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

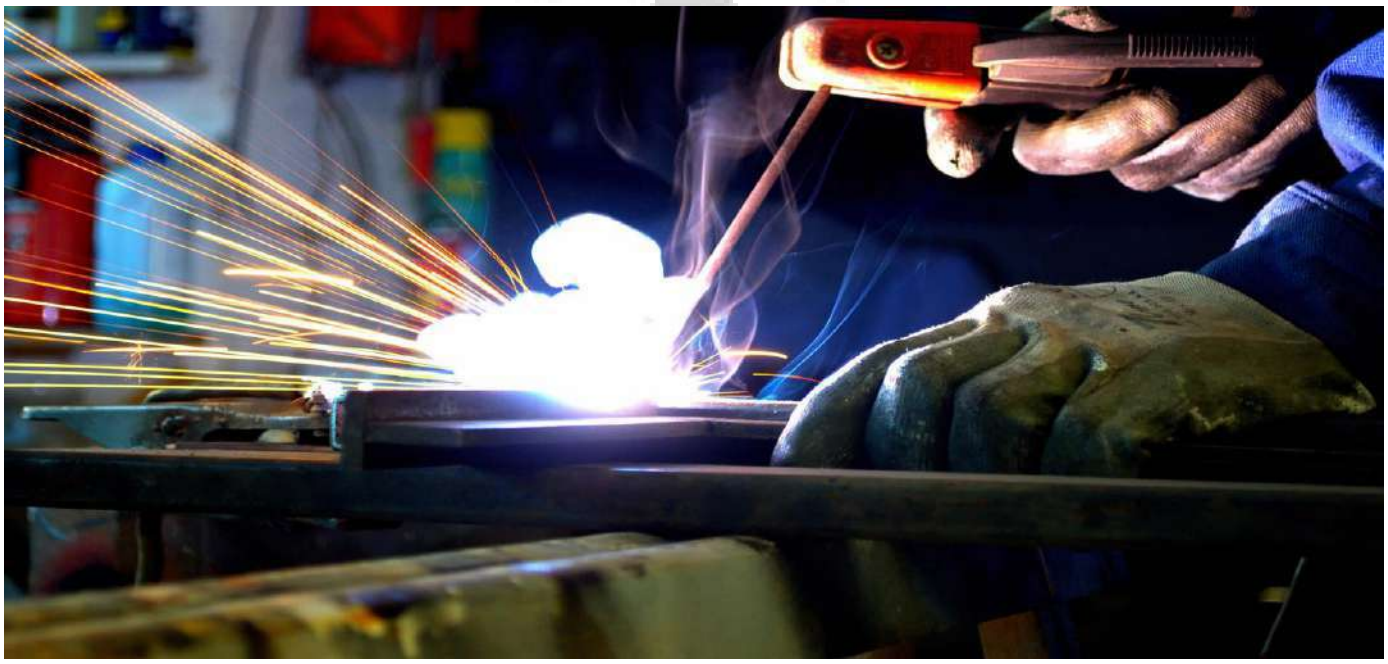
COMPETENCY BASED CURRICULUM

WELDER

(Duration: One Year)

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL- 4



SECTOR – CAPITAL GOODS AND MANUFACTURING

WELDER

(Engineering Trade)

(Revised in 2017)

Version: 1.1

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL - 4

Developed By

Ministry of Skill Development and Entrepreneurship

Directorate General of Training
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
EN-81, Sector-V, Salt Lake City,
Kolkata – 700 091

ACKNOWLEDGEMENT

The DGT sincerely acknowledges contributions of the Industries, State Directorates, Trade Experts, Domain Experts and all others who contributed in revising the curriculum. Special acknowledgement is extended by DGT to the following expert members who had contributed immensely in this curriculum.

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

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

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

CONTENTS

1. COURSE INFORMATION

During the one year duration a candidate is trained on subjects Professional Skill, Professional Knowledge, Engineering Drawing, Workshop Science & Calculation and Employability Skills. In addition to this a candidate is entrusted to make/do project work and Extra Curricular Activities to build up confidence. The broad components covered under Professional Skill subject are as below:

The practical skills are imparted in simple to complex manner & simultaneously theory subject is taught in the same fashion to apply cognitive knowledge while executing task. The safety aspects covers components like OSH&E, PPE, Fire extinguisher, First Aid and in addition 5S being taught. The practical part starts with edge preparation by hacksawing, filing and fitting followed by Oxy Acetylene Welding & Brazing, Oxy Acetylene Cutting, Shielded Metal Arc Welding, Gas Metal Arc Welding, Gas Tungsten Arc Welding and Spot Welding, Plasma Cutting and Arc Gouging. These processes are widely used in Industries.

During the practice on Welding / Brazing process, the trainees will learn to read the job drawing, select the required base metal and filler metals, cut the metals by appropriate process, carry out edge preparation, setup the plant and do welding/Brazing on M.S, SS, Aluminium and Copper in different positions. On completion of each job the trainees will also evaluate their jobs by visual inspection, and identify the defects for further correction/improvement. They learn to adapt precautionary measures such as preheating; maintaining inter-pass temperature and post weld heat treatment for Welding Alloy steel, Cast Iron etc. The Work Shop calculation taught will help them to plan and cut the required jobs economically without wasting the material and also used in estimating the Electrodes, filler metals etc. The Workshop Science taught will help them to understand the materials and properties, effect of alloying elements etc. Engineering Drawing taught will be applied while reading the job drawings and will be useful in understanding the location, type and size of weld to be carried out.

The professional knowledge taught will be useful in understanding the principles of Welding, Brazing and Cutting process, use of jigs and Fixtures, distortion and methods of control, selection of consumables and to take precautionary measures for storage and handling and apply the same for executing the Cutting, Welding and Brazing.

The knowledge and practice imparted on Destructive and Non-destructive testing will be use in understanding the standard quality of welds and to carry out shop floor Inspection and test in laboratories.

One project need to be completed by the candidates in a group. In addition to above components the core skills components viz., Workshop calculation & science, Engineering drawing, employability skills are also covered. These core skills are essential skills which are necessary to perform the job in any given situation.

2. TRAINING SYSTEM

2.1 GENERAL

Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers range of vocational training courses catering to the need of different sectors of Labour market. The vocational training programmes are running under aegis of National Council of Vocational Training (NCVT). Craftsman Training Scheme (CTS) and Apprenticeship Training Scheme (ATS) are two pioneer programmes under NCVT for propagating vocational training.

Welder trade under CTS is one of the most popular courses running on pan India through ITIs. The course is of one year duration. It mainly consists of Domain area and Core area. The Domain area (Trade Theory & Practical) impart professional skills and knowledge, while Core area (Workshop Calculation & science, Engineering Drawing and Employability Skills) impart requisite core skill, knowledge and life skills. After passing out the training program, the trainee is awarded National Trade Certificate (NTC) by NCVT which is recognized worldwide.

Candidates need broadly to demonstrate that they are able to:

- Read & interpret technical parameters/documentation, plan work, identify necessary materials and tools;
- Perform task with due consideration to safety rules, accident prevention regulations and environmental protection stipulations;
- Apply professional knowledge, core skills & employability skills while performing the job.
- 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 CAREER PROGRESSION PATHWAYS

- 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.

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)	1075
2	Professional Knowledge (Trade Theory)	258
3	Workshop Calculation & Science	86
4	Engineering Drawing	129
5	Employability Skills	110
6	Library & Extracurricular activities	62
7	Project work	80
8	Revision & Examination	280
	Total	**2080**

2.4 ASSESSMENT & CERTIFICATION

The trainee will be tested for his skill, knowledge and attitude during the period of course and at the end of the training programme as notified by Govt of India from time to time. The Employability skills will be tested in first year itself.

a) The **Internal assessment** 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 template (Annexure – II).

b) The final assessment will be in the form of summative assessment method. The All India Trade Test for awarding NTC will be conducted by NCVT as per guideline of Govt. of India. The pattern and marking structure is being notified by govt. of India from time to time. **The learning outcome and assessment criteria will be basis for setting question papers for final assessment. The examiner during final examination will also check** individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

2.4.1 PASS REGULATION

For the purposes of determining the overall result, weightage of 100% is applied for six months and one year duration courses and 50% weightage is applied to each examination for two years courses. The minimum pass percent for Practical is 60% & minimum pass percent for Theory subjects is 33%.

2.4.2 ASSESSMENT GUIDELINE

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking assessment. Due consideration should be given while assessing for team work, avoidance/reduction of scrap/wastage and disposal of scarp/wastage as per procedure, behavioral attitude, sensitivity to environment and regularity in training. The sensitivity towards OSHE and self-learning attitude are to be considered while assessing competency.

Assessment will be evidence based comprising 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

Evidences of internal assessments are to be preserved until forthcoming examination for audit and verification by examination 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 with occasional guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of an acceptable standard of craftsmanship.	• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment • 60-70% accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • A fairly good level of neatness and consistency in the finish • Occasional support in completing the project/job.
(b)Weightage in the range of above75% - 90% to be allotted during assessment	
For this grade, the candidate, with little guidance and showing due regard for safety procedures and practices, has	• Good skill levels in the use of hand tools, machine tools and workshop equipment • 70-80% accuracy achieved while undertaking

produced work which demonstrates attainment of a reasonable standard of craftsmanship.	different work with those demanded by the component/job/set standards. • A good level of neatness and consistency in the finish • Little support in completing the project/job
(c) Weightage in the range of above 90% to be allotted during assessment	
For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship.	• High skill levels in the use of hand tools, machine tools and workshop equipment • Above 80% accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • A high level of neatness and consistency in the finish. • Minimal or no support in completing the project.

3. JOB ROLE

Brief description of Job roles:

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 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.

Welder, operates; spot welding machine to joint metal sheet by resistance welding method. Feeds metal sheets to be welded according to type of machine and welds them by pressing paddle, or by automatic arrangements.

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.

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

Reference NCO 2015:

i. 7212.0100- Welder, Gas
ii. 7212.0200- Welder, Electric
iii. 7212.0700- Welder, Resistance
iv. 7212.0400- Gas Cutter
v. 7212.0500-Brazer
vi. 7212.0105- Tungsten Inert Gas Welder
vii. 7212.0303 -Gas Metal Arc Welder/Metal Inert Gas/Metal Active Gas/Gas Metal Welder (MIG/MAG/GMAW)
viii. 7212.0111- Repair Welder
ix. 7212.0402- Plasma Cutter – Manual

4. NSQF LEVEL COMPLIANCE

NSQF level for **Welder** trade under CTS: **Level 4**

As per notification issued by Govt. of India dated- 27.12.2013 on National Skill Qualification Framework total 10 (Ten) Levels are defined.

Each level of the NSQF is associated with a set of descriptors made up of five outcome statements, which describe in general terms, the minimum knowledge, skills and attributes that a learner needs to acquire in order to be certified for that level.

Each level of the NSQF is described by a statement of learning outcomes in five domains, known as level descriptors. These five domains are:

a. Process
b. professional knowledge
c. professional skill
d. Core skill and
e. Responsibility

The Broad Learning outcome of **Welder** trade under CTS mostly matches with the Level descriptor at Level- 4.

The NSQF level-4 descriptor is given below:

Level	Process Required	Professional Knowledge	Professional Skill	Core Skill	Responsibility
Level 4	Work in familiar, predictable, routine, situation of clear choice	Factual knowledge of field of knowledge or study	Recall and demonstrate practical skill, routine and repetitive in narrow range of application, using appropriate rule and tool, using quality concepts	Language to communicate written or oral, with required clarity, skill to basic Arithmetic and algebraic principles, basic understanding of social political and natural environment	Responsibility for own work and learning.

5. GENERAL INFORMATION

Name of the Trade	Welder
NCO - 2015	7212.0100, 7212.0200, 7212.0700,7212.0400, 7212.0500, 7212.0105, 7212.0303
NSQF Level	Level – 4
Duration of Craftsmen Training	One year
Entry Qualification	Passed 10th Class Examination
Unit Strength (No. Of Student)	20
Space Norms	80 Sq. m
Power Norms	16 KW
Instructors Qualification for	
1. Welder Trade	Degree in Mechanical / Metallurgy / Production Engineering/ Mechatronics from recognized university/ college with one year experience in relevant field. **OR** Diploma in Mechanical and allied from recognized technical board of education with two years experience in relevant field. **OR** NTC/ NAC passed in the Trade of "Welder" With 3 years' post qualification experience in the relevant field. **Essential Qualification:** Craft Instructor Certificate in relevant trade under NCVT. ***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	Degree in Engineering with one year experience. OR Diploma in Engineering with two years experience. **Essential Qualification:** Craft Instructor Certificate in RoD& A course under NCVT.
3. Engineering Drawing	Degree in Engineering with one year experience. OR Diploma in Engineering with two years experience.

	OR NTC / NAC in the Draughtsman (Mechanical) with three years experience. **<u>Essential Qualification</u>:** Craft Instructor Certificate in RoD & A course under NCVT.
4. Employability Skill	MBA OR BBA with two years experience OR Graduate in Sociology/ Social Welfare/ Economics with Two years experience OR Graduate/ Diploma with Two years experience and trained in Employability Skills from DGT institutes. AND Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above. **OR** Existing Social Studies Instructors duly trained in Employability Skills from DGT institutes
List of Tools and Equipment	As per Annexure – I

Distribution of training on Hourly basis: (Indicative only)

Total hours /week	Trade practical	Trade theory	Work shop Cal. &Sc.	Engg. Drawing	Employability skills	Extra-curricular activity
40 Hours	25 Hours	6 Hours	2 Hours	3 Hours	2 Hours	2 Hours

6. LEARNING/ ASSESSABLE OUTCOME

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

6.1. GENERIC LEARNING OUTCOME

1. Recognize & comply safe working practices, environment regulation and housekeeping.
2. Understand and explain different mathematical calculation & science in the field of study including basic electrical. *[Different mathematical calculation & science -Work, Power & Energy, Algebra, Geometry & Mensuration, Trigonometry, Heat & Temperature, elasticity]*
3. Interpret specifications, different engineering drawing and apply for different application in the field of work. *[Different engineering drawing-Geometrical construction, Dimensioning, Layout, Method of representation, Symbol, Different Projections, Assembly drawing, Sectional views, Estimation of material]*
4. Select and measure dimension of components and record data.
5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.
6. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.
7. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.
8. Plan and execute the work related to the occupation.

6.2 SPECIFIC LEARNING OUTCOME

9. Set the gas welding plant and join MS sheet in different position. *[Different position: - 1F, 2F, 3F, 1G, 2G, 3G.]*
10. Set the SMAW machine and perform different type of joints on MS in different position observing standard procedure. *[different types of joints- Fillet (T-joint, lap & Corner), Butt (Square & V); different position - 1F, 2F, 3F,4F, 1G, 2G, 3G, 4G]*
11. Set the oxy- acetylene cutting plant and perform different cutting operations on MS plate. *[Different cutting operation – Straight, Bevel, circular]*
12. Perform welding in different types of MS pipe joints by Gas welding (OAW). *[Different types of MS pipe joints – Butt, Elbow, T-joint, angle (45°) joint, flange joint]*

13. Set the SMAW machine and perform welding in different types of MS pipe joints by SMAW. *[Different types of MS pipe joints – Butt, Elbow, T-joint, angle (45°) joint, flange joint]*
14. Choose appropriate welding process and perform joining of different types of metals and check its correctness. *[appropriate welding process – OAW, SMAW; Different metal – SS, CI, Brass, Aluminium]*
15. Demonstrate arc gouging operation to rectify the weld joints.
16. Test welded joints by different methods of testing. *[different methods of testing- Dye penetration test, Magnetic particle test, Nick break test, Free band test, Fillet fracture test]*
17. Set GMAW machine and perform welding in different types of joints on MS sheet/plate by GMAW in various positions by dip mode of metal transfer. *[different types of joints- Fillet (T-joint, lap, Corner), Butt (Square & V); various positions- 1F, 2F, 3F,4F, 1G, 2G, 3G]*
18. Set 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 (T-joint, lap, Corner), Butt (Square & V) ; different metals- Aluminium, Stainless Steel; different position- 1F & 1G]*
19. Perform Aluminium & MS pipe joint by GTAW in flat position.
20. Set the Plasma Arc cutting machine and cut ferrous & non-ferrous metals.
21. Set the resistance spot welding machine and join MS & SS sheet.
22. Perform joining of different similar and dissimilar metals by brazing operation as per standard procedure. *[different similar and dissimilar metals- Copper, MS, SS]*
23. Repair Cast Iron machine parts by selecting appropriate welding process. *[Appropriate welding process- OAW, SMAW]*
24. Hard facing of alloy steel components/ MS rod by using hard facing electrode.

7. LEARNING OUTCOME WITH ASSESSMENT CRITERIA

GENERIC LEARNING OUTCOME	
LEARNING OUTCOME	**ASSESSMENT CRITERIA**
1. Recognize & comply safe working practices, environment regulation and housekeeping.	1.1 Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements.
	1.2 Recognize and report all unsafe situations according to site policy.
	1.3 Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures.
	1.4 Identify, handle and store / dispose off dangerous/unsalvageable goods and substances according to site policy and procedures following safety regulations and requirements.
	1.5 Identify and observe site policies and procedures in regard to illness or accident.
	1.6 Identify safety alarms accurately.
	1.7 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.
	1.8 Identify and observe site evacuation procedures according to site policy.
	1.9 Identify Personal Productive Equipment (PPE) and use the same as per related working environment.
	1.10 Identify basic first aid and use them under different circumstances.
	1.11 Identify different fire extinguisher and use the same as per requirement.
	1.12 Identify environmental pollution & contribute to avoidance of same.
	1.13 Take opportunities to use energy and materials in an environmentally friendly manner
	1.14 Avoid waste and dispose waste as per procedure
	1.15 Recognize different components of 5S and apply the same in the working environment.
2. Understand and explain different mathematical calculation & science in the	2.1 Explain concept of basic science related to the field such as Material science, Mass, weight, density, heat & temperature, heat treatment.

field of study including basic electrical. *[Different mathematical calculation & science -Work, Power & Energy, Algebra, Geometry, Mensuration, Trigonometry, Heat & Temperature, elasticity]*	2.2 Measure dimensions as per drawing
	2.3 Use scale/ tapes to measure for fitting to specification.
	2.4 Comply given tolerance.
	2.5 Prepare list of appropriate materials by interpreting detail drawings and determine quantities of such materials.
	2.6 Ensure dimensional accuracy of assembly by using different instruments/gauges.
	2.7 Explain basic electricity, insulation & earthing.
3. Interpret specifications, different engineering drawing and apply for different application in the field of work. *[Different engineering drawing-Geometrical construction, Dimensioning, Layout, Method of representation, Symbol, Different Projections, Assembly drawing, Sectional views, Estimation of material]*	3.1 Read & interpret the information on drawings and apply in executing practical work.
	3.2 Read & analyse the specification to ascertain the material requirement, tools, and assembly /maintenance parameters.
	3.3 Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
4. Select and measure dimension of components and record data.	4.1 Select appropriate measuring scale/tape/gauges.
	4.2 Measure dimension of the components/assembly & compare with given drawing/measurement.
5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.	5.1 Explain the concept of productivity and quality tools and apply during execution of job.
	5.2 Understand the basic concept of labour welfare legislation and adhere to responsibilities and remain sensitive towards such laws.
	5.3 Knows benefits guaranteed under various acts
6. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.	6.1 Explain the concept of energy conservation, global warming, pollution and utilize the available recourses optimally & remain sensitive to avoid environment pollution.
	6.2 Dispose waste following standard procedure.
7. Explain personnel finance,	7.1 Explain personnel finance and entrepreneurship.

entrepreneurship and manage/organize related task in day to day work for personal & societal growth.	7.2 Explain role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non financing support agencies to familiarizes with the Policies /Programmes & procedure & the available scheme.
	7.3 Prepare Project report to become an entrepreneur for submission to financial institutions.
8. Plan and execute the work related to the occupation.	8.1 Use documents, drawings and recognize hazards in the work site.
	8.2 Plan workplace/ assembly location with due consideration to operational stipulation
	8.3 Communicate effectively with others and plan project tasks
	8.4 Execute the task effectively.

SPECIFIC LEARNING OUTCOME	
LEARNINGOUTCOMES	**ASSESSMENT CRITERIA**
9. Set the gas welding plant and join MS sheet in different position. *[Different position: - 1F, 2F, 3F, 1G, 2G, 3G.]*	9.1 Plan and select the nozzle size, working pressure, type of flame, filler rod as per requirement.
	9.2 Prepare, set and tack the pieces as per drawing.
	9.3 Set up the tacked joint in specific position.
	9.4 Deposit the weld following proper welding technique and safety aspect.
	9.5 Carry out visual inspection to ascertain quality weld joint.
10. Set the SMAW machine and perform different type of joints on MS in different position observing standard procedure. *[different types of joints- Fillet (T-joint, lap & Corner), Butt (Square & V); different position - 1F, 2F, 3F,4F, 1G, 2G, 3G, 4G]*	10.1 Plan and select the type & size of electrode, welding current.
	10.2 Prepare edge as per requirement
	10.3 Prepare, set SMAW machine and tack the pieces as per drawing.
	10.4 Set up the tacked pieces in specific position.
	10.5 Deposit the weld maintaining appropriate arc length, electrode angle, welding speed, weaving technique and safety aspects.
	10.6 Clean the welded joint thoroughly.
	10.7 Carry out visual inspection for appropriate weld joint & check by gauges.
11. Set the oxy- acetylene cutting plant and perform different cutting operations on MS plate. *[Different cutting operation – Straight, Bevel, circular]*	11.1 Plan and mark on MS plate surface for straight/bevel/circular cutting.
	11.2 Select the nozzle size and working pressure of gases as per requirement.
	11.3 Set the marked plate properly on cutting table.
	11.4 Set the cutting plant & perform the cutting operation maintaining proper techniques and all safety aspects.
	11.5 Clean the cutting burrs and inspect the cut surface for soundness of cutting.
12. Perform welding in different types of MS pipe joints by Gas welding (OAW). *[Different types of MS pipe joints – Butt,*	12.1 Plan and prepare the development for a specific type of pipe joint.
	12.2 Mark and cut the MS pipe as per development.
	12.3 Select the size of filler rod, size of nozzle, working pressure etc.
	12.4 Set and tack the pieces as per drawing.

Elbow, T-joint, angle (45°) joint, flange joint]	12.5 Deposit the weld bead maintaining proper technique and safety aspects.
	12.6 Inspect the welded joint visually for poor penetration, uniformity of bead and surface defects.
13. Set the SMAW machine and perform welding in different types of MS pipe joints by SMAW. *[Different types of MS pipe joints – Butt, Elbow, T-joint, angle (45°) joint, flange joint]*	13.1 Plan and prepare the development for a specific type of pipe joint.
	13.2 Mark and cut the MS pipe as per development.
	13.3 Select the electrode size and welding current for welding.
	13.4 Set and tack the pieces as per drawing.
	13.5 Deposit the weld bead maintaining proper technique and safety aspects.
	13.6 Insect the welded joint visually for root penetration, uniformity of bead and surface defects.
14. Choose appropriate welding process and perform joining of different types of metals and check its correctness. *[appropriate welding process – OAW, SMAW; Different metal – SS, CI, Brass, Aluminium]*	14.1 Plan and prepare the pieces for welding.
	14.2 Select the type and size of filler rod and flux/electrode, size of nozzle and gas pressure/welding current, preheating method and temperature as per requirement.
	14.3 Set and tack metals as per drawing.
	14.4 Deposit the weld maintaining appropriate technique and safety aspects.
	14.5 Cool the welded joint by observing appropriate cooling method. Use post heating, peening etc. as per requirement.
	14.6 Clean the joint and inspect the weld for its uniformity and different types of surface defects.
15. Demonstrate arc gouging operation to rectify the weld joints.	15.1 Plan and select the size of electrode for Arc gouging.
	15.2 Select the polarity and current as per requirement.
	15.3 Perform gouging adapting proper gouging technique.
	15.4 Clean and check to ascertain the required stock removed.
16. Test welded joints by different methods of	16.1 Plan and select the job and clean the surface thoroughly.
	16.2 Select the appropriate testing methods.

testing. *[different methods of testing- Dye penetration test, Magnetic particle test, Nick break test, Free band test, Fillet fracture test]*	16.3	Perform testing of welded joints adapting standard operating procedure.
	16.4	Record the test result & compare with standard parameter/ result value.
	16.5	Accept/reject the job based on test result.
17. Set GMAW machine and perform welding in different types of joints on MS sheet/plate by GMAW in various positions by dip mode of metal transfer. *[different types of joints- Fillet (T-joint, lap, Corner), Butt (Square & V); various positions- 1F, 2F, 3F,4F, 1G, 2G, 3G]*	17.1	Select size of electrode wire, welding voltage, gas flow rate, wire feed rate as per requirement.
	17.2	Prepare, set (machine & Job) and tack the pieces as per drawing and type of joints.
	17.3	Set up the tacked joint in specific position.
	17.4	Deposit the weld adapting proper welding technique and safety aspects.
	17.5	Carry out visual inspection to ensure quality of welded joint.
	17.6	Inspect the weld using Dye-penetration Test (DPT)/Magnetic particle Test (MPT).
18. Set 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 (T-joint, lap, Corner), Butt (Square & V) ; different metals- Aluminium, Stainless Steel; different position- 1F & 1G]*	18.1	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.
	18.2	Prepare, set (machine & Job) and tack the pieces as per drawing and type of joints.
	18.3	Set up the tacked joint in specific position.
	18.4	Deposit the weld by adapting proper welding technique and safety aspects.
	18.5	Carry out visual inspection to ensure quality of welded joint.
	18.6	Inspect the weld using Dye-penetration Test (DPT)/Magnetic particle Test (MPT).
19. Perform Aluminium & MS pipe joint by GTAW in flat position.	19.1	Plan and prepare development or edge preparation for specific type of pipe joint.
	19.2	Mark and cut the MS pipe as per development.
	19.3	Select the type of welding current, size and type of tungsten electrode, size of nozzle, gas flow rate and welding current as per requirement.
	19.4	Set and tack the piece as per drawing.
	19.5	Deposit the weld bead maintaining proper technique and safety aspects.
	19.6	Inspect the welded joint visually for root

		penetration, bead uniformity and surface defects.
20. Set the Plasma Arc cutting machine and cut ferrous & non-ferrous metals.	20.1	Plan and mark on Ferrous/Non ferrous metal plates surface for plasma cutting.
	20.2	Select the torch/nozzle size, current and working pressure of gas as per requirement.
	20.3	Set the marked plate properly on cutting table.
	20.4	Set the plasma cutting machine and perform the cutting operation by adapting proper techniques and safety aspects.
	20.5	Clean and inspect the cut surface for quality of cutting.
21. Set the resistance spot welding machine and join MS & SS sheet.	21.1	Plan and select the material and clean the surface thoroughly.
	21.2	Set the spot welding parameters on machine.
	21.3	Spot weld the joint adapting appropriate techniques and safety.
	21.4	Inspect the joint for soundness of weld.
22. Perform joining of different similar and dissimilar metals by brazing operation as per standard procedure. *[different similar and dissimilar metals- Copper, MS, SS]*	22.1	Plan and select the nozzle size, working pressure type of flame, filler rod and flux as per requirement.
	22.2	Prepare, set and tack the pieces as per drawing.
	22.3	Braze the joint adapting proper brazing technique and safety aspect.
	22.4	Carry out visual inspection to ascertain quality weld joint.
23. Repair Cast Iron machine parts by selecting appropriate welding process. *[Appropriate welding process- OAW, SMAW]*	23.1	Plan and prepare the job as per requirement.
	23.2	Select the type & size of electrode, power source, polarity, welding current as per requirement
	23.3	Set the part properly.
	23.4	Deposit the weld adapting appropriate welding technique and safety aspects.
	23.5	Clean the welded joint thoroughly.
	23.6	Carry out visual inspection to ascertain quality of weld joint.
24. Hard facing of alloy steel components / MS rod	24.1	Plan and prepare the component by cleaning the surface thoroughly.
	24.2	Select the type & size of electrode, power source,

by using hard facing electrode.		welding current as per requirement.
	24.3	Deposit the weld observing standard practice and safety.
	24.4	Clean the welded surface thoroughly
	24.5	Carryout visual inspection to ascertain quality of weld.

8. SYLLABUS

SYLLABUS - WELDER				
First Year				
Week No.	**Reference Learning Outcome**	**Process code**	**Professional Skills (Trade Practical) with Indicative hrs.**	**Professional Knowledge (Trade Theory)**
1	• Recognize & comply safe working practices, environment regulation and housekeeping.		1. Demonstration of Machinery used in the trade. (6 hrs.) 2. Identification to safety equipment and their use etc. (4 hrs.) 3. Hack sawing, filing square to dimensions. (7 hrs.) 4. Marking out on MS plate and punching. (8 hrs.)	- Importance of trade Training. - 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.
2	• Set the gas welding plant and join MS sheet in different position. *[Different position: - 1F, 2F, 3F, 1G, 2G, 3G.]* • Set the SMAW machine and perform different type of joints on MS in different position observing standard procedure. *[different types of joints- Fillet (T-joint, lap & Corner), Butt (Square & V); different position - 1F, 2F, 3F,4F, 1G, 2G, 3G, 4G]*	OAW-01 SMAW-01	5. Setting of oxy-acetylene welding equipment, Lighting and setting of flame. (2 hrs.) 6. Perform fusion run without filler rod on MS sheet 2mm thick in flat position. (2 hrs.) 7. Setting up of Arc welding machine & accessories and striking an arc. (2 hrs.) 8. Deposit straight line bead on MS plate in flat position. (2 hrs.)	- Introduction and definition of welding. - Arc and Gas Welding Equipments, tools and accessories. - Various Welding Processes and its applications. - Arc and Gas Welding terms and definitions.
3	• Set the gas welding plant and join MS sheet in different position. *[Different position: - 1F, 2F, 3F,*	OAW-02	9. Depositing bead with filler rod on M.S. sheet 2 mm thick in flat position. (10 hrs.)	- Different process of metal joining methods: Bolting, riveting, soldering, brazing, seaming etc. - Types of welding joints and its

	1G, 2G, 3G.]	OAW-03	10. Edge joint on MS sheet 2 mm thick in flat position without filler rod. (15 hrs.)	applications. Edge preparation and fit up for different thickness. - Surface Cleaning
4	• Set the SMAW machine and perform different type of joints on MS in different position observing standard procedure. *[different types of joints- Fillet (T-joint, lap & Corner), Butt (Square & V); different position - 1F, 2F, 3F,4F, 1G, 2G, 3G, 4G]*	SMAW-02 SMAW-03	11. Straight line beads on M.S. plate 10 mm thick in flat position. (10 hrs.) 12. Weaved bead on M. S plate 10mm thick in flat position. (15 hrs.)	- Basic electricity applicable to arc welding and related electrical terms &definitions. - Heat and temperature and its terms related to welding - Principle of arc welding. And characteristics of arc.
5	• Set the oxy-acetylene cutting plant and perform different cutting operations on MS plate. *[Different cutting operation – Straight, Bevel, circular]*	OAGC-01 OAGC-02 OAGC-03 OAGC-04 OAGC-05 OAGC-06	13. Setting up of oxy-acetylene and make straight cuts (freehand) (2 hrs.) 14. Perform marking and straight line cutting of MS plate 10 mm thick by gas. Accuracy within ±2mm. (4 hrs.) 15. Beveling of MS plates 10 mm thick, cutting regular geometrical shapes and irregular shapes, cutting chamfers by gas cutting. (7 hrs.) 16. Circular gas cutting on MS plate 10 mm thick by *profile cutting machine.*(7 hrs.) 17. Marking and perform radial cuts, cutting out holes using oxy-acetylene gas cutting.(3 hrs.) 18. Identify cutting defects viz., distortion, grooved, fluted or ragged cuts;	- Common gases used for welding & cutting, flame temperatures and uses. - Chemistry of oxy-acetylene flame. - Types of oxy-acetylene flames and uses. - Oxy-Acetylene Cutting Equipment principle, parameters and application.

			poor draglines; rounded edges; tightly adhering slag.(2 hrs.)	
6	• Set the gas welding plant and join MS sheet in different position. *[Different position: - 1F, 2F, 3F, 1G, 2G, 3G.]* • Set the SMAW machine and perform different type of joints on MS in different position observing standard procedure. *[different types of joints- Fillet (T-joint, lap & Corner), Butt (Square & V); different position - 1F, 2F, 3F,4F, 1G, 2G, 3G, 4G]*	OAW-04 SMAW-04 OAW-05	19. Square butt joint on M.S. sheet 2 mm thick in flat Position. **(1G)**(8 hrs.) 20. Fillet "T" joint on M.S. Plate 10 mm thick in flat position. **(1F)**(8 hrs.) 21. Open corner joint on MS sheet 2 mm thick in flat Position **(1F)**(9 hrs.)	- Arc welding power sources: Transformer, Motor Generator set, Rectifier and Inverter type welding machines and its care & maintenance.. - Advantages and disadvantages of A.C. and D.C. welding machines
7	-do-	SMAW-05 OAW-06 SMAW-06	22. Fillet lap joint on M.S. plate 10 mm thick in flat position. **(1F)**(8 hrs.) 23. Fillet "T" joint on MS sheet 2 mm thick in flat position. **(1F)**(8 hrs.) 24. Open Corner joint on MS plate 10 mm thick in flat position. **(1F)**(9 hrs.)	- Welding positions as per EN &ASME : flat, horizontal, vertical and over head position. - Weld slope and rotation. - Welding symbols as per BIS & AWS.
8	-do-	OAW-07 SMAW-07 I&T-01	25. Fillet Lap joint on MS sheet 2 mm thick in flat position**. (1F)**(10 hrs.) 26. Single "V" Butt joint on MS plate 12 mm thick in flat position **(1G)** . (13 hrs.) 27. Testing of weld joints by visual inspection. (1 hrs.) 28. Inspection of welds by using weld gauges. (1 hrs.)	- Arc length – types – effects of arc length. - Polarity: Types and applications. - Weld quality inspection, common welding mistakes and appearance of good and defective welds - Weld gauges & its uses

9	-do-	OAW-08 SMAW-08 SMAW-09	29. Square Butt joint on M.S. sheet. 2 mm thick in Horizontal position. **(2G)**(10 hrs.) 30. Straight line beads and multi layer practice on M.S. Plate 10 mm thick in Horizontal position. (6 hrs.) 31. Fillet " T" joint on M.S. plate 10 mm thick in Horizontal position**. (2F)**(9 hrs.)	- Calcium carbide properties and uses. - Acetylene gas properties and generating methods. - Acetylene gas Purifier, Hydraulic back pressure valve and Flash back arrestor
10	-do-	OAW-09 SMAW-10	32. Fillet Lap joint on M.S. sheet 2 mm thick in horizontal position **(2F)**(12 hrs.) 33. Fillet Lap joint on M.S. plate 10 mm thick in horizontal position. (13 hrs.) **(2F)**	- Oxygen gas and its properties - Production of oxygen by Air liquefaction. - Charging process of oxygen and acetylene gases - Oxygen and Dissolved Acetylene gas cylinders and Color coding for different gas cylinders. - Gas regulators, types and uses.
11	-do-	OAW-10 OAW-11 SMAW-11	34. Fusion run with filler rod in vertical position on 2mm thick M.S sheet. (8hrs.) 35. Square Butt joint on M.S. sheet. 2 mm thick in vertical position **(3G)**(8 hrs.) 36. Single Vee Butt joint on M.S. plate 12 mm thick in horizontal position **(2G)**.	- Oxy acetylene gas welding Systems (Low pressure and High pressure). Difference between gas welding blow pipe(LP & HP) and gas cutting blow pipe - Gas welding techniques. Rightward and Leftward techniques.

			(9 hrs.)	
12	-do-	SMAW- 12 OAW-12 SMAW-13	37. Weaved bead on M.S Plate 10mm in vertical position.(8 hrs.) 38. Fillet "T" joint on M.S sheet 2 mm thick in vertical position. **(3F)**(8 hrs.) 39. Fillet "T" joint on M.S. plate 10 mm thick in vertical position. **(3F)**(9 hrs.)	- Arc blow – causes and methods of controlling. - Distortion in arc & gas welding and methods employed to minimize distortion - Arc Welding defects, causes and Remedies.
13	• Set the SMAW machine and perform different type of joints on MS in different position observing standard procedure. *[different types of joints- Fillet (T-joint, lap & Corner), Butt (Square & V); different position - 1F, 2F, 3F,4F, 1G, 2G, 3G, 4G]* • Perform welding in different types of MS pipe joints by Gas welding (OAW). *[Different types of MS pipe joints – Butt, Elbow, T-joint, angle (45°) joint, flange joint]*	OAW-13 SMAW-14	40. Structural pipe welding butt joint on MS pipe Ø 50 and 3mm WT in 1G position. (15 hrs.) 41. Fillet Lap joint on M.S. Plate 10 mm in vertical position. **(3G)**(10 hrs.)	- Specification of pipes, various types of pipe joints, pipe welding all positions, and procedure. - Difference between pipe welding and plate welding.
14	-do-	SMAW-15 OAW-14	42. Open Corner joint on MS plate 10 mm thick in vertical position. **(2F)**(10 hrs.) 43. Pipe welding - Elbow joint on MS pipe Ø 50 and 3mm WT. **(1G)**(15 hrs.)	- Pipe development for Elbow joint, "T" joint, Y joint and branch joint - Manifold system
15	-do-	OAW-15	44. Pipe welding "T" joint on	- Gas welding filler rods,

			MS pipe Ø 50 and 3mm WT. **(1G)**(10 hrs.)	specifications and sizes. - Gas welding fluxes – types and functions.
		SMAW-16	45. Single "V" Butt joint on MS plate12 mm thick in vertical position (3G). (15 hrs.)	- Gas Brazing & Soldering : principles, types fluxes & uses - Gas welding defects, causes and remedies.
16	-do-	OAW-16	46. Pipe welding 45 ° angle joint on MS pipe Ø 50 and 3mm WT. **(1G)**(15 hrs.)	- Electrode : types, functions of flux, coating factor, sizes of electrode Coding of electrode as per BIS, AWS, - Effects of moisture pick up. - Storage and baking of electrodes. - Special purpose electrodes and their applications.
		SMAW-17	47. Straight line beads on M.S. plate 10mm thick in over head position. (10 hrs.)	
17	• Set the SMAW machine and perform different type of joints on MS in different position observing standard procedure. *[different types of joints- Fillet (T-joint, lap & Corner), Butt (Square & V); different position - 1F, 2F, 3F,4F, 1G, 2G, 3G, 4G]* • Set the SMAW machine and perform welding in different types of MS pipe joints by SMAW. *[Different types of MS pipe joints – Butt, Elbow, T-joint, angle (45°) joint, flange joint]*	SMAW-18	48. Pipe Flange joint on M.S plate with MS pipe Ø 50 mm X 3mm WT **(1F)**(15 hrs.)	- Weldability of metals, importance of pre heating, post heating and maintenance of inter pass temperature.
		SMAW-19	49. Fillet "T" joint on M.S. plate 10 mm thick in over head position. **(4F)**(10 hrs.)	
18	-do-	SMAW-20	50. Pipe welding butt joint on MS pipe Ø 50 and 5 mm WT. in 1G position. (15	- Classification of steel. - Welding of low, medium and high carbon steel and alloy

		SMAW-21	hrs.) 51. Fillet Lap joint on M.S. plate 10 mm thick in over head position. **(4G).** (10 hrs.)	steels.
19	-do-	SMAW-22 SMAW-23	52. Single "V" Butt joint on MS plate 10mm thick in over head position**(4G)** (15 hrs.) 53. Pipe butt joint on M. S. pipe Ø 50mm WT 6mm (**1G** Rolled).(10 hrs.)	- Effects of alloying elements on steel - Stainless steel types- weld decay and weldability.
20	• Choose appropriate welding process and perform joining of different types of metals and check its correctness. *[appropriate welding process – OAW, SMAW; Different metal – SS, CI, Brass, Aluminium]*	OAW-17 SMAW -24 OAW-18	54. Square Butt joint on S.S. sheet. 2 mm thick in flat position. **(1G)**(8 hrs.) 55. Square Butt joint on S.S. Sheet 2 mm thick in flat position. **(1G)**(8 hrs.) 56. Square Butt joint on Brass sheet 2 mm thick in flat position. **(1G)**(9 hrs.)	- Brass – types – properties and welding methods. - Copper – types – properties and welding methods.
21	• Choose appropriate welding process and perform joining of different types of metals and check its correctness. *[appropriate welding process – OAW, SMAW; Different metal – SS, CI, Brass, Aluminium]* • Demonstrate arc gauging operation to rectify the weld joints.	OAW-19 SMAW-25 AG-01	57. Square Butt & Lap joint on M.S. sheet 2 mm thick by brazing in flat position. (11 hrs.) 58. Single "V" butt joint C.I. plate 6mm thick in flat position. **(1G)**(11 hrs.) 59. Arc gouging on MS plate 10 mm thick. (3 hrs.)	- Aluminium and its alloys, properties and weldability, Welding methods - Arc cutting & gouging,

22	• Choose appropriate welding process and perform joining of different types of metals and check its correctness. *[appropriate welding process – OAW, SMAW; Different metal – SS, CI, Brass, Aluminium]*	OAW-20 OAW-21	60. Square Butt joint on Aluminium sheet. 3 mm thick in flat position. (12 hrs.) 61. Bronze welding of cast iron (Single "V" butt joint) 6mm thick plate **(1G).**(13 hrs.)	- Cast iron and its properties types. - Welding methods of cast iron.
23-26	**Revision**			
27	• Test welded joints by different methods of testing. *[different methods of testing- Dye penetration test, Magnetic particle test, Nick break test, Free band test, Fillet fracture test]*	I&T-02 I&T-03 I&T-04 I&T-05 I&T-06	62. Dye penetrant test. (5 hrs.) 63. Magnetic particle test. (5 hrs.) 64. Nick- break test. (5 hrs.) 65. Free bend test. (5 hrs.) 66. Fillet fracture test. (5 hrs.)	- Types of Inspection methods - Classification of destructive and NDT methods - Welding economics and Cost estimation.
28	• Set GMAW machine and perform welding in different types of joints on MS sheet/plate by GMAW in various positions by dip mode of metal transfer. *[different types of joints- Fillet (T-joint, lap, Corner), Butt (Square & V); various positions- 1F, 2F, 3F,4F, 1G, 2G, 3G]*	GMAW- 01 GMAW - 02	67. Introduction to safety equipment and their use etc. (2 hrs.) 68. Setting up of GMAW welding machine & accessories and striking an arc. (4 hrs.) 69. Depositing straight line beads on M.S Plate. (10 hrs.) 70. Fillet weld – "T" joint on M.S plate 10mm thick in flat position by Dip transfer. **(1F)** (9 hrs.)	- Safety precautions in Gas Metal Arc Welding and Gas Tungsten Arc welding. - Introduction to GMAW - equipment – accessories. - Various other names of the process. (MIG/MAG/CO_2 welding.)
29	-do-	GMAW -03	71. Fillet weld – Lap joint on M.S. sheet 3mm thick in flat position by	- Advantages of GMAW welding over SMAW , limitations and applications

			Dip transfer. **(1F)** (8 hrs.)	- Process variables of GMAW. - Modes of metal transfer – dip or short circuiting transfer, spray transfer (free flight transfer) and globular transfer (intermittent transfer) and Pulsed metal transfer.
		GMAW -04	72. Fillet weld – "T" joint on M.S. sheet 3mm thick in flat position by Dip transfer. **(1F)** (8 hrs.)	
		GMAW -05	73. Fillet weld – corner joint on M.S. sheet 3mm thick in flat position by Dip transfer. **(1F)** (9 hrs.)	
30	-do-	GMAW -06	74. Butt weld – Square butt joint on M.S sheet 3mm thick in flat position **(1G)** (10 hrs.)	- Wire feed system – types – care and maintenance. - Welding wires used in GMAW, standard diameter and codification as per AWS.
		GMAW -07	75. Butt weld – Single "V" butt joint on M.S plate 10 mm thick by Dip transfer in flat position. **(1G)** (15 hrs.)	
31	-do-	GMAW -08	76. Fillet weld – "T" joint on M.S plate 10mm thick in Horizontal position by Dip transfer. **(2F)** (10 hrs.)	- Types of shielding gases and gas mixtures used in GMAW and its applications. - Flux cored arc welding – description, advantage, welding wires, coding as per AWS.
		GMAW -09	77. Fillet weld – corner joint on M.S plate 10mm thick in Horizontal position by Dip transfer. **(2F)** (15 hrs.)	
32	-do-	GMAW -10	78. Fillet weld – "T" joint on M.S. sheet 3mm thick in	- Edge preparation of various thicknesses of metals for GMAW.

			Horizontal position by Dip transfer. **(2F)** (10 hrs.)	- GMAW defects, causes and remedies
		GMAW -11	79. Fillet weld – corner joint on M.S. sheet 3mm thick in Horizontal position by Dip transfer. **(2F)** (15 hrs.)	
33	-do-	GMAW -12	80. Fillet weld – "T" joint on M.S plate 10mm thick in vertical position by Dip transfer. **(3F)** (10 hrs.)	- Heat input and techniques of controlling heat input during welding. - Heat distribution and effect of faster cooling
		GMAW -13	81. Fillet weld – corner joint on M.S plate 10mm thick in vertical position by dip transfer. **(3F)** (15 hrs.)	
34	-do-	GMAW -14	82. Fillet weld – Lap joint on M.S. sheet 3mm thick in vertical position by Dip transfer. **(3F)** (10 hrs.)	- Pre heating & Post Weld Heat Treatment - Use of temperature indicating crayons
		GMAW -15	83. Fillet weld – corner joint on M.S. sheet 3mm thick in vertical position by Dip transfer. **(3F)** (15 hrs.)	
35	-do-	GMAW -16	84. Fillet weld – Lap and "T" joint on M.S sheet 3mm thick inover head position by Dip transfer. **(4F)** (25	- Submerged arc welding process –principles, equipment, advantages and limitations

			hrs.)	
36	-do-	GMAW -17	85. Tee Joints on MS Pipe Ø 60 mm OD x 3 mm WT 1G position – Arc constant (Rolling) (25 hrs.)	- Electro slag and Electro gas welding processes–principles, equipments, advantages and limitations
37	-do-	GMAW -18 GMAW -19	86. Depositing bead on S.S sheet in flat position. (10 hrs.) 87. Butt joint on Stainless steel 2 mm thick sheet in flat position by Dip transfer. (15 hrs.)	- Thermit welding process- types, principles, equipments, Thermit mixture types and applications. - Use of backing strips and backing bars
38	• Set 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 (T-joint, lap, Corner), Butt (Square & V) ; different metals- Aluminium, Stainless Steel; different position- 1F & 1G]*	GTAW -01 GTAW -02	88. Depositing bead on Aluminium sheet 2 mm thick in flat position. (10 hrs.) 89. Square butt joint on Aluminium sheet 1.6mm thick in flat position. (15 hrs.)	- GTAW process - brief description. Difference between AC and DC welding, equipments, polarities and applications. - Various other names of the process (TIG, Argonarc) - Power sources for GTAW - AC &DC
39	-do-	GTAW -03 GTAW -04	90. Fillet weld – "T" joint on Aluminium sheet 1.6 mm thick in flat position. **(1F)** (10 hrs.) 91. Fillet weld – Outside corner joint on Aluminium sheet 2	- Tungsten electrodes –types & uses, sizes and preparation - GTAW Torches- types, parts and their functions - GTAW filler rods and selection criteria

			mm thick in flat position. **(1F)** (15 hrs.)	
40	-do-	GTAW -05	92. Butt weld - Square butt joint on Stainless steel sheet 1.6 mm thick in flat position with purging gas **(1G)** (25 hrs.)	- Edge preparation and fit up. - GTAW parameters for welding of different thickness of metals - Pulsed TIG welding - brief description, pulse parameters slope up and slope down.
41	-do-	GTAW -06	93. Fillet weld – "T" joint on Stainless steel sheet 1.6 mm thick in flat position. **(1F)** (25 hrs.)	- Argon / Helium gas properties – uses. - GTAW Defects, causes and remedy.
42	• Perform Aluminium & MS pipe joint by GTAW in flat position.	GTAW -07	94. Pipe butt joint on Aluminium pipe Ø 50 mm x 3 mm WT in Flat position. **(1G)** (25 hrs.)	- Friction welding process- equipment and application - Laser beam welding (LBW)and Electron beam welding(EBW)
43	• Perform Aluminium & MS pipe joint by GTAW in flat position. • Set the Plasma Arc cutting machine and cut ferrous & non-ferrous metals.	GTAW -08 PAC-01	95. "T" Joints on MS Pipe Ø 50 mm OD x 3 mm WT, position – Flat **(1F)** (15 hrs.) 96. Straight cutting on ferrous and non ferrous (10 hrs.)	- Plasma Arc Welding (PAW) and cutting (PAC) process – equipments and principles of operation. - Types of Plasma arc, advantages and applications.
44	• Set the resistance spot welding machine and join MS & SS sheet.	RW-01 RW-02	97. Lap joint on Stainless steel sheet by Resistance Spot welding (10 hrs.) 98. MS sheets joining by Resistance Spot welding (15 hrs.)	- Resistance welding process - types, principles, power sources and welding parameters. - Applications and limitations.
45	• Perform joining of different similar and dissimilar metals by brazing operation as per standard procedure. *[different*	OAW-01 OAW-02	99. Square butt joint on Copper sheet 2mm thick in flat position. **(1G)** (15 hrs.) 100. "T" joint on Copper to MS sheet	- Metalizing – types of metalizing principles, equipments, advantages and applications - Manual Oxy – acetylene powder coating process- principles of operation and applications

	similar and dissimilar metals- Copper, MS, SS]		2mm thick in flat position by Brazing **(1F)** (10 hrs.)	
46	-do-	OAW-03 OAW-04	101. Silver brazing on S.S Sheet with copper sheet "T" joint. (10 hrs.) 102. Silver brazing on copper tube to tube. (15 hrs.)	- Welding codes and standards - Reading of assembly drawing - Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR)
47	• Repair Cast Iron machine parts by selecting appropriate welding process. *[Appropriate welding process- OAW, SMAW]* • Hard facing of alloy steel components / MS rod by using hard facing electrode	OAW - 05 SMAW-01 SMAW-02	103. Repair welding of broken C.I. machine parts by oxy-acetylene welding with C.I and bronze filler rod. (10 hrs.) 104. Repair welding of broken C.I machine parts by C.I. electrode. (8 hrs.) 105. Hard surfacing practice on M.S round rod Ø 25 mm by using Hard facing electrode in flat position. (7 hrs.)	- Hard facing/ surfacing necessity, surface preparation, various hard facing alloys and advantages of hard facing.
48-49	**In-plant training / Project work** **Broad area:** a) Universal welding manipulator b) Metal rack c) Cylinder trolley with chain provision for locking d) Welding fixture for TIG- butt/ corner joint with purging facility			
50-51	**Revision**			
52	**Examination**			

Abbreviations:

SMAW - Shielded Metal Arc Welding
OAW - Oxy-Acetylene Gas Welding
OAGC - Oxy-Acetylene Gas Cutting
GMAW - Gas Metal Arc Welding
GTAW - Gas Tungsten Arc Welding
PAC - Plasma Arc Cutting
RW - Resistance Welding
I&T - Inspection & Testing
WT - Wall Thickness.

Note: -

1. *Some of the sample project works (indicative only) are given at the mid and end of each year.*
2. *Instructor may design their own project and also inputs from local industry may be taken for designing such new project.*
3. *The project should broadly covered maximum skills in the particular trade and must involve some problem solving skill. Emphasis should be on Teamwork: Knowing the power of synergy/ collaboration, Work to be assigned in a group (Group of at least 4 trainees). The group should demonstrate Planning, Execution, Contribution and application of Learning. They need to submit Project report.*
4. *If the instructor feels that for execution of specific project more time is required then he may plan accordingly in appropriate time during the execution of normal trade practical.*
5. *More emphasis to be given on video/real-life pictures during theoretical classes. Some real-life pictures/videos of welded items like boiler drum, ship building, heavy welded structures etc., may be shown to the trainees to give a feel of Industry and their future assignment.*

9. SYLLABUS - CORE SKILLS

9.1 WORKSHOP CALCULATION SCIENCE & ENGINEERING DRAWING

Duration: One Year		
S No.	**Workshop Calculation and Science**	**Engineering Drawing**
1.	**Unit**: Systems of unit- FPS, CGS, MKS/SI unit, unit of length, Mass and time, Conversion of units	Engineering Drawing: Introduction and its importance - Relationship to other technical drawing types - Conventions - Viewing of engineering drawing sheets. - Method of Folding of printed Drawing Sheet as per BIS SP:46-2003
2.	**Fractions** : Fractions, Decimal fraction, L.C.M., H.C.F., Multiplication and Division of Fractions and Decimals, conversion of Fraction to Decimal and vice versa. Simple problems using Scientific Calculator.	Drawing Instruments : their Standard and uses - Drawing board, T-Square, Drafter (Drafting M/c), Set Squares, Protractor, Drawing Instrument Box (Compass, Dividers, Scale, Diagonal Scales etc.), Pencils of different Grades, Drawing pins / Clips.
3.	**Ratio & Proportion** : Simple calculation on related problems.	Lines : - Definition, types and applications in Drawing as per BIS SP:46-2003 - Classification of lines (Hidden, centre, construction, Extension, Dimension, Section) - Drawing lines of given length (Straight, curved) - Drawing of parallel lines, perpendicular line - Methods of Division of line segment
4.	**Percentage**: Introduction, Simple calculation. Changing percentage to fraction and decimal & vice-versa.	Free hand drawing of - Lines, polygons, ellipse, etc. - geometrical figures and blocks with dimension - Transferring measurement from the given object to the free hand sketches.

5.	**Material Science** : properties - Physical & Mechanical, Types – Ferrous & Non-Ferrous, difference between Ferrous and Non-Ferrous metals, introduction of Iron, Cast Iron, Wrought Iron, Steel, difference between Iron and Steel, Alloy steel, carbon steel, stainless steel, Non-Ferrous metals, Non-Ferrous Alloys.	Lettering and Numbering as per BIS SP46-2003: - Single Stroke, Double Stroke, inclined, Upper case and Lower case.
6.	**Mass, Weight and Density**: Mass, Unit of Mass, Weight, difference between mass and weight. Density, unit of density. Relation between mass, weight & density. Simple problems related to mass, weight, and density.	Drawing of Geometrical Figures: Definition, nomenclature and practice of : - - Angle: Measurement and its types, method of bisecting. - Triangle -different types - Rectangle, Square, Rhombus, Parallelogram. - Circle and its elements.
7.	**Work, Power and Energy**: work, unit of work, power, unit of power, Horse power of engines, mechanical efficiency, energy, use of energy, potential and kinetic energy, examples of potential energy and kinetic energy.	Sizes and Layout of Drawing Sheets - Basic principle of Sheet Size - Designation of sizes - Selection of sizes - Title Block, its position and content - Borders and Frames (Orientation marks and graduations) - Grid Reference - Item Reference on Drawing Sheet (Item List)
8.	-----	Method of presentation of Engineering Drawing - Pictorial View - Orthographic View - Isometric view
9.	------	Symbolic Representation used in the related trade (as per BIS SP:46-2003) of : - Fastener (Rivets, Bolts and Nuts) - Bars and profile sections - Weld, brazed and soldered joints. - Electrical and electronics element - Piping joints and fittings
10.	**Basic Algebra**: Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	**Dimensioning practice:** - Position of dimensioning (unidirectional, aligned, as per BIS SP:46-2003) - Types of arrowhead

		- Leader Line with text - Symbols preceding the value of dimension and dimensional tolerance.
11.	**Mensuration :** Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle, Volume of solids – cube, cuboid, cylinder and Sphere. Surface area of solids – cube, cuboid, cylinder and Sphere.	Drawing of Solid figures (Cube, Cuboids, Cone, Prism, Pyramid, Frustum of Cone and Pyramid.) with dimensions.
12.	**Trigonometry:** Trigonometrical ratios, measurement of angles. Trigonometric tables	Free hand Drawing of Solid figures (Prism, Pyramid, Frustum of Cone and Pyramid.) with dimensions.
13.	**Elasticity:** Elastic & Plastic material. Stress & strain and their units. Young's modules. Ultimate stress and breaking stress.	Free Hand sketch of hand tools and measuring tools used in respective trades.
14.	**Heat & Temperature**: Heat and temperature, their units, difference between heat and temperature, boiling point, melting point, Scale of temperature, relation between different scale of temperature. Thermometer, pyrometer. Transmission of heat, conduction, convection, radiation.	**Projections:** - Concept of axes plane and quadrant. - Orthographic projections - Method of first angle and third angle projections (definition and difference) - Symbol of First angle and 3rd angle projection as per IS specification.
15.	**Basic Electricity**: Introduction, use of electricity, how electricity is produced, Types of current_ AC, DC, their comparison, voltage, resistance, their units. Conductor, insulator, Types of connections – series, parallel, electric power, Horse power, energy, unit of electrical energy. - Electrical insulating materials. - Basic concept of earthing.	Drawing of Orthographic projection in 3rd angle.

16.	- Area of irregular surfaces. - Application related to shop problems.	Free hand Drawing of simple fastener (Rivet, Bolts, Nuts & Screw)
17.	- Material weight and cost problems related to trade.	Free hand sketching of simple objects related to trade.
18.	- Temperature measuring instruments. Specific heats of solids & liquids.	- Riveted joints-Butt & Lap (Drawing one for each type).
19.	- Thermal Conductivity, Heat loss and heat gain.	- Reading of drawing. Simple exercises related to missing lines, dimensions. How to make queries.
20.	- Heat treatment and advantages.	- Simple exercises relating missing symbols. - Missing views
21.	----------	- Concept of preparation of assembly drawing and detailing. Preparation of simple assemblies & their details of trade related job/exercises with the dimensions from the given sample or models.
22.	----------	Reading of fabricated engineering drawing

9.2 EMPLOYABILITY SKILLS

Duration: 110 Hrs.	
1. English Literacy	**Duration : 20 Hrs. Marks : 09**
Pronunciation	Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech)
Functional Grammar	Transformation of sentences, Voice change, Change of tense, Spellings.
Reading	Reading and understanding simple sentences about self, work and environment
Writing	Construction of simple sentences Writing simple English
Speaking / Spoken English	Speaking with preparation on self, on family, on friends/ classmates, on know, picture reading gain confidence through role-playing and discussions on current happening job description, asking about someone's job habitual actions. Cardinal (fundamental) numbers ordinal numbers. Taking messages, passing messages on and filling in message forms Greeting and introductions office hospitality, Resumes or curriculum vita essential parts, letters of application reference to previous communication.
2. I.T. Literacy	**Duration : 20 Hrs. Marks : 09**
Basics of Computer	Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer.
Computer Operating System	Basics of Operating System, WINDOWS, The user interface of Windows OS, Create, Copy, Move and delete Files and Folders, Use of External memory like pen drive, CD, DVD etc, Use of Common applications.
Word processing and Worksheet	Basic operating of Word Processing, Creating, opening and closing Documents, use of shortcuts, Creating and Editing of Text, Formatting the Text, Insertion & creation of Tables. Printing document. Basics of Excel worksheet, understanding basic commands, creating simple worksheets, understanding sample worksheets, use of simple formulas and functions, Printing of simple excel sheets.
Computer Networking and Internet	Basic of computer Networks (using real life examples), Definitions of Local Area Network (LAN), Wide Area Network (WAN), Internet, Concept of Internet (Network of Networks), Meaning of World Wide Web (WWW), Web Browser, Web Site, Web page and Search Engines. Accessing the Internet using Web Browser,

	Downloading and Printing Web Pages, Opening an email account and use of email. Social media sites and its implication. Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT - ACT, types of cyber crimes.
3. Communication Skills	**Duration : 15 Hrs.** **Marks : 07**
Introduction to Communication Skills	Communication and its importance Principles of Effective communication Types of communication - verbal, non verbal, written, email, talking on phone. Non verbal communication -characteristics, components-Para-language Body language Barriers to communication and dealing with barriers. Handling nervousness/ discomfort.
Listening Skills	Listening-hearing and listening, effective listening, barriers to effective listening guidelines for effective listening. Triple- A Listening - Attitude, Attention & Adjustment. Active Listening Skills.
Motivational Training	Characteristics Essential to Achieving Success. The Power of Positive Attitude. Self awareness Importance of Commitment Ethics and Values Ways to Motivate Oneself Personal Goal setting and Employability Planning.
Facing Interviews	Manners, Etiquettes, Dress code for an interview Do's & Don'ts for an interview.
Behavioral Skills	Problem Solving Confidence Building Attitude
4. Entrepreneurship Skills	**Duration : 15 Hrs.** **Marks : 06**
Concept of Entrepreneurship	Entrepreneur - Entrepreneurship - Enterprises:-Conceptual issue Entrepreneurship vs. management, Entrepreneurial motivation. Performance & Record, Role & Function of entrepreneurs in relation to the enterprise & relation to the economy, Source of business ideas, Entrepreneurial opportunities, The process of setting up a business.
Project Preparation &	Qualities of a good Entrepreneur, SWOT and Risk Analysis. Concept &

Marketing analysis	application of PLC, Sales & distribution Management. Different Between Small Scale & Large Scale Business, Market Survey, Method of marketing, Publicity and advertisement, Marketing Mix.
Institutions Support	Preparation of Project. Role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non financing support agencies to familiarizes with the Policies /Programmes & procedure & the available scheme.
Investment Procurement	Project formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment procedure - Loan procurement - Banking Processes.
5. Productivity	**Duration : 10 Hrs.** **Marks : 05**
Benefits	Personal / Workman - Incentive, Production linked Bonus, Improvement in living standard.
Affecting Factors	Skills, Working Aids, Automation, Environment, Motivation - How improves or slows down.
Comparison with developed countries	Comparative productivity in developed countries (viz. Germany, Japan and Australia) in selected industries e.g. Manufacturing, Steel, Mining, Construction etc. Living standards of those countries, wages.
Personal Finance Management	Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and Insurance.
6. Occupational Safety, Health and Environment Education	**Duration : 15 Hrs.** **Marks : 06**
Safety & Health	Introduction to Occupational Safety and Health importance of safety and health at workplace.
Occupational Hazards	Basic Hazards, Chemical Hazards, Vibroacoustic Hazards, Mechanical Hazards, Electrical Hazards, Thermal Hazards. Occupational health, Occupational hygienic, Occupational Diseases/ Disorders & its prevention.
Accident & safety	Basic principles for protective equipment. Accident Prevention techniques - control of accidents and safety measures.
First Aid	Care of injured & Sick at the workplaces, First-Aid & Transportation of sick person.
Basic Provisions	Idea of basic provision legislation of India. safety, health, welfare under legislative of India.
Ecosystem	Introduction to Environment. Relationship between Society and Environment, Ecosystem and Factors causing imbalance.

Pollution	Pollution and pollutants including liquid, gaseous, solid and hazardous waste.
Energy Conservation	Conservation of Energy, re-use and recycle.
Global warming	Global warming, climate change and Ozone layer depletion.
Ground Water	Hydrological cycle, ground and surface water, Conservation and Harvesting of water.
Environment	Right attitude towards environment, Maintenance of in -house environment.
7. Labour Welfare Legislation	**Duration : 05 Hrs.** **Marks : 03**
Welfare Acts	Benefits guaranteed under various acts- Factories Act, Apprenticeship Act, Employees State Insurance Act (ESI), Payment Wages Act, Employees Provident Fund Act, The Workmen's compensation Act.
8. Quality Tools	**Duration : 10 Hrs.** **Marks : 05**
Quality Consciousness	Meaning of quality, Quality characteristic.
Quality Circles	Definition, Advantage of small group activity, objectives of quality Circle, Roles and function of Quality Circles in Organization, Operation of Quality circle. Approaches to starting Quality Circles, Steps for continuation Quality Circles.
Quality Management System	Idea of ISO 9000 and BIS systems and its importance in maintaining qualities.
House Keeping	Purpose of House-keeping, Practice of good Housekeeping.
Quality Tools	Basic quality tools with a few examples.

ANNEXURE-I

LIST OF TOOLS AND EQUIPMENT			
WELDER (For batch of 20 Candidates)			
S No.	**Name of the Tools & Equipment**	**Specification**	**Quantity**
A. TRAINEES TOOL KIT (For each additional unit trainees tool kit Sl. 1-15 is required additionally)			
1.	Welding helmet fiber		*20 Nos.
2.	Welding hand shield fiber		*20 Nos.
3.	Chipping hammer	with metal handle 250 Grams	*20 Nos.
4.	Chisel cold	flat 19 mm x 150 mm	*20 Nos.
5.	Centre punch	9 mm x 127 mm	*20 Nos.
6.	Dividers	200 mm	*20 Nos.
7.	Stainless steel rule	300mm	*20 Nos.
8.	Scriber	150 mm double point	*20 Nos.
9.	Flat Tongs	350mm long	*20 Nos.
10.	Hack saw frame	fixed 300 mm	*20 Nos.
11.	File half round	bastard 300 mm	*20 Nos.
12.	File flat	350 mm bastard	*20 Nos.
13.	Hammer ball pane	1 kg with handle	*20 Nos.
14.	Tip Cleaner		*20 Nos.
15.	Try square	6”	*20 Nos.
B. INSTRUMENTS AND GENERAL SHOP OUTFIT - For 2 (1+1) units no additional items are required			
TOOLS & EQUIPMENT			
16.	Spindle key		4 Nos.
17.	Screw Driver	300mm blade and 250 mm blade	1 each
18.	Number punch	6 mm	2 set
19.	Letter punch	6 mm	2 set
20.	Magnifying glass	100 mm dia.	2 Nos.
21.	Universal Weld measuring gauge		2 Nos.
22.	Earth clamp	600A	6 Nos.
23.	Spanner D.E.	6 mm to 32mm	2 sets
24.	C-Clamps	10 cm and 15 cm	2 each
25.	Hammer sledge	double faced 4 kg	1 No.
26.	S.S tape	5 meters flexible in case	1 No.
27.	Electrode holder	600 amps	6 Nos.
28.	H.P. Welding torch	with 5 nozzles	2 sets
29.	Oxygen Gas Pressure	regulator double stage	2 Nos.

30.	Acetylene Gas Pressure	regulator double stage	2 Nos.
31.	CO_2 Gas pressure regulator	with flow meter	2 set
32.	Argon Gas pressure regulator	with flow meter	2 set
33.	Metal rack	182 cm x 152 cm x 45 cm	1 No.
34.	First Aid box		1 No.
35.	Steel lockers	with 8 Pigeon holes	2 Nos.
36.	Steel almirah / cupboard		2 Nos.
37.	Black board and easel with stand		1 No.
38.	Flash back arrester (torch mounted)		4 pairs
39.	Flash back arrester (cylinder mounted)		4 pairs
GENERAL SHOP OUTFIT			
40.	Welding Transformer	with all accessories (400A, OCV 60–100 V, 60% duty cycle)	1 set
41.	Welding Transformer (or) Inverter based welding machine	with all accessories (300A, OCV 60 – 100 V, 60% duty cycle)	1 set
42.	D.C Arc welding rectifiers set with all accessories	(400 A. OCV 60 – 100 V, 60% duty cycle)	1 sets
43.	GMAW welding machine	400A capacity with air cooled torch, Regulator, Gas pre-heater, Gas hose and Standard accessories	1 set
44.	AC/DC GTAW welding machine	with water cooled torch 300 A, Argon regulator, Gas hose, water circulating system and standard accessories.	1 set
45.	Air Plasma cutting equipment	with all accessories, capacity to cut 12 mm clear cut	1 set
46.	Air compressor suitable for above air plasma cutting system.		1 No.
47.	Auto Darkening Welding Helmet		2 Nos.
48.	Spot welding machine	15 KVA with all accessories	1 set
49.	Portable gas cutting machine	capable of cutting Straight & Circular with all accessories	1 set
50.	Pedestal grinder fitted with coarse and medium grain size grinding wheels	300 mm dia.	1 No.
51.	Bench grinder fitted with fine grain size silicon carbide green grinding wheel	150 mm dia.	1 No.
52.	AG 4 Grinder		2 Nos.

53.	Suitable gas welding table	with fire bricks	2 Nos.
54.	Suitable Arc welding table	with positioner	6 Nos.
55.	Trolley for cylinder (H.P. Unit)		2 Nos.
56.	Hand shearing machine capacity	cut 6 mm sheets and flats	1 No.
57.	Power saw machine	14''	1 No.
58.	Portable drilling machine	(Cap. 6 mm)	1 No.
59.	Oven, electrode drying	0 to 350°C, 10 kg capacity	1 No.
60.	Work bench	340x120x75 cm with 4 bench vices of 150 mm jaw opening	4 sets
61.	Oxy Acetylene Gas cutting blow pipe		2 sets
62.	Oxygen, Acetylene Cylinders **		2 each
63.	CO_2 cylinder **		2 Nos.
64.	Argon gas cylinder **		2 Nos.
65.	Anvil 12 sq. inches working area with stand		1 No.
66.	Swage block		1 No.
67.	Die penetrant testing kit		1 set
68.	Magnetic particle testing Kit #		1 set
69.	Fire extinguishers (foam type and CO_2 type)		1. No.
70.	Fire buckets with stand		4 Nos.
71.	Portable abrasive cut-off machine		1 No.
72.	Suitable Gas cutting table		1 No.
73.	Welding Simulators for SMAW/GTAW/GMAW		1 each (Optional)
C. CONSUMABLE			
74.	Leather Hand Gloves	14"	*20 pairs.
75.	Cotton hand Gloves	8"	*20 pairs
76.	Leather Apron leather		*20 Nos.
77.	S.S Wire brush	5 rows and 3 rows	*20 Nos. each
78.	Leather hand sleeves	16"	*20 pairs
79.	Safety boots for welders		*20 pairs
80.	Leg guards leather		*20 pairs
81.	Rubber hose clips	½"	*20 Nos.
82.	Rubber hose oxygen	8 mm dia X 10 Mtr. long as per BIS	2 Nos.
83.	Rubber hose acetylene	8 mm dia X 10 Mtr. long as per BIS	2 Nos.
84.	Arc welding cables multi cored copper	400/ 600 amp as per BIS	45 mts. each
85.	Arc welding single coloured glasses	108 mm x 82 mm x 3 mm. DIN 11A &12 A	34 Nos.

86.	Arc welding plain glass	108 mm x 82 mm x 3 mm.	68 Nos.
87.	Gas welding Goggles	with Colour glass 3 or 4A DIN	34 Nos.
88.	Safety goggles plain		34 Nos.
89.	Spark lighter		6 Nos.
90.	AG 4 Grinding wheels		10 Nos.
D. CLASS ROOM FURNITURE FOR TRADE THEORY			
91.	Instructor's table and Chair (Steel)		1 set
92.	Students chairs with writing pads		*20 Nos.
93.	White board	size 1200mm X 900 mm	1 No.
94.	Instructors lap top with latest (vista & above) configuration pre-loaded with operating system and MS Office package.		1 No.
95.	LCD projector with screen.		1 No.
96.	Welding Process, Inspection & codes DVD/ CDs		1 set each (optional)
E. TOOLS & EQUIPMENT FOR ENGINEERING DRAWING HALL			
97.	Drawing Board		20 Nos.
98.	Models : Solid & cut section		as required
99.	Table for trainees		20 Nos.
100.	Stool for trainees		20 Nos.
101.	Cupboard (big)		1 No.
102.	White Board	size: 8ft. x 4ft.	1 No.
103.	Trainer's Table		1 No.
104.	Trainer's Chair		1 No.

Note:

1. *** Optionally Gas cylinders can also be hired as and when required.*
2. *Quantity marked with * has been increased as per the batch size.*
3. *Internet facility is desired to be provided in the class room.*
4. *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.*
5. *# One machine per institute irrespective of number of units of welding trade is necessary.*

TOOLS & EQUIPMENT FOR EMPLOYABILITY SKILLS		
S. No.	**Name of the Equipment**	**Quantity**
1.	Computer (PC) with latest configurations and Internet connection with standard operating system and standard word processor and worksheet software	10 Nos.
2.	UPS - 500Va	10 Nos.
3.	Scanner cum Printer	1 No.
4.	Computer Tables	10 Nos.
5.	Computer Chairs	20 Nos.
6.	LCD Projector	1 No.
7.	White Board 1200mm x 900mm	1 No.
Note: - Above Tools & Equipment are not required, if Computer LAB is available in the institute.		

ANNEXURE-II

FORMAT FOR INTERNAL ASSESSMENT

Name & Address of the Assessor:		**Year of Enrollment:**
Name & Address of ITI (Govt./Pvt.):		**Date of Assessment:**
Name & Address of the Industry:		**Assessment location: Industry / ITI**
Trade Name:	**Examination:**	**Duration of the Trade/course:**
Learning Outcome:		

S No.	Candidate Name	Father's/Mother's Name	Safety Consciousness (15)	Workplace Hygiene & Economical use of materials (5)	Attendance/ Punctuality (10)	Ability to follow Manuals/ Written instructions (5)	Application of Knowledge (10)	Skills to Handle Tools/ Equipment/ Instruments/ Devices (10)	Economical use of Materials (5)	Working Strategy (10)	Quality in Workmanship/ Performance (15)	VIVA (15)	**Total Internal Assessment Marks**	**Result (Y/N)**
Maximum Marks (Total 100 Marks)			**15**	**5**	**10**	**5**	**10**	**10**	**5**	**10**	**15**	**15**		
1														
2														