has to maintain an individual trainee portfolio in line with assessment guidelines. 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 Method**. The All India Trade Test for awarding National Craft Instructor Certificate will be conducted by DGT at the end of the year as per the guidelines of DGT. The learning outcome and assessment criteria will be the basis for setting question papers for final assessment**.** The external 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 CRITERIA

Allotment of Marks among the subjects for Examination:
The minimum pass percent for Trade Practical, TM practical Examinations and Formative assessment is 60% & for all other subjects is 40%.There will be no Grace marks.

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. While assessing, the major factors to be considered are approaches to generate solutions to specific problems by involving standard/non-standard practices.

Due consideration should also 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 of the following:

- Demonstration of Instructional Skills (Lesson Plan, Demonstration Plan)
- Record book/daily diary
- Assessment Sheet
- Progress chart
- Video Recording
- Attendance and punctuality
- Viva-voce
- Practical work done/Models

- Assignments
- Project work

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

Performance Level	Evidence
(a) Weightage in the range of 60%-75% to be allotted during assessment	
For performance in this grade, the candidate should be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of an ***acceptable standard*** of crafts instructorship with ***occasional*** **guidance** and engage students by demonstrating good attributes of a trainer.	• Demonstration of ***fairly good*** skill to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field. • Average engagement of students for learning and achievement of goals while undertaking the training on specific topic. • A fairly good level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson. • Occasional support in imparting effective training.
(b) Weightage in the range of 75%-90% to be allotted during assessment	
For performance in this grade, the candidate should be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of a ***reasonable standard*** of crafts instructorship with ***little*** **guidance** and engage students by demonstrating good attributes of a trainer.	• Demonstration of ***good*** skill to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field. • Above average in engagement of students for learning and achievement of goals while undertaking the training on specific topic. • Agood level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson. • Little support in imparting effective training.
(c) Weightage in the range of more than 90% to be allotted during assessment	
For performance in this grade, the candidate should be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of a ***high standard*** of crafts instructorship with	• Demonstration of ***high*** skill level to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field. • Good engagement of students for learning and achievement of goals while undertaking

minimal or no support and engage students by demonstrating good attributes of a trainer.	the training on specific topic. • Ahigh level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson. • Minimal or no support in imparting effective training.

3. GENERAL INFORMATION

Name of the Trade	**WELDER - CITS**
Trade Code	**DGT/ 4005**
Reference NCO 2015	2356.0100, 7212.0100, 7212.0200, 7212.0700, 7212.0400, 7212.0500, 7212.0105, 7212.0303, 7212.0111, 7212.0402.
Reference NOS	CSC/N9537, CSC/N9538, CSC/N9539, CSC/N9540, CSC/N9541, CSC/N9410, CSC/N9542, CSC/N9546, CSC/N9547, CSC/N9540, CSC/N9548, CSC/N9549, CSC/N9543, CSC/N9544, CSC/N9545, ASC/N9410, ASC/N9411
NSQF Level	Level- 5
Duration of Craft Instructor Training	One Year
Unit Strength (No. Of Student)	25
Entry Qualification	Degree in Mechanical/ Production/ Metallurgy / Mechatronics Engineering from AICTE/ UGC recognized Engineering College/ University OR 03 years Diploma in Mechanical/ Production/ Metallurgy/ Mechatronics Engineering after class 10th from recognized Board / University. OR Ex-serviceman from Indian Armed forces with 15 years of service in related field as per equivalency through DGR. OR 10th class with 1-year NTC passed in the trade of Welder or related trades + 2 years related experience
Minimum Age	18 years as on first day of academic session.
Space Norms	120 Sq. m
Power Norms	20 KW
Instructors Qualification for	
1. Welder - CITS Trade	B.Voc./Degree in Mechanical / Production Engineering from AICTE/UGC recognized Board / University with two years experience in relevant field. OR 03 years Diploma in Mechanical / Production/ Metallurgy/ Mechatronics Engineering from AICTE/ recognized Board/ University or relevant Advanced Diploma (Vocational) from DGT with Five years experience respectively. OR Ex-serviceman from Indian Armed forces with 15 years of service in related field as per equivalency through DGR. Candidate should have undergone methods of Instruction of course or minimum 2 yrs. of experience in technical training institute of Indian Armed Forces. OR NTC/ NAC in relevant trade with seven years experience. **<u>Essential Qualification:</u>** National Craft Instructor Certificate (NCIC) in welder trade, in any of the

	variants under DGT.
2. Workshop Calculation & Science	B.Voc/Degree in any Engineering from AICTE/ UGC recognized Engineering College/ university with two years experience in relevant field. **OR** 3 years Diploma in Engineering from AICTE /recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with five years experience in relevant field. **OR** NTC/ NAC in any Engineering trade with seven years experience in relevant field. **Essential Qualification:** National Craft Instructor Certificate (NCIC) in relevant trade. **OR** 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 two years experience in relevant field. OR 03 years Diploma in Engineering from AICTE /recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with five years' experience in the relevant field. OR NTC/ NAC in any one of the 'Mechanical group (Gr.-I) trades categorized under Engg. Drawing'/ D'man Mechanical / D'man Civil' with seven years experience. **Essential Qualification:** National Craft Instructor Certificate (NCIC) in relevant trade. **OR** NCIC in RoDA / D'man (Mech. /civil) or any of its variants under DGT.
4. Training Methodology	B.Voc./Degree in any discipline from AICTE/ UGC recognized College/ university with two years experience in training/ teaching field. OR Diploma in any discipline from recognized board / University with five years experience in training/teaching field. OR NTC/ NAC passed in any trade with seven years experience in training/ teaching field. **Essential Qualification:** National Craft Instructor Certificate (NCIC) in any of the variants under DGT / B.Ed /ToT from NITTTR or equivalent.
5. Minimum Age for Instructor	21 years

4. JOB ROLE

Brief description of job roles:

Manual Training Teacher/Craft Instructor; instructs students in ITIs/Vocational Training Institutes in respective trades as per defined job role. Imparts theoretical instructions for the use of tools &equipments of related trades and related subjects. Demonstrate process and operations related to the trade in the workshop; supervises, assesses and evaluates students in their practical work. Ensures availability & proper functioning of equipment and tools in stores.

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

several points simultaneously. Important variations include types of joints welded (seam, spot, butt) and types of materials welded (aluminium, steel).

Welder while doing gas cutting; cuts metal to require shape and size by gas flame either manually or by machine. Examines material to be cut and marks it according to instruction of specification. Makes necessary connections and fits required size of nozzle in 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 while doing gas brazing; joints metal parts by heating using flux and filler rods. Cleans and fastens parts to be joined face to face by wire brush. Apply flux on the joint and heats by torch to melt filler rods into joint. Allows it to cool down. Clean and examines the joint.

Welder while doing Gas Tungsten Arc welding 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 metal pieces such as Steel, Stainless steel and Aluminiun metals.

Welder 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 pre-heater 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, and Stainless steel metals.

Repair Welder, is responsible for maintaining and operating all welding related works. The individual must be able to use hand welding techniques or welding equipment and tools to join various metal components and also carry out repair work on machinery and equipment.

Iron and Steel Plasma Cutter-Manual cuts different materials (mild carbon steel, stainless steel, aluminium, high tensile and special steels, and other materials) in various profiles. This

involves setting-up and preparing operations interpreting the right information from the specification documents, obtaining the right consumables and other materials, etc.

Welder while doing Arc welding, 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.

Reference NCO-2015:

a) 2356.0100 - Manual Training Teacher/Craft Instructor
b) 7212.0100- Welder, Gas
c) 7212.0200- Welder, Electric
d) 7212.0700- Welder, Resistance
e) 7212.0400- Gas Cutter
f) 7212.0500-Brazer
g) 7212.0105- Tungsten Inert Gas Welder
h) 7212.0303 - Gas Metal Arc Welder/Metal Inert Gas/Metal Active Gas/Gas Metal Arc Welder (MIG/MAG/GMAW)
i) 7212.0111- Repair Welder
j) 7212.0402- Iron and Steel Plasma Cutter-Manual

Reference NOS:

a. CSC/N9537
b. CSC/N9538
c. CSC/N9539
d. CSC/N9540
e. CSC/N9541
f. CSC/N9410
g. CSC/N9542
h. CSC/N9546
i. CSC/N9547
j. CSC/N9540
k. CSC/N9548
l. CSC/N9549
m. CSC/N9543
n. CSC/N9544
o. CSC/N9545
p. ASC/N9410
q. ASC/N9411

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 TRADE TECHNOLOGY

1. Recognize & comply safe working practices, environment regulation and housekeeping. (NOS: CSC/N9511)
2. Monitor the oxy- acetylene cutting plant and perform different cutting operations on MS plate. [Different cutting operation – Straight, Bevel, circular]. (NOS: CSC/N9537)
3. Demonstrate the SMAW machine and perform different type of joints on M.S. And S.S. in different position observing standard procedure. [different types of joints- Fillet (Lap, T-joint, & Corner), Butt (Square butt & Single "V" butt); different position - 1F, 2F, 3F,4F, 1G, 2G, 3G, 4G]. (NOS: CSC/N9538)
4. Monitor the gas welding plant and evaluate the joints in different metals (M.S., Aluminium, Copper, Brass, Stainless Steel sheet) and in different position. [Different position: - 1F, 2F, 3F, 1G, 2G, 3G.] by OAW. (NOS: CSC/N9539)
5. Evaluate welding in different types of pipe joints [Butt Joint, Elbow, T- joint, angle (450) joint, flange joint] in 1G / DHP by OAW. (NOS: CSC/N9540)
6. Demonstrate arc gouging operation to rectify the weld joints by SMAW and monitor hard facing of alloy steel components / MS rod by using hard facing electrode. (NOS: CSC/N9541)
7. Analyze& perform brazing and Silver Brazing in different Joint (Square Butt Joint, Lap Joint, "T" joint, joint) on M.S. sheet and bell mouth joint on Tube (Brass & Copper) by OAW.(NOS: CSC/N9410)
8. Assess welding in butt joint on MS pipe in different position (1G, 2G, 5G & 6G) by SMAW using Liquid Penetrant Test during Root Pass & Cover Pass. (NOS: CSC/N9542)
9. Demonstrate fusion Welding & Bronze Welding in Single "V" Butt joint on Cast Iron (6 mm thick) in 1G/ DHP by choosing appropriate welding process (OAW & SMAW). (NOS: CSC/N9546)
10. Demonstrate GMAW / FCAW machine and analyze welding in different types of joints [Fillet Joints (T-joint, lap, Corner), Butt Joints (Square & Single V)] on different type of metals (M.S., S.S. sheet/plate by GMAW / FCAW in various positions [various positions- 1F, 2F, 3F,4F, 1G, 2G, 3G]. (NOS: CSC/N9547)
11. Monitor welding in T-joint, on M.S. Pipe in 1G / DHP by GMAW.(NOS: CSC/N9540)
12. Demonstrate the GTAW machine and evaluate welding by GTAW in different types of joints on different metals in different position and check correctness of the weld. [different types of joints- Fillet (lap, T-joint, Corner), Butt (Square & V); different metals- Mild Steel., Aluminium, Stainless Steel; different position- 1F,2F, 3F, & 1G, 2G, 3G]. (NOS: CSC/N9548)

13. Monitor Tube Welding (M.S. to S.S. Tube) in Butt joint in 1G position by GTAW. (NOS: CSC/N9549)
14. Plan & operate the Plasma Arc cutting machine and cut ferrous & non-ferrous metals. (NOS: CSC/N9543)
15. Review and perform Résistance Spot welding, Seam welding and Submerged Arc Welding on different metals in different position and check correctness of the weld. (NOS: CSC/N9544)
16. Analyse& assess welded joints by different methods of testing. (NOS: CSC/N9545)
17. Read and apply engineering drawing for different application in the field of work. (NOS: ASC/N9410)
18. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: ASC/N9411)

6. COURSE CONTENT

SYLLABUS FOR WELDER - CITS TRADE			
TRADE TECHNOLOGY			
Duration	**Reference Learning Outcome**	**Professional Skill (Trade Practical)**	**Professional Knowledge (Trade Theory)**
Practical 12 Hrs Theory 05 Hrs	Recognize & comply safe working practices, environment regulation and housekeeping.	1. Familiarize with the Institute. 2. Identify, select & review machinery used in the trade. 3. Implement & monitor use of safety equipment and their applications etc.	Importance of Welding in Industry Course objectives Safety precautions in Shielded Metal Arc Welding (SMAW),Oxy Acetylene Welding (OAW) and Oxy Acetylene Gas Cutting (OAGC) Fire and firefighting equipments.
Practical 12 Hrs Theory 05 Hrs	Monitor the oxy-acetylene cutting plant and perform different cutting operations on MS plate. [Different cutting operation – Straight, Bevel, circular].	4. Perform & monitor Oxy-Acetylene gas cutting (manual) straight, bevel and circular cutting on Mild steel plate. (10 mm. thick). 5. Assess weld joint preparation for fillet weld (Cutting to size, fit up, tack weld etc.).	Introduction of Arc, Gas and other welding process and their applications. Oxy-Acetylene gas cutting of metals-cut ability, cutting parameters and faults in cutting
Practical 38 Hrs Theory 12 Hrs	Demonstrate the SMAW machine and perform different type of joints on M.S. And S.S. in different position observing standard procedure. [different types of joints- Fillet (Lap, T-joint, & Corner), Butt (Square butt & Single “V” butt); different position - 1F, 2F, 3F,4F, 1G, 2G, 3G, 4G].	6. Review Lap, Tee and Corner joints on M.S. plate (10 mm. thick plate) in flat position by SMAW. 7. Perform & examine Single 'V butt joint on M.S. (10 mm. thick plate) in flat position by SMAW.	Basic electricity applicable to arc welding, Heat and temperature and its terms related to welding Principle of arc welding and characteristics of arc. Types of weld joints. Edge preparation.
		8. Perform & assess Lap, Tee and Corner joints on M.S. plate (10 mm. thick plate) in horizontal position by SMAW. 9. Analyze & construct Single 'V butt joint on M.S. (10 mm. thick plate) in horizontal position by SMAW.	Arc welding power sources- AC welding Transformer -DC welding Motor generator set Welding Rectifier and inverter type welding machines. Advantages and disadvantages of A.C. and D.C. welding machines.
		10. Practice & review Lap, Tee and Corner joints on M.S. plate (10 mm. thick plate) in vertical position by SMAW. 11. Make Single 'V butt joint on M.S. (10 mm. thick plate) in	Arc length - types - effects of arc length. Welding position - slope and rotation as per ASME and EURO standard. Polarity: Types and

		Vertical position by SMAW.	applications.
Practical 60 Hrs Theory 25 Hrs	Monitor the gas welding plant and evaluate the joints in different metals (M.S., Aluminium, Copper, Brass, Stainless Steel sheet) and in different position. [Different position: - 1F, 2F, 3F, 1G, 2G, 3G.] by OAW.	12. Practice & review Lap, Tee and Corner joints on M.S. plate (10 mm. thick plate) in Overhead position by SMAW. 13. Build & assess single 'V butt joint on M.S. (10 mm. thick plate) in overhead position by SMAW.	Arc blow and methods to control arc blow. Weld stresses, Distortion and methods of control. Arc Welding defects, causes and Remedies.
		14. Fabricate & evaluate square butt joint on M.S Sheet (2 mm. thick sheet) in flat position by OAW. 15. Analyze & make lap & Tee joint on M.S. Sheet (2 mm. thick sheet) in flat position by OAW.	Common gases used for welding & cutting. Chemistry of Oxy-Acetylene flame. Types of Oxy-Acetylene flame and applications
		16. Plan & make square butt joint on M.S Sheet (2 mm. thick sheet) in Horizontal position by OAW. 17. Monitor & review Lap &Tee joint on M.S. Sheet (2 mm. thick sheet) in Horizontal position by OAW.	Production of calcium carbide. Acetylene gas properties, manufacturing methods Acetylene gas Purifier, Hydraulic back pressure valve and Flash back arrestor.
		18. Construct & monitor Square butt joint on M.S Sheet (2 mm. thick sheet) in Vertical position by OAW. 19. Plan & make Lap & Tee joint on M.S. Sheet (2 mm. thick sheet) in Vertical position by OAW.	Oxygen - properties - manufacturing methods. Oxygen and Acetylene gas cylinders-charging methods-Colour coding for different gas cylinders, safe handling and storage Gas pressure regulator, Gas welding and cutting blow pipe.
		20. Make and examine Square But, Lap and Tee joints on M.S. Sheet 1.6 mm thick by brazing.	Gas welding techniques. Rightward and Leftward techniques. Gas welding filler rods, specifications and sizes. Gas welding fluxes - types and functions. Gas welding defects, causes and remedies.
		21. Plan & make square butt joint on Aluminium Sheet (3 mm. thick) in flat position by OAW. 22. Assess square butt joint on copper Sheet (2 mm thick) in	Classification of steel. Welding of low, medium and high carbon steel and alloy steels

		flat position by OAW.	Aluminium- properties and weldability, welding methods. Copper - types- properties and welding methods.
		23. Monitor Square butt joint on Brass Sheet (2 thick sheet) in flat position by OAW. 24. Evaluate square butt joint on Stainless steel (2 mm. thick sheet) in flat position by OAW Pipe butt joint on M.S. pipe outer dia. 50 mm x 3 mm. wall thickness in down hand position by OAW.	Brass - types - properties and welding methods. Stainless steel - types- weld decay and weldability
Practical 10 Hrs Theory 05 Hrs	Evaluate welding in different types of pipe joints [Butt Joint, Elbow, T- joint, angle (45^0) joint, flange joint] in 1G / DHP by OAW.	25. Assess pipe elbow and "T" joint on M.S. pipe outer dia. 50 mm x 3 mm wall thickness in down hand position by OAW. 26. Monitor Pipe welding 45 ° angle joint on MS pipe 0.50 and 3mm WT by OAW.	Development drawings for pipe Elbow joint. Development drawings for pipe 'T' Joint. Development drawings for pipe Branch 'Y' Joints.
Practical 10 Hrs Theory 05 Hrs	Demonstrate arc gouging operation to rectify the weld joints by SMAW and Monitor hard facing of alloy steel components / MS rod by using hard facing electrode.	27. Analyze & construct Square Butt joint on S.S. Sheet 3 mm thick in flat position by SMAW. 28. Repair and review welds by Arc gouging and re-welding by SMAW. 29. Assess single 'V butt joint on cast iron (6 mm. thick) in flat position by SMAW. 30. Analyze & perform hard surfacing practice on M.S. round rod 0. 25 mm by using Hard facing electrode.	Electrode - types - functions of flux, types of flux, coating factor, sizes of electrode. Coding of electrode as per IS and AWS. Criteria for selection of electrode. Effects of moisture pickup and backing of Electrodes.
Practical 10 Hrs Theory 05 Hrs	Analyze & Perform Brazing and Silver Brazing in different Joint (Square Butt Joint, Lap Joint, “T” joint, joint) on M.S. sheet and bell mouth joint on Tube (Brass & Copper) by OAW.	31. Monitor Silver brazing on S.S Sheet with copper sheet "T" joint. 32. Monitor Silver brazing on copper tube to tube Bronze welding of cast iron (6mm. thick) in flat position By OAW.	Brazing-principles, types of brazing,applications, filler rods and fluxes, necessity of cleaning, brazing parameters, brazing techniques and cleaning.
Practical 60 Hrs Theory 25 Hrs	Assess welding in butt joint on MS pipe in different position (1G, 2G, 5G & 6G) by SMAW using Liquid Penetrant Test during Root Pass & Cover	33. Analyze Pipe butt joint on M.S. pipe outer dia. 50 mm x 3 mm. wall thickness in down hand position by SMAW. 34. Evaluate Pipe elbow& 'T" joint on M.S. pipe outer dia. 50 mm x 3 mm. wall thickness in	Introduction to pipe welding Difference between plate and pipe welding. Types of pipes and pipe schedule Preparation work before

	Pass.	down hand position by SMAW.	welding
		35. Assess Pipe welding 45 ° angle joint on MS pipe 0 50 and 3mm WT. by SMAW. 36. Construct Single "V" butt joint on M.S pipe in (schedule 40) in 1G position by SMAW. 37. Inspect and clear using LPI testing during Root pass and cover pass.	Basic pipe welding procedure uphill welding, downhill welding and horizontal welding Pipe welding position 1G, 2G, 5G & 6G
		38. Make Single "V" butt joint on M.S pipe (schedule 60) in 2G position by SMAW. 39. Inspect and clear using LPI testing during Root pass and cover pass.	Procedure for welding heavy wall pipes in 5G & 6G position welding
		40. Weld pipes (schedule 80) in 5G position by SMAW. 41. Inspect and clear using LPI testing during Root pass and cover pass.	Importance of pre heating, post heating and maintenance of inter pass temperature. Use of temperature indicating crayons
		42. Weld of pipes (schedule 80) in 6G position by SMAW. 43. Inspect and clear using LPI testing during Root pass and cover pass.	Welding symbols as per BIS & AWS. Reading of assembly drawings
Practical 24 Hrs Theory 10 Hrs	Demonstrate fusion Welding & Bronze Welding in Single “V” Butt joint on Cast Iron (6 mm thick) in 1G/ DHP by choosing appropriate welding process (OAW & SMAW).	44. Monitor Fusion welding Single 'V butt joint on cast iron (6 mm. thick) in flat position by OAW. 45. Perform Bronze welding Single 'V butt joint on cast iron (6 mm. thick) in flat position by OAW.	Cast iron -types- properties and uses. Welding methods of cast iron.
		46. Weld joint preparation for pipe fillet welding pipe to pipe fillet weld on MS pipes by SMAW, position. 47. Illustrate study of Welding drawings. 48. Illustrate study of welding codes & standards.	Requirement for qualification in different codes Qualification procedure under various codes Different tests and inspection involved in qualification Pressure welding codes and standards (IBR, ASME etc.) Writing procedure for WPS and PQR
Practical 78 Hrs Theory	Demonstrate GMAW / FCAW machine and analyze welding in	49. Set up and monitor GMAW welding machine & accessories.	Safety precautions pertaining to GTAW & GMAW.

25 Hrs	different types of joints [Fillet Joints (T-joint, lap, Corner), Butt Joints (Square & Single V)] on different type of metals (M.S., S.S. sheet/plate by GMAW / FCAW in various positions [various positions- 1F, 2F, 3F,4F, 1G, 2G, 3G]	50. Perform & check Lap, Tee and Corner joints on M.S. plate (10 mm. thick plate) in flat position by GMAW. 51. Construct & evaluate Single 'V butt joint on M.S. (10 mm. thick plate) in flat position by GMAW.	Introduction to CO2 welding - equipment -accessories. Description of CO2 welding set with diagram Constant Voltage Power source for CO2 welding - working principle Advantages & Limitations of GMAW over other welding processes
		52. Construct Lap, Tee and Corner joints on M.S. sheet (3 mm. thick plate) in Horizontal position by GMAW. 53. Make Single 'V butt joint on M.S. (10 mm. thick plate) in Horizontal position by GMAW.	Power source & accessories Wire feed units - types - applications, limitations care and maintenance.
		54. Demonstrate fabrication of Lap, Tee and Corner joints on M.S. plate (sheet 6 mm. thick plate) in Vertical downward progression by GMAW. 55. Make single 'V butt joint on M.S. (10 mm. thick plate) in Vertical position by GMAW.	Welding Gun-types, description of parts functions and maintenance. Modes of metal transfer - Dip or Short circuiting transfer, Spray transfer (free flight transfer) and Globular transfer (intermittent transfer) and applications. Welding parameters for GMAW M.S and Alloy steels-related Tables / data
		56. Analyze & make Tee joint on M.S plate 10 mm thick plate by Vertical upward progressionLap, Tee and Corner joints on M.S. plate (10 mm. thick plate) in Overhead position by GMAW. 57. Review Single 'V butt joint on M.S. (10 mm. thick plate) in Over head position by GMAW.	Welding wires used in CO2 welding -diameter - specification as per AWS and applications. Shielding gases & Gas mixtures, and its applications in GMAW Edge preparation and fit up of various thicknesses of metals for GMAW. Types of weld defects, causes and remedy in GMAW process
		58. Monitor Single "V' joint by Flux cored Arc welding (on 12 mm thick plate) Lap & Square butt and T joint on S.S sheet. 2 mm thick by GMAW.	Flux cored arc welding - description, advantage Welding wire for Flux cored Arc Welding, types coding as per AWS and specification - Trouble shooting in MIG welding
		59. Evaluate Single "V" and fillet	Introduction to GTAW (TIG

		Tee joint on Aluminium plate (thickness 6 mm) by GMAW.	welding) equipment - advantages over SMAW and oxy-acetylene welding. GTAW: Power sources - high frequency unit, D.C. suppressor unit and uses.
Practical 10 Hrs Theory 06 Hrs	Monitor welding in T-joint, on M.S. Pipe in 1G / DHP by GMAW.	60. Monitor & assess Tee Joints on MS Pipe 0 60 mm OD x 3 mm WT in flat position - Arc constant (Rolling) by GMAW.	Effect of polarity in DC TIG Welding and application of straight and reversed polarity. GTAW torches, types, parts and functions Edge preparation and fit up for TIG welding sheets, plates and pipes
Practical 60 Hrs Theory 25 Hrs	Demonstrate the GTAW machine and evaluate welding by GTAW in different types of joints on different metals in different position and check correctness of the weld. [different types of joints- Fillet (lap, T-joint, Corner), Butt (Square & V) ; different metals- Mild Steel., Aluminium, Stainless Steel; different position- 1F,2F, 3F, & 1G, 2G, 3G].	61. Set and check GTAW welding machine & accessories. 62. Make Lap, Tee and Corner joint on MS sheet in down hand position by GTAW. 63. Assess the Square butt joint on MS in down hand position by GTAW.	Welding parameters and Tables & data relating to TIG welding. - Tungsten electrode, Types, sizes, and uses. coding as per AWS
		64. Construct Lap, Tee and Corner joint on MS sheet 1.6 mm in Vertical position by GTAW. 65. Make Square butt joint on MS sheet 2 mm in Vertical position by GTAW.	Filler metals for GTAW Types & Specifications as per BIS & AWS and applications Argon / Helium gas properties and application.
		66. Monitor Square butt joint on Aluminium sheet 3 mm thick in Flat position by GTAW. 67. Assess Lap, "T" and Corner joint on Aluminium sheet 2 mm thick in down hand position by GTAW.	Pulsed TIG welding and application Different type of weld joints- plates & pipes
		68. Construct Square butt joint on Aluminium sheet 2 mm thick in Horizontal & vertical positions by GTAW. 69. Make Lap, Tee and Corner joint on Aluminium sheet 2 mm thick in down Horizontal & vertical positions by GTAW.	Advantages of root pass welding of pipes by TIG welding Square wave concept and Wave balancing.
		70. Monitor the fabrication of Square butt joint on S.S sheet 1.6 mm thick in Flat position by GTAW. 71. Lap, Tee and Corner joint on S.S sheet 1.6 mm thick in Flat	Types of weld defects, causes and remedy in GTAW process Purging : Importance, Method of purging

		position by GTAW.	
		72. Plan & make Square butt joint on S.S sheet 1.6 mm thick in Vertical position by GTAW. 73. Make Lap, Tee and Corner joint on S.S sheet 1.6 mm thick in Vertical position by GTAW. 74. Monitor the formation of Single V butt joint on Aluminum sheet 6 mm thick by GTAW in down hand position.	Submerged Arc welding - Principles, application-Types of fluxes, welding head, power source and Parameter setting
Practical 24 Hrs Theory 10 Hrs	Monitor Tube Welding (M.S. to S.S. Tube) in Butt joint in 1G position by GTAW.	75. Make Square butt joint on Tube welding on M.S. & S.S tube metals in rolled position by GTAW and monitor the same.	Micro plasma welding principles, Equipment, power source, parameter settings, Advantages & limitations Plasma cutting principles and advantages
		76. Plan & perform Root pass welding of M. S schedule 40pipes by GTA Welding up to 6G Positions.	Friction welding process: principles, application, advantages, Principles and applications of Friction Stir welding
Practical 12 Hrs Theory 05 Hrs	Plan & operate the Plasma Arc cutting machine and cut ferrous & non-ferrous metals.	77. Plan & monitor Plasma cutting of SS sheets & Aluminum plates. 78. CNC profile cutting practice using air plasma torch.	Principles and applications of Laser welding, Electron beam welding, Electro slag welding, Electro gas welding, Thermit welding etc. Principles and application of Water jet cutting & laser cutting
Practical 25 Hrs Theory 10 Hrs	Review and perform Resistance Spot welding, Seam welding and Submerged Arc Welding on different metals in different position and check correctness of the weld.	79. Make Lap joint on Stainless steel sheet by Resistance Spot welding MS sheets joining by Resistance Spot welding. 80. Practice on Seam welding machine.	Resistance welding processes: Principles, application, advantages, Elements, Control parameters, Various types viz. Spot, seam projection , Flash butt etc,
		81. Practice on Automatic Submerged Arc Welding machine 82. Demonstrate butt joint Robot Welding.	Robot Welding - principles, applications and advantages. Programming concept. Mechanical Testing of Metals. Principles, Applications of - Hardness testing (Rockwell and Brinell) - Impact testing (Izod and Charpy) - Tensile testing and Bend Test
Practical	Analyze & assess	83. Perform & review Hardness	Non destructive Testing of

35 Hrs Theory 12 Hrs	welded joints by different methods of testing.	Testing. 84. Plan Bend Testing of Weldments. 85. Perform Tensile testing. 86. Conduct Impact Testing.	Metals. Visual inspection Dye penetrant test - Principles - Advantages Limitations - Types of Penetrants -Cleaners - Dwelling time etc. Magnetic Particle Test (MPT)- Principles - Advantages - Limitations - Types of Magnetation - Current requirements - Testing equipments - Indication and Interpretations Eddy current testing - Principles, advantages & limitations
		87. Inspect Dimensional weldments using weld gauge. 88. Plan & prepare Weld test specimen. 89. Conduct Visual inspection of weldments. 90. Evaluate welding defects using Dye penetrant. 91. Evaluate welding defects using cleaners and perform Magnetic Particle Testing. 92. Evaluation of defects Eddy current testing.	Ultrasonic Testing (UT)- Principles - Advantage - Limitations Measuring Techniques - Standard reference blocks - Contact Testing procedure -Indications and interpretations Radiographic testing (RT) - Principles - Advantages - Limitations - Basic Radiation Physics - X-Rays - Gama Rays - Radiographic Techniques - Radiographic Interpretation and Evaluation
		93. Set & Calibrate Ultrasonic Flaw detector. 94. Assess Ultrasonic Flaw detector- application on weldments. 95. Illustrate Study of IIW / ASTM reference Radiograph. 96. Interpret Radiographic films. 97. Analyze & Prepare welding inspection reports.	Certification methods for welding inspectors Codes and standards for welding inspection
ENGINEERING DRAWING (40 Hrs.)			
Professional Knowledge ED- 40	Read and apply engineering drawing for different application in the field	**CIRCLES, TANGENTS AND ELLIPSE:** Practical applications procedure for constructing tangent to given circle-lines- loop pattern--tangential circles- external tangents- internal tangents ellipse **PARABOLIC CURVES, HYPERBOLA:** Involutes - Properties and their	

Hrs.	of work.	application. Procedure for constructing parabolic curve-hyperbolic curve-in volute curve. epicycloids, hypocycloid, Involutes, spiral & Archimedes spiral **TECHNICAL DRAWING/ SKETCHING OF COMPONENTS' PARTS:** Views of object Importance of technical sketching-types of sketches-Isometric drawing sketching- Oblique drawing sketching. **PROJECTIONS**: Theory of projections (Elaborate theoretical instructions), Reference planes, orthographic projections concept 1st Angle and 3rd Angle, Projections of points, Projections of Lines– determination of true lengths & inclinations. Projections of plane, determination of true shape. Exercises on missing surfaces and views. Orthographic drawing or interpretation of views. Introduction to first angle projections of solids. **ISOMETRIC VIEWS**: Fundamentals of isometric projections (Theoretical Projections) Isometric views from 2 to 3 given orthographic views. Preparation of simple working drawing of Furniture items like table, stool and any job prepared in the workshop. **SECTIONAL VIEWS:** Importance and salient features, Methods of representing sections, conventional sections of various materials, classification of sections, conventional in sectioning. Drawing of full section, half section, partial or broken out sections, offset sections, revolved sections and removed sections. Drawing of different conventions for materials in section, conventional breaks for shafts, pipes, Rectangular, square angle, channel, rolled sections. Exercises on sectional views of different objects. - **DEVELOPMENT AND INTERSECTIONS:** Development of surfaces-Types of surface- Methods of development-Intersection- Methods of drawing intersection lines-critical point or key point. **FASTENERS**: Sketches of elements of screw threads, Sketches of studs, cap screws machine screws, set screws, Locking devices, bolts, Hexagonal & square nuts & nut bolt & washer assembly. Sketches of plain spring lock, toothed lock, washers, cap nut, check nut, slotted nut, cassel nut, sawn nut, wing nut, eye blot, tee bolt & foundation bolt. Sketches of various types of rivet heads (snap–pan–conical– countersunk) Sketches of keys (sunk, flat, saddle, gib head, woodruff) Sketches of hole & shaft assembly. **DETAIL DRAWING AND ASSEMBLY DRAWING:** Details of machine drawing- Assembly drawing- surface quality-surface finish standard-Method of indicating surface roughness for general engineering drawing-symbols used for indication of surface roughness-symbols for direction of lay. Geometrical tolerance. Detail drawing of the following with complete dimensioning,

		tolerances, material and Surface finish specifications 1. Universal couplings 2. Ball bearing and roller bearing. 3. Fast and loose pulley. 4. Stepped and V belt pulley. 5. Flanged Pipe joints, right angle bend. 6. Tool Post of Lathe Machine. 7. Tail Stock of Lathe Machine 8. Stepped and V belt pulley. 9. Flanged Pipe joints, right angle bend. 10. Tool Post of Lathe Machine. 11. Tail Stock of Lathe Machine Practice of blue print reading on limit, size, fits, tolerance, machining symbols, and reading out of assembly drawing etc., ISO Standards. **READING OF ENGINEERING DRAWING:** Blue print and machine drawing reading exercises. **GRAPHS & CHARTS**: Types (Bar, Pie, Percentage bar, Logarithmic), Preparation & interpretation of the graphs and charts. **AUTO CAD:** Familiarization with AutoCAD application in engineering drawing. Practice on AutoCAD using Draw & Modify commands. Practice on AutoCAD with Rectangular snap using Draw, Modify, Inquiry commands. Practice on AutoCAD using text dimensioning& dimensioning styles Practice on AutoCAD to draw nuts, bolts & washers. Isometric views-isometric views with square, taper and radial surface-simple & complex views. Perspective views. Practice on AutoCAD using isometric snap to make isometric drawings Practice on AutoCAD using Hatch command and application. Practice on AutoCAD using 3D primitives with UCS (User Co-ordinate system).
WORKSHOP CALCULATION & SCIENCE (40 Hrs.)		
Professional Knowledge WCS- 40 Hrs.	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.	**<u>WORKSHOP CALCULATION:</u>** **Fraction:** Concept of Fraction, Numbers, Variable, Constant, **Ratio & Proportion**: - Trade related problems **Percentage:** Definition, changing percentage to decimal and fraction and vice versa. Applied problems related to trade. Estimation and cost of product. **Algebra:** Fundamental Algebraic formulae for multiplication and factorization. Algebraic equations, simple & simultaneous equations, quadratic equations and their applications. **Mensuration 2D:** Concept on basic geometrical definitions, basic geometrical theorems. Determination of areas, perimeters of triangles, quadrilaterals, polygons, circle, sector etc.

		Mensuration 3D: Determination of volumes, surface areas of cube, cuboids cylinders, hollow cylinder, sphere prisms, pyramids cone spheres, frustums etc. Mass, Weight, Volume, Density, Viscosity, Specific gravity and related problems. **Trigonometry:** Concept of angles, measurement of angles in degrees, grades and radians and their conversions. Trigonometrical ratios and their relations. Review of ratios of some standard angles (0, 30,45,60,90 degrees), Height & Distances, Simple problems. **Graphs:** basic concept, importance. Plotting of graphs of simple linear equation. Related problems on ohm's law, series-parallel combination. **Statistics:** Frequency tables, normal distribution, measure of central tendency – Mean, Median & Mode. Concept of probability. Charts like pie chart, bar chart, line diagram, Histogram and frequency polygon. **WORKSHOP SCIENCE:** **Units and Dimensions:** Conversions between British & Metric system of Units. Fundamental and derived units in SI System, Dimensions of Physical Quantities (MLT)-Fundamental & Derived. **Engineering Materials:** Classification properties and uses of ferrous metals, non-ferrous metals, alloys etc. Properties and uses of non-metals such as wood, plastic, rubber, ceramics industrial adhesives. **Heat & Temperature:** Concepts, differences, effects of heat, different units, relation, specific heat, thermal capacity, latent heat, water equivalent, mechanical equivalent of heat. Different Temperature measuring scales and their relation. Transference of heat, conduction, convection and radiation. Thermal Expansion related calculations. **Force and Motion**: Newton's laws of motion, displacement, velocity, acceleration, retardation, rest & motion such as linear, angular. Force – units, different laws for composition and resolution of forces. Concept on centre of gravity and equilibrium of forces in plane. Concept of moment of inertia and torque. **Work, power & energy**: Definitions, units, calculation & application. Concept of HP, IHP, BHP and FHP – related calculations with mechanical efficiency. S.I. unit of power and their relations. **Friction:** Concept of friction, laws of friction, limiting friction, coefficient of friction and angle of friction. Rolling friction & sliding friction with

		examples. Friction on inclined surfaces **Stress & Strain:** Concepts of stress, strain, modulus of elasticity. Stress- strain curve. Hook's law, different module of elasticity like Young's modulus, modulus of rigidity, bulk modulus and their relations. Poisson's ratio. **Simple machines:** Concept of Mechanical Advantage, Velocity Ratio, Efficiency and their relations. Working principles of inclined plane, lever, screw jack, wheel and axle, differential wheel and axle, worm and worm wheel, rack and pinion. Gear train. **Electricity:** Basic definitions like emf, current, resistance, potential difference, etc. Uses of electricity. Difference between ac and dc. Safety devices. Difference between conductors and semiconductors and resistors, Materials used for conductors, semiconductors and resistors. Ohm's Law. Series, parallel and series-parallel combination of resistances. Concept, definitions and units of electrical work, power and energy with related problems. **Fluid Mechanics:** Properties of fluid (density, viscosity, specific weight, specific volume, specific gravity) with their units. Concept of atmospheric pressure, gauge pressure, absolute pressure, vacuum and differential pressure.

SYLLABUS FOR CORE SKILLS
1. Training Methodology (Common for all trades) (270 Hrs + 180 Hrs)

Learning outcomes, assessment criteria, syllabus and Tool List of above Core Skills subjects which is common for a group of trades, provided separately in www.bharatskills.gov.in/ dgt.gov.in

7. ASSESSMENT CRITERIA

LEARNING OUTCOME	ASSESSMENT CRITERIA
TRADE TECHNOLOGY	
1. Recognize & comply safe working practices, environment regulation and housekeeping. (NOS: CSC/N9511)	Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements.
	Recognize and report all unsafe situations according to site policy.
	Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures.
	Identify, handle and store / dispose off dangerous/unsalvageable goods and substances according to site policy and procedures following safety regulations and requirements.
	Identify and observe site policies and procedures in regard to illness or accident.
	Identify safety alarms accurately.
	Report supervisor/ Competent of authority in the event of accident or sickness of any staff and record accident details correctly according to site accident/injury procedures.
	Identify and observe site evacuation procedures according to site policy.
	Identify Personal Productive Equipment (PPE) and use the same as per related working environment.
	Identify basic first aid and use them under different circumstances.
	Identify different fire extinguisher and use the same as per requirement.
	Identify environmental pollution & contribute to avoidance of same.
	Take opportunities to use energy and materials in an environmentally friendly manner
	Avoid waste and dispose waste as per procedure
	Recognize different components of 5S and apply the same in the working environment.
2. Monitor the oxy- acetylene cutting plant and perform different cutting operations on MS plate. [Different cutting operation – Straight, Bevel, circular]. (NOS: CSC/N9537)	Plan and mark on MS plate surface for straight/bevel/circular cutting.
	Select the nozzle size and working pressure of gases as per requirement.
	Set the marked plate properly on cutting table.
	Set the cutting plant & perform the cutting operation maintaining proper techniques and all safety aspects.
	Clean the cutting burrs and inspect the cut surface for soundness of cutting.

3. Demonstrate the SMAW machine and perform different type of joints on M.S. And S.S. in different position observing standard procedure. [different types of joints- Fillet (Lap, T-joint, & Corner), Butt (Square butt & Single "V" butt); different position - 1F, 2F, 3F,4F, 1G, 2G, 3G, 4G]. (NOS: CSC/N9538)	Plan and select the type & size of electrode, welding current.
	Prepare edge as per requirement
	Prepare, set SMAW machine and tack the pieces as per drawing.
	Set up the tacked pieces in specific position.
	Deposit the weld maintaining appropriate arc length, electrode angle, welding speed, weaving technique and safety aspects.
	Clean the welded joint thoroughly.
	Carry out visual inspection for appropriate weld joint & check by
	Carry out visual inspection for appropriate weld joint & check by gauges.
4. Monitor the gas welding plant and evaluate the joints in different metals (M.S., Aluminium, Copper, Brass, Stainless Steel sheet) and in different position. [Different position: - 1F, 2F, 3F, 1G, 2G, 3G.] by OAW. (NOS: CSC/N9539)	Plan and select the nozzle size, working pressure, type of flame, filler rod as per requirement.
	Prepare, set and tack the pieces as per drawing.
	Set up the tacked joint in specific position.
	Deposit the weld following proper welding technique and safety aspect.
	Carry out visual inspection to ascertain quality weld joint.
5. Evaluate welding in different types of pipe joints [Butt Joint, Elbow, T- joint, angle (450) joint, flange joint] in 1G / DHP by 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.
6. Demonstrate arc gouging operation to rectify the weld joints by SMAW and monitor hard facing of alloy steel components / MS rod by using hard facing electrode. (NOS: CSC/N9541)	Plan and select the size of electrode for Arc gouging.
	Select the polarity and current as per requirement.
	Perform gouging adapting proper gouging technique.
	Clean and check to ascertain the required stock removed.
	Plan and prepare the component by cleaning the surface thoroughly.
	Select the type & size of electrode, power source, welding current as per requirement.
	Deposit the weld observing standard practice and safety.
	Clean the welded surface thoroughly
	Carryout visual inspection to ascertain quality of weld.
7. Analyze & Perform Brazing and	Plan and select the nozzle size, working pressure, type of

Silver Brazing in different Joint (Square Butt Joint, Lap Joint, "T" joint, joint) on M.S. sheet and bell mouth joint on Tube (Brass & Copper) by OAW. (NOS:CSC/N9410)	flame, filler rod as per requirement.
	Prepare, set and tack the pieces as per drawing.
	Set up the tacked joint in specific position.
	Braze the joint by following proper welding technique and safety aspect.
	Carry out visual inspection to ascertain quality weld joint.
8. Assess welding in butt joint on MS pipe in different position (1G, 2G, 5G & 6G) by SMAW using Liquid Penetrant Test during Root Pass & Cover Pass. (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.
	Plan and select the job and clean the surface thoroughly
	Select the appropriate testing methods.
	Perform testing of welded joints adapting standard operating procedure.
	Record the test result & compare with standard parameter/ result value.
	Accept/reject the job based on test result.
	Insect the welded joint visually for root penetration, uniformity of bead and surface defects.
9. Demonstrate fusion Welding & Bronze Welding in Single "V" Butt joint on Cast Iron (6 mm thick) in 1G/ DHP by choosing appropriate welding process (OAW & SMAW). (NOS: CSC/N9546)	Plan and prepare the job as per requirement
	Select the type & size of Filler rod OR electrode., size of nozzle, working pressure etc.for OAW And power source, polarity, welding current for SMAW as per requirement
	Set the part properly.
	Deposit the weld adapting appropriate welding technique and safety aspects.
	Clean the welded joint thoroughly.
	Carry out visual inspection to ascertain quality of weld joint.
10. Demonstrate GMAW / FCAW machine and perform welding in different types of joints [Fillet Joints (T-joint, lap, Corner), Butt Joints (Square &Single V)]on different type of metals (M.S., S.S. sheet/plate by GMAW / FCAW in various positions [various positions- 1F, 2F, 3F,4F, 1G, 2G, 3G]. (NOS: CSC/N9547)	Select size of electrode wire, welding voltage, gas flow rate, wire feed rate as per requirement.
	Prepare, set (machine & Job) and tack the pieces as per drawing and type of joints.
	Set up the tacked joint in specific position.
	Deposit the weld adapting proper 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).
11. Monitor welding inT-joint, on M.S. Pipe in 1G / DHP by GMAW. (NOS: CSC/N9540)	Select size of electrode wire, welding voltage, gas flow rate, wire feed rate as per requirement.
	Prepare, set (machine & Job) and tack the pieces as per drawing and type of joints.

	Arrange 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).
12. Demonstrate the GTAW machine and perform welding by GTAW in different types of joints on different metals in different position and check correctness of the weld. [different types of joints- Fillet (lap,T-joint, Corner), Butt (Square & V) ; different metals- Mild Steel., Aluminium, Stainless Steel; different position- 1F,2F, 3F,& 1G, 2G, 3G]. (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 (machine & Job) and tack the pieces as per drawing and type of joints.
	Set up the tacked joint in specific position.
	Deposit the weld by adapting proper 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).
13. Monitor Tube Welding (M.S. to S.S. Tube) in Butt joint in 1G position by GTAW. (NOS:CSC/N0204, NOS:CSC/N9549)	Demonstrate the making of Square butt joint on Tube welding on M.S. tube metals in rolled position by GTAW.
	Demonstrate the making of Square butt joint on Tube welding on S.S tube metals in rolled position by GTAW.
	Assess the joint as per given the specifications.
14. Plan & operate the Plasma Arc cutting machine and cut ferrous & non-ferrous metals. (NOS: CSC/N9543)	Demonstrate Plasma cutting of given SS sheets plates.
	Demonstrate Plasma cutting of given Aluminum plates.
	Demonstrate CNC profile cutting practice using air plasma torch.
15. Review and perform Resistance Spot welding, Seam welding and Submerged Arc Welding on different metals in different position and check correctness of the weld. (NOS: CSC/N9544)	Operate Seam welding machine.
	Demonstrate construction of lap joint on Stainless steel sheet by Resistance Spot welding MS sheets joining by Resistance Spotwelding.
	Perform welding on Automatic Submerged Arc Welding.
	Demonstrate butt joint Robot Welding.

16. Analyze& assess welded joints by different methods of testing. (NOS: CSC/N9545)	Plan and select the job and clean the surface thoroughly.
	Analyze& select the appropriate testing methods.
	Perform & monitor testing of welded joints adapting standard operating procedure.
	Record & evaluate the test result & compare with standard parameter/ result value.

	Accept/reject the job based on test result.
17. Read and apply engineering drawing for different application in the field of work. (NOS: ASC/N9410)	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.
18. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: ASC/N9411)	Solve different mathematical problems
	Explain concept of basic science related to the field of study

8. INFRASTRUCTURE

LIST OF TOOLS AND EQUIPMENT FOR WELDER (CITS)			
For Batch Of 25 Candidates			
S No.	**Name of the Tool & Equipment**	**Specification**	**Quantity**
A. Consumable			
1.	Leather Hand Gloves	14"	26 pairs
2.	Cotton hand Gloves	8"	26 pairs
3.	Leather Apron leather		26 nos.
4.	S.S Wire brush	5 rows and 3 rows	26 nos. each
5.	Leather hand sleeves	16"	26 pairs
6.	Safety boots for welders		26 pairs
7.	Leg guards leather		26 pairs
8.	Rubber hose clips	1/2"	26 nos.
9.	Rubber hose oxygen	8 mm dia X 10 Mts long as per BIS	2 nos.
10.	Rubber hose acetylene	8 mm dia X 10 Mts long as per BIS	2 nos.
11.	Arc welding cables multi cored copper	400/ 600 amp as per BIS	45 mts. each
12.	Arc welding single coloured glasses	108 mm x 82 mm x 3 mm. DIN 11A &12A	34 nos.
13.	Arc welding plain glass	108 mm x 82 mm x 3 mm.	68 nos.
14.	Gas welding Goggles with Colour glass	3 or 4A DIN	34 nos.
15.	Safety goggles plain		34 nos.
16.	Spark lighter		6 nos.
17.	AG 4 Grinding wheels		10 nos.
B. Trainees Tools Kit			
18.	Welding helmet fiber		26 nos.
19.	Welding hand shield fiber		26 nos.
20.	Chipping hammer with metal handle	250 Grams	26 nos.
21.	Chisel cold flat	19 mm x 150 mm	26 nos.
22.	Centre punch	9 mm x 127 mm	26 nos.
23.	Dividers	200 mm	26 nos.
24.	Stainless steel rule	300mm	26 nos.
25.	Scriber	150 mm double point	26 nos.
26.	Flat Tongs	350mm long	26 nos.
27.	Hack saw frame fixed	300 mm	26 nos.
28.	File half round bastard	300 mm	26 nos.
29.	File flat	350 mm bastard	26 nos.
30.	Hammer ball pane	1 kg with handle	26 nos.
31.	Tip Cleaner		26 nos.
32.	Try square	6"	26 nos.

C. GENERAL SHOP OUTFIT:			
33.	Spindle key		4
34.	Screw Driver	300mm blade and 250 mm blade	1 each
35.	Number punch	6 mm	2 set
36.	Letter punch	6 mm	2 set
37.	Magnifying glass	100 mm .dia	2
38.	Universal Weld measuring gauge		2
39.	Earth clamp	600A	6
40.	Spanner D.E.	6 mm to 32mm	2 sets
41.	C-Clamps	10 cm and 15 cm	2 each
42.	Hammer sledge double faced	4 kg	1
43.	S.S tape	5 meters flexible in case	1
44.	Electrode holder	600 amps	6
45.	H.P. Welding torch with 5 nozzles		2 sets
46.	Oxygen Gas Pressure regulator double stage		2
47.	Acetylene Gas Pressure regulator double stage		2
48.	CO_2 Gas pressure regulator, with flow meter		2 set
49.	Argon Gas pressure regulator with flow meter		2 set
50.	Metal rack	182 cm x 152 cm x 45 cm	1
51.	First Aid box		1
52.	Steel lockers with 8 Pigeon holes		3
53.	Steel almirah / cupboard		3
54.	Black board and easel with stand		1
55.	Flash back arrester (torch mounted)		4 pairs
56.	Flash back arrester (cylinder mounted)		4 pairs
57.	Welding Transformer with all accessories	(400A,OCV 60-100 V, 60% duty cycle)	2 sets
58.	Welding Transformer with all accessories	(300A , OCV 60 - 100 V, 60% duty cycle)	2 sets
59.	Inverter based welding Power source	(300A)	1 No
60.	D.C Arc welding rectifiers set with all accessories	(400 A. OCV 60 -100 V, 60% duty cycle)	2 sets
61.	GMAW welding machine	400A capacity with air cooled torch, Regulator, Gas preheater, Gas hose and Standard accessories	3 set
62.	AC/DC GTAW welding machine	With water cooled torch 300 A, Argon regulator, Gas hose, water circulating system and standard accessories.	3 set
63.	Air Plasma cutting equipment with all accessories, capacity to cut	25 mm clear cut	1 set
64.	Air compressor suitable for air		1

	plasma cutting system		
65.	Auto Darkening Welding Helmet		2
66.	Spot welding machine to 15 KVA with all accessories	15 KVA with all accessories	1 set
67.	Portable gas cutting machine capable of cutting Straight & Circular with all accessories		1 set
68.	Pedestal grinder fitted with coarse and medium grain size grinding wheels	dia. 300 mm	1
69.	Bench grinder fitted with fine grain size silicon carbide green grinding wheel	dia. 150 mm	1
70.	AG 4 Grinder		2
71.	Suitable gas welding table with fire bricks		2
72.	Suitable Arc welding table with positioner		14
73.	Trolley for cylinder (H.P. Unit)		2
74.	Hand shearing machine capacity to cut 6 mm sheets and flats		1
75.	Power saw machine	18"	1
76.	Portable drilling machine	(Cap. 6 mm)	1
77.	Oven, electrode drying	0 to 350°C, 10 kg capacity	1
78.	Work bench	340x120x75 cm with 4 bench vices of 150 mm jaw opening	4 sets
79.	Oxy Acetylene Gas cutting blow pipe		2 sets
80.	Oxygen, Acetylene Cylinders		2 each
81.	CO_2 cylinder		3 Nos.
82.	Argon gas cylinder		3 Nos.
83.	Anvil 12 sq. inches working area with stand		
84.	Swage block		
85.	Die penetrant testing kit		5 set
86.	Magnetic particle testing Machine Prode Type with all standard accessories		1 set
87.	Fire extinguishers (foam type and CO_2 type)		
88.	Fire buckets with stand		
89.	Portable abrasive cut-off machine		
90.	Suitable Gas cutting table		
91.	Welding Simulators for SMAW/GTAW/GMAW		1 each*
92.	Seam welding Machine(longitudinal) 75 KVA with accessories		1*
93.	Potable CNC profile cutting system with all standard accessories		1*

94.	Ultrasonic flaw detector with accessories		
95.	Submerged arc welding machine with accessories (1000 amps)		
96.	Radiographic reference standard		
97.	Eddy current tester		1*
98.	Friction welding machine		
99.	Welding motor generator	(300 Amps)	1 No
100.	X-ray film illuminator		
101.	Electric pipe cutting and beveling machine, cutting capacity 15 mm wall thickness M.S. pipes		
102.	Fume extractor system connecting all the Welding booths		1 set
103.	Pressure vessel codes (Book or CD) IBR & ASME sec IX		
104.	Structural welding codes D1.1 (Book or CD)		
105.	Universal Testing Machine 20T		1 set*
106.	Rockwell hardness Testing machine		
107.	Impact testing Machine (Charpy & Izod Combined)		
108.	MAG welding Robot with all standard accessories		1 set*
D. List of Furniture, Accessories and Audio Visual Aids			
109.	Class Room Chairs (armless) / Dual desk may also be allowed		25 nos.
110.	Class Room Tables	(3 ft X 2ft) / Dual desk may also be allowed	25 nos.
111.	Chair for Trainer (armed) movable		01no.
112.	Table for Trainer	(4ft X 2ft) with Drawer and cupboard	01no.
113.	LCD Projector		01 no.
114.	Computer System with latest configuration with	CPU: 32/64 Bit i3/i5/i7 or latest processor, Speed: 3 GHz or Higher. Cache Memory: - Minimum 3 MB or better. RAM:-8 GB DDR-III or Higher. Hard Disk Drive: 500GB or Higher, 7200 rpm (minimum) or Higher, Wi-Fi Enabled. Network Card: Integrated Gigabit Ethernet (10/100/1000) - Wi-Fi, USB Mouse, USB Keyboard and Monitor (Min. 17 Inch), Standard Ports and connectors. DVD Writer, Speakers And Mic. Licensed Windows Operating System / OEM Pack(Preloaded),	01 set

		Antivirus / Total Security	
115.	UPS		As required
116.	Computer Table		01 no.
117.	White Board	(6ft X 4 ft.)	01 no.
118.	LCD Projector Screen		01 no.
119.	Air Conditioner (OPTIONAL)	1.5Ton	As required
120.	Wall Clock		01 no.
121.	Wall charts, Transparencies and DVDs related to the trade		As required
122.	Document Camera / Visualizer		01 no.
123.	Smart Board / Inter Active Board		01 no.
124.	Over Head Projector		01 no.
125.	Video Camera with stand		01 no.
126.	Printer cum Scanner		01 no.
127.	Laptop with all latest OS		01 no.


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