

SYLLABUS OF SEMESTER SYSTEM
FOR THE TRADE OF

REFRACTORY TECHNICIAN

SEMESTER PATTERN

Under

Craftsmen Training Scheme (CTS)
(Two years/Four Semesters)

Revised in
2014

By
Government of India
Ministry of Labour & Employment (DGE&T)

GENERAL INFORMATION

- 1. Name of the Trade** : **Refractory Technician**
- 2. N.C.O. Code**
- 3. Duration of Training** : Two years (Four semesters each of six months duration).
- 4. Power Norms** : 13.6 KW
- 5. Space Norms** : 130 Sq. mt. (Max L:B: :2:1)
- 6. Entry Qualification** : Passed 10th Class with Science and Mathematics under 10+2 system of Education or its equivalent
- 7. Trainees per unit** : 16 (Supernumeraries/Ex-Trainee allowed: 5)
- 8a. Qualification for Instructors** : Degree in Mechanical/Ceramic/Metallurgy Engineering from recognized university with one year post qualification experience in the relevant field.
OR
Diploma in Mechanical /Ceramic/Metallurgy Engineering from a recognized board of technical education with two year post qualification experience in the relevant field.
OR
NTC/NAC passed in same trade with 3 years post qualification experience.
- 8b. Desirable Qualification** : Preference will be given to a candidate with Craft Instructor certificate (CIC) in **Refractory Technician Trade**.

Note:

- (i) Out of two Instructors required for the unit of 2(1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications.
- (ii) Instructor qualification for WCS and E.D, as per the training manual.

Distribution of training on Hourly basis:

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

COURSE INFORMATION

1. Introduction:

- This course is meant for the candidates who aspire to become a professional Refractory Technician.

2. Terminal Competency/Deliverables:

After successful completion of this course the trainee shall be able to perform the following skills with proper sequence:

1. The trainees can work in the industry as semi-skilled Refractory Technician.
2. The trainee can work in the field of steel industry, Foundry observing safety precautions.
3. The trainees can work on Dismantle & assemble of Refractory liner.

3. Employment opportunities:

On successful completion of this course, the candidates shall be gainfully employed in the following industries:

1. Production & Manufacturing industries.
2. Service industries like Railways.
3. Defence organisations
4. In public sector industries like BHEL, BEML, SAIL, BFL, etc and private industries in India & abroad.

4. Further learning pathways:

- On successful completion of the course trainees can pursue Apprenticeship training in the reputed Industries / Organizations.
- On successful completion of the course trainees can opt for Diploma course (Lateral entry).

SYLLABUS FOR THE TRADE OF REFRACTORY TECHNICIAN

First Semester

(Semester Code no. RFC - 01)

Duration : Six Month

WEEK NO.	TRADE PRACTICAL	TRADE THEORY
1.	<p>Importance of trade training, List of tools & Machinery used in the trade. Health & Safety: Introduction to safety equipments and their uses. Introduction of first aid, operation of Electrical mains.</p> <p>Occupational Safety & Health Importance of housekeeping & good shop floor practices. Health, Safety and Environment guidelines, legislations & regulations as applicable. Disposal procedure of waste materials like cotton waste, metal chips/burrs etc. Basic safety introduction, Personal protective Equipments(PPE):- Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message. Preventive measures for electrical accidents & steps to be taken in such accidents. Use of Fire extinguishers.</p>	<p>Importance of safety and general precautions observed in the in the industry/shop floor. All necessary guidance to be provided to the new comers to become familiar with the working of Industrial Training Institute system including stores procedures. Soft Skills: its importance and Job area after completion of training. Introduction of First aid. Operation of electrical mains. Introduction of PPEs. Introduction to 5S concept & its application. Response to emergencies eg; power failure, fire, and system failure.</p>
2&3	<p>Use of vice clamps, holding the job in the vice and practice of metal sawing with hacksaw and filing the edges maintaining squareness of all the faces. Marking practice using hermaphrodite caliper, surface gauge, engineers" try square, marking off table etc. Marking out lines, gripping suitably in the vice jaw, hacksawing to given dimensions, sawing different sections. Filing flat surface and checking the flatness and squareness with engineers" try square. Filing four edges, checking all dimensions with outside caliper and steel rule.</p>	<p>Description, construction and uses of different hand tools such as files, chisels, hacksaw & hammer etc. Description, construction and uses of different marking tools such as steel rule, caliper, punches, v-block, scribing block etc. Description construction and uses of different job holding devices. Common hand tools, such as:- Steel rule, types of rules and their use. Divides, Calipers, Centre punch, Dot punch, Prick punch, their description and use. Different types of hammers and their use. "V" Block and marking off table Bench vice, types, use, care and maintenance, vice clamp, hacksaw frame and blade, their types, uses. Method of sawing</p>

4.	Marking of straight, arcs and parallel lines with odd leg calipers, scribing block and steel rule. Marking practice with divider. (Circles, arcs and parallel lines). Chipping flat surfaces along a marked line. Finding and marking centre line of cylindrical system, with the help of “spirit level and plumb”.	Scribing block, Chisel – types, metal and use. Marking block and uses. Surface plates, parallel block, angle plate and Trammel. Surface plate, its use, care and maintenance. Use of Spirit level.
5.	Drilling of various sizes of holes on a MS plate. Tapping of different sizes tapped holes on drilled job.	Types of drill bits and parts. Method of drill grinding, cutting angle, defects in drilling and its remedy. Drill chuck and its use. Drilling Process: Types of drilling machines and their use. Taps and Tapping: Types, parts, formula for tapped hole, method of cutting thread with tap. Tap handle, method of extract a broken tap.
6.	Measurement of different dimensions using Vernier height gauge, vernier caliper and micrometer.	Vernier height gauge, vernier caliper its least count, use, care and maintenance. Outside and inside micrometer. Its reading least count, use, care and maintenance. Gauge and indication classification. Types of gauges and their use. Use of slip gauge. Ringing action. Working principle of dial gauge.
7.	Forging: - Preparation of hearth. Making of centre punch Making of flat chisel. Making of screwdriver.	Blacksmith and Forging/Heat treatment: Forge types and uses. Forge tools. Forging operations such as: Marking, Cutting, Drawing out, Jumping, Bending, Punching, Setting down and Forge welding.
8.	Practice on pneumatics tools like jack hammer, rammer & pressure gauge.	Basics of hydraulics & pneumatics.
9.	Sheet metal work: Cutting various types of Geometrical shapes. Use of flat scraper to make the surface even of a dove tail fitting.	Sheet metal work: Introduction, sheet metal hand tools, shears, sheet metal bench tools such as vice and machine tools. Scrapers: Types, method of scraping, Precautions during scraping operation.
10.	Practice on all types of gauges.	Gauge and indication classification. Types of gauges and their use. Use of slip gauge. Ringing action. Working principle of dial gauge. Sine bar. Method of measuring with a sine bar.
11.	Practice on different types of fitting joints.	Fasteners: Kinds of fastening Bolts, their types and uses, Nuts, their types and uses, Washers, types and uses, Screws, Key and Key way, types and uses. Studs. Pins and cutters.
12.	Welding (Arc), Striking straight beads left to right and right to left. Square butt joint. Lap Joint.	Arc welding process: Welding method, welding machines, electrode, coding, polarity, edge preparation, types of welding joints and beads.
13.	“T” Joint and Corner joint.	Arc welding process: Welding method, welding

		machines, electrode, coding, polarity, edge preparation, types of welding joints and beads.
14.	Gas cutting and Gas welding. Cutting of straight and curved metal pieces. Fusion runs on a M.S. Sheet. Left to Right and Right to Left.	Gas welding methods: Oxy-acetylene welding, Flames, Gas and Arc welding tools, Oxygen and Acetylene cylinder, Gas regulator, Gas welding equipments, back ward and right ward welding. Welding positions.
15.	Use of dies and making of external threads on various dia MS rods and fit the threaded rods on previous tapped holes.	Dies and dieing: Types of dies, die handle, method of using a die. Reamer parts, kinds of reamer, stud extraction
16.	Pipe fitting: Threading of pipes with the use of pipe die. Use of different types of pipe fittings.	Pipe and pipe fittings: Introduction. Different types of pipes, Pipe Accessories, G.I Pipe accessories, Tools and signs (symbols) of pipe fitting.
17.	Measurement of AC, DC by using multimeter. Measurement of AC voltage using step up & step down transformer. Measurement of resistance, Voltage & current.	Fundamental of AC & DC, voltmeter, ammeter, ohm meter, transducer and sensors. Principle of magnetic induction (Self & mutual), Electric passive component – resistor, capacitor & inductor.
18-19	Demonstration&Practice of various types of refractories.	<p>What is refractory. Classification of refractory. Properties of refractories.</p> <p>Bricks classification, chemical composition and its application area wise , insulation , Bricks expansion material (ceramic fiber, Hysil block etc..),</p> <p><u>Different Shapes:</u></p> <ul style="list-style-type: none"> ➤ Regular Straight shapes. ➤ Side Arch Shape. ➤ End Arch Shape. ➤ Key and Mini key Shape. ➤ Semi Universal Shape. ➤ Circular Bricks. Skewback Shape. ➤ Checkers Bricks. <p>Other refractory product like castable, motar etc.</p>
20.	Practice on operation of water spray gun, vacuum sweepers, Dry fog nozzles, water sprinkler etc. Demonstration&practice on prevention of various health hazards.	Safety and environment measures. Major forms of pollution in refractory industry. Sources of pollution & various control techniques. Occupational health hazards and its control. Different hazards in refractory industry. Prevention of occupational diseases.
21.	Practice on handling various fuels. Operation & maintenance of Producer gas plant.	<p>Types of fuel used in refractory industry:</p> <ul style="list-style-type: none"> • Coal • Coke • Producer Gas • Furnace oil • LPG <p>Safety & occupational hazard aspect in handling Producer gas plant.</p>
23&24	Revision	
25	Examination	

SYLLABUS FOR THE TRADE OF REFRACTORY TECHNICIAN

Second Semester

(Semester Code no. RFC- 02)

Duration: Six Month

WEEK NO.	TRADE PRACTICAL	TRADE THEORY
1.	Demonstration&practice of different raw material & handling of same.	Different raw materials used in manufacturing refractory & their basic physical & chemical properties.
2.	Demonstration&practice on quality control.	Quality assurance, Definition & importance of Quality control, quality circle. Basic Concept of 5S, Kaizen, TPM, TQM & ISO 9000.
3-4.	Demonstrate&practice different manufacturing processes at plant/video demonstration.	Different processes involved in refractory. a) Crushing, Grinding and Sieving b) Batching & mixing c) Hand moulding d) Pressing e) Vibro casting f) Drying g) Firing h) Physical checking
5-7.	Demonstration&practice on Sieve Analysis of different grain size. Identification of parts of mixing machine & operation of mixing ma/c. Practice on changing /adjusting scrapper, Adjustment of roller height.. Checking consistency of mixed material and workability.	Crushing & grinding: Knowledge of adjustment for fineness of the output. Various types/parts of Mixing machine. Maintenance of mixing machines. Mixing sequence of different quality mixtures. Physical check of mixture to ensure completion of mixing. Unloading of mixture to bucket. and moisture content of mixture.
8-10.	Practice on weighing of material, filling the mould & operating the pressing(Mechanical & Hydraulic) and gauging of the bricks. Physical inspection of bricks for cracks, lamination & wrecks, warpage. Checking of bulk density of bricks. Practice on operation /monitoring parameters of press.(Manul/Hydraulic)	Moulding and pressing: Types of press & sequence of operation of press machine. Press capacity linked with bulk density. Different defects, identification & reporting.
11.	Segregation, Sizes, Edges & corner and any other physical defects.	Shaping/Moulding methods. The various processes of shaping/moulding and their limitation. The process of release from mould and handling of bricks to prevent damage. Pre weighing of mixture for consistent

		product.
12-13.	Demonstration/practice on drying of bricks. Practice on dryers.	Drying of bricks. The objectives of drying Classification of dryers. The various dryers used in refractory industries and the process involved in these.
14.	Demonstration/practice of different temperature measuring instrument. Reading of temperature. Practice on preventive maintenance.	Temperature, Measurement & instruments used in measuring temperature. Thermocouple & its application in measuring temperature (Pyrometer). Maintenance system. Types of maintenance. Importance of preventive maintenance. Preventive maintenance steps on various plant & machinery.
15-17.	Observation and practice on loading/unloading, drying schedule, monitoring of firing schedule. Physical Inspection of finished product. Practice on loading/unloading of bricks.	Types of kilns for calcinations of raw materials. Different zones of kiln, Fuel used in the kiln
18-20.	Practice on operation & maintenance of kiln. Practice on firing schedule.	Firing of bricks. Kilns for firing of refractory and loading pattern of bricks. Firing schedule & Maturing temperature. Different types of kilns used for firing of bricks. Tunnel kiln. Chamber kiln. Shuttle kiln. Down Draught (DD) kiln.
21.	Practice on brick checking. Demonstration waste utilization.	Checking of bricks after firing: Sizes, lamination / Cracks, Spongy / Segregation and Edge and corner breakage and other physical defects. <u>Waste Utilization:</u> Recycling of refractory. Control of dust and gasses leakage during the process. Efficient utilization of resources. Optimization of kiln loading Mill house. Operational discipline & control, Firing criteria.
22-23	Implant training / Project work (work in a team)	
24-25	Revision	
26	Examination	

SYLLABUS FOR THE TRADE OF REFRACTORY TECHNICIAN

Third Semester

(Semester Code no. RFC- 03)

Duration: Six Month

WEEK NO.	TRADE PRACTICAL	TRADE THEORY
1-2.	Demonstrate & practice different application method at plant/video demonstration.	Basic Application of monolithic refractory 1. Storage 2. Worksite 3. Equipment 4. Installation 5. Steel surface 6. Anchoring 7. Formwork / shuttering 8. Water quality 9. Mixing 10. Sampling 11. Vibrating / Rodding 12. Application 13. Joints in monolithics 14. Curing 15. Dry out 16. Criteria for acceptance Cracks 17. Defects and acceptance criteria 18. Inspection
3-4.	Brick cutting (m/c & hand), Brick joining.	Basic application of shaped refractory. Various Heat Treatment Processes – 1. Hardening 2. Normalizing 3. Tempering 4. Annealing 5. Case Carburizing
5.	Practice on fitting scaffolding.	Scaffolding. Purpose of scaffolding. Materials used in scaffolding & safety aspect in it.
6-8.	Practice with gunning machine, ramming, patching..	Gunning, Ramming, Shot crating, Patching, Coating, hot repair
9.	Demonstration on energy conservation. Practice on 5S.	Energy conservation. Concerns for energy conservation. Energy conservation drive. Areas of improvement. Best practices to be adopted for energy conservation.
10- 11.	Industry visit to get practical knowledge of kiln maintenance.	Maintenance of kilns. Preventive, Periodical & break down maintenance. Various parameters to be checked during maintenance. Melting practice of Pig Iron

		Melting practice of Grey Cast Iron.
12-13.	Familiarization & Identification of computer parts. Practice on computer for MS word, MS power point, MS Excel.	Introduction to computer basics: Basics of computer, MS word, MS power point, MS Excel. Report writing as per Proforma.
14 - 16.	Practice on packaging.	<u>Packaging of refractory :</u> Design of pallets. Pallet dimensions. Arrangement of loading of different shapes in the pallets. Outer packaging for container shipment. Stretch wrapping. Primary packing. Secondary packing. Final packing.
17 - 21.	Operation of brick cutting m/c , checking perpendicularity of lining using plumb, Mortar preparation , Monitoring thickness of mortar during installation, Demolition of existing/used lining. Use of leveling tool, Sprit level, water level. Use of wooden hammer for adjusting brick level. Measuring, cutting & Installation of Key brick. Practice on hand grinding. Use of brick holder & brick. Use of skew brick & Arch making, use of screw jack	Sorting tools <ul style="list-style-type: none"> • Hand tools to remove packing materials Survey tools <ul style="list-style-type: none"> • Levelling tools • Length level 2 m • Marking paint red Carpenter tools <ul style="list-style-type: none"> • Hammer; nails; wood; electric/handsaw Demolishing / wrecking <ul style="list-style-type: none"> • Wrecking Machine, wrecking hammers Brickwork tools <ul style="list-style-type: none"> -- Marking Pen -- Hammer; (metallic / rubber /wood) -- Buckets -- Rigging chisels -- Trowel for applying mortar -- Measuring tools (meter; stick; level; brick layer string -- Profiles; brick-layer string; -- Brick Cutting machine, (diamond saw) -- Level instrument; -- Paddle mixer for mixing mortar, -- Brick Laying Machine, /screw jack.
22-23	Implant training / Project work (work in a team)	
24-25	Revision	
26	Examination	

SYLLABUS FOR THE TRADE OF REFRACTORY TECHNICIAN

Fourth Semester

(Semester Code no. RFC- 04)

Duration: Six Month

Week No.	TRADE PRACTICAL	TRADE THEORY
1- 4.	<p>Opening & repair of vibrator needle, rammer, pneumatic breaker, replacement of chisel.</p> <p>Testing of water quality using litmus paper. Water temperature, quantity of mixing water, time of mixing, Lead time/measurement, Mixer operation, adjustment of scrapper & Cleaning mixer after use & preventive maintenance.</p> <p>Preparation & Fixing of shuttering, Checking Vibrator for capability, vibration time, Height of Castable for vibration, Roding practice.</p> <p>Sprinkling water on casted segment for natural/wet curing.</p> <p>Identifying & reporting physical defects after Dry out.</p>	<p>1 Storage</p> <p>2 Worksite</p> <p>3 Equipment</p> <p>4 Installation</p> <ul style="list-style-type: none"> - Steel surface - Anchoring - Formwork / shuttering - Water quality - Mixing - Sampling - Vibrating / Rodding - Application - Joints in monolithics <p>5 Curing</p> <p>6 Dry out</p> <p>7 Criteria for acceptance</p> <ul style="list-style-type: none"> - Cracks - Defects and acceptance criteria <p>8 Inspection</p>
5.	Demonstration on different parts of the furnaces.	<p><u>Application of refractory:</u></p> <p>Nomenclature of different parts of the furnaces. The industries of application of refractory:</p> <ul style="list-style-type: none"> • Iron & Steel • Aluminium & non-ferrous • Foundry • Cement • Thermal Power/Inclinators • Petrochemical/Refinery • Chemical/Fertilizer • Glass
6 - 7.	Practical training in the model workshop / fields.	<p>Iron & steel:-</p> <p>Hot metal transfer Ladle, Torpedo Ladles, Sponge iron kilns. Video/Visual display(audio visual display)</p> <p>Induction furnace, Electric Arc furnace, LD converter,</p>

		Ladles, Tundish.
8- 9.	Preparation of heating chart & report making.	Curing, Preheating/Dry out, tempering schedule/cycle of furnaces after refractory installation.
10-12.	Refractory lining practices.	Study of the refractory lining drawings.
13 - 14.	Refractory lining practices. Construction of vertical wall, brick laying, gunning, anchor welding, fixing of shuttering & formers, vibro casting, Ramming, Patching/Troweling, fettling(Construction/expansion joints)	Shaped & Unshaped refractory lining. Anchor types, Construction joints, Expansion joints.
15 - 16.	Practical training in the model workshop / fields.	Iron & steel: Slide gate fixing, Porous plug fixing, Fixing of CC refractories.
17.	Prepare different Types of documentation as per industrial need by different methods of recording information	Importance of Technical English terms used in industry –(in simple definition only)Technical forms, process charts, activity logs, in required formats of industry, estimation, cycle time, productivity reports, job cards
18- 20.	Demonstration & practice Tools, Tackles and Operation.	<u>Tools, Tackles and Operation:</u> Trainings : (Understanding different parts, function and operation), Gunning machine, Spray machine, Fixing devices – PP, SGP, CC Extraction devices – PP, SGP, CC; Pneumatic Rammer, Pencil Vibrator, Vibrating & Casting machines.
21.	-Do-	<u>Maintenance of Refractory lining. : Different types of refractory practices like LD converter, Laddle, Tundishes, Slide gate refractory, rotary kiln,Mills, Reheating furnace.</u> <u>Occupational Health Hazards and its control.</u> Types of hazards. Knowledge about hazardous materials in the process and how to handle them. Fundamental of fire and explosion and how to prevent fire. Identification of fire extinguisher. Metal safety data sheet (MSDS).
22-23	Implant training / Project work (work in a team)	
24-25	Revision	
26	Examination	

TRADE: REFRACTORY TECHNICIAN
LIST OF TOOLS & EQUIPMENTS

A : Trainee's Tool Kit:

Sl. No.	Name	Quantity
1	Steel Rule 12"	21Nos.
2	Hammer Ball Pin 0.45 Kg	21Nos.
3	Hammer Flat (optional)	21Nos.
4	Chisel Cold Flat 2cmX22Cm	21Nos.
5	File Flat 300 mm Bastered	21Nos.
6	File Flat 300 mm Second Cut	21Nos.
7	File Half Round Bastard 200 mm	21Nos.
8	Safety goggles	21Nos.
9	Goggles Furness, Antigua Around Heat Proof	21Nos.
10	Head wear anticoncusion Furness	05 Nos.
11	Pliers 20cm	21Nos.
12	Vice bench 12cm Jaw	21Nos.
13	Sledge Hammer 5kg	04 Nos.
14	Buckets 10 Ltr. Capacity	05 Nos.
15	Sprit level 150 mm	05 Nos.
16	Pocket steel Tape 1800mm long	21Nos.
17	Crow Bar 1500mm	02 Nos.
18	Screw Driver 300mm	21Nos.
19	Bench Grinder	02 Nos.
20	Hacksaw 30cm adjustable	21Nos.
21	Work Bench 2400mm x 1300mm x 800 mm	04 Nos.
22	Shovel	04 Nos.
23	Trammel	02 Nos.
24	Scriber	21Nos.
25	Calipers Odd leg	21Nos.
26	Caliper inside 150 mm	21Nos.
27	Centre Punch 150 mm	21Nos.
28	Trowels(Suare & triangle, 4nos. each)	08 Nos.
29	Measuring tape 2500mm	05 Nos.
30	Hand gloves Leather	21Nos.
31	Pliers 150mm	21Nos.
32	Screw driver 100mm	21Nos.
33	Tester	21Nos.

B. Tools & equipments for Production:

Sl. No.	NAME	Quantity
1*	Jaw crusher	1 No.
2*	Roller crusher	1 No.
3*	Ball Mill/Vibro mill	1 No.
4*	Sieves	5 Nos.
5*	Mixer machine	1 No.
6*	Press Machine	1 No.
7*	Dryer (Oven hot air)	1 No.
8*	Kiln	1 No.
9	Moulds(Different shapes)	2 each
10*	Drying furnace(Lab scale) Int. Vol.Im3	1 No.
11*	Rammer	1 No.
12	Air Compressor(5bar)	1 No.

C. Tools & equipments for Application:

Sl. No.	Name	Quantity
1	Brick cutting m/c with cutting wheel	5 Nos.
2	Stirrer	2 Nos.
3	Gunning machine	2 Nos.
4	Models for electric arc furnace	1 No.
5	Models for Basic Oxygen furnace	1 No.
6	Models for Rotary kiln	1 No.
7*	Ladle	1 No.
8*	Tundish	1 No.
9	Jack hammer with drill bits	1 No.
10	Vibrator with needle	2 Nos.
11	Spraying machine	2 Nos.

Note: - For the items marked ‘*’ MOU with a refractory manufacturing company may be done for imparting training to the trainees.

D. General Tools & Equipments:

Sl. No.	Name	Quantity
1	Spirit level	4 Nos.
2	Water level	4 Nos.
3	Wooden/aluminium rafter (optional)	2 Nos.
4	Plumb	5 Nos.
5	Masonry hammer	5 Nos.
6	Slide caliper	5 Nos.
8	Wooden hammer	5 Nos.
9	GI Pipe(2") with clamps for scaffolding	As required
10	Filler Gauge (Min 0.5mm – 5mm)	1 No.
11	Laser thermometer(Optional)	1 No.
12	Pyrometer	1 No.
13	Joint filler	1 No.
14	Chisel flat 20X200mm	5 Nos.
15	Pressure gauge	1 No.
17	Screw jack	1 No.
17	Weighing m/c(Min: 10 Kg)	1 No.
18	Wheel barrow	2 Nos.
19	MS pan	2 Nos.
20	Measuring flask	2 Nos.
21	Litmus paper	As required
22	Thermometer	1 No.
23	Stop watch	1 No.
24	Glass biker	1 No.
25	Star Delta starter	1 No.
26	Multimeter	2 Nos.
27	Voltmeter	2 Nos.
28	Flowmeter	2 Nos.
29	Vicat apparatus	1 No.
30	Piano wire/ Wire gauge pad (Optional)	2 nos.
31	Auto CAD software	1 No.
32	Hand saw	10 Nos.
33	Electric hand drill	1 No.
34	Micrometer (0-25, 25-50,50-75mm)	1 set each
35	Vernier calipers(0-200mm)(.02 discount)	1 No.
36	Welding transformer (Not required if welder trade exist)	1 No.
37	C-Clamp 20 cm Perforated Hood	5 Nos.
38	C-Clamp 30cm Light Duty Steel	5 Nos.
39	Surface plate 300x300mm	2 Nos.
40	Drill twist (metric) 3mm to 12mm	1 sets
41	Tapes and dies complete set in box BSW,BSF, Metric	2 sets each
42	Oil Can ½ ft	3 Nos.
43	Wire Brush	10 nos.
44	Double ended spanner 10mm to 25mm	5 Nos.
45	Drill Chuck 0 to 12 morse taper	1 No.
46	Drill machine to drill upto 12mm dia	1 No.

47	Digital multimeter	4 Nos.
48	AC Motor single Phase	1 No.
49	AC Motor three Phase	1 No.

E. List of additional tools for allied trade in welding

Sl. No.	Name & Description of Machines	Quantity
1.	Transformer welding set 150 amps. – continuous welding current, with all accessories and electrode holder	1 Set
2.	Welder cable to carry 200 amps. With flexible rubber cover	20 Meter
3.	Lugs for cable	12 Nos.
4.	Earth clamps.	2 Nos.
5.	Arc welding table (all metal top) 122 cm X 12 cm X 60 cm with positioner.	1 No.
6.	Oxy – acetylene gas welding set equipment with hoses, regulator and other accessories.	1 Set.
7.	Gas welding table with positioner	1 No
8.	Welding torch tips of different sizes	1 Set
9.	Gas lighter.	2 Nos
10.	Trolley for gas cylinders.	1 No
11.	Chipping hammer.	2 Nos
12.	Gloves (Leather)	2 Pairs
13.	Leather apron.	2 Nos
14.	Spindle key for cylinder valve.	2 Nos.
15.	Welding torches 5 to 10 nozzles.	1 Set.
16	Welding goggles	4 Pairs.
17.	Welding helmet with coloured glass	2 Nos.
18.	Tip cleaner	10 Sets.

Note: -The above items are to be provided for Training where the Welding trade does not exist.

F. Tools for Allied Trade- Sheet Metal Work

Sl. No.	Name of the items	Qty
1	Trammel 30cm.	1 no.
2	Prick punch	2 nos.
3	Mallet.	2 nos.
4	Snips straight 25 cm.	2 nos.
5	Setting hammers with handle.	2 nos.
6	Planishing hammer.	2 nos.
7	Snip bent 25 cm.	2 nos.
8	Stake hatchet.	2 nos.
9	Stake grooving.	2 nos.
10	Gauge imperial sheet.	1 no.

Note: -The above items are to be provided for Training where the Sheet Metal trade does not exist.

G. General Furniture:

1	Almirah (as per required size)	2 Nos.
2	Steel Rack (5'x4'x2')	2 Nos.
3	Fire Extinguisher	2 Nos.
4	First aid Box	1 No.

LIST OF TRADE COMMITTEE MEMBERS

Sl. No.	Name & Designation Sh/Mr/Ms.	Organization	Mentor Council Designation
Members of Sector Mentor council			
1.	A. D. Shahane, Vice-President, (Corporate Trg.)	Larsen & Turbo Ltd., Mumbai:400001	Chairman
2.	Dr. P.K.Jain, Professor	IIT, Roorkee, Roorkee-247667, Uttarakhand	Member
3.	N. Ramakrishnan, Professor	IIT Gandhinagar, Gujarat-382424	Member
4.	Dr. P.V.Rao, Professor	IIT Delhi, New Delhi-110016	Member
5.	Dr. Debdas Roy, Asstt. Professor	NIFFT, Hatia, Ranchi-834003, Jharkhand	Member
6.	Dr. Anil Kumar Singh, Professor	NIFFT, Hatia, Ranchi-834003, Jharkhand	Member
7.	Dr. P.P.Bandyopadhyay Professor	IIT Kharagpur, Kharagpur- 721302, West Bengal	Member
8.	Dr. P.K.Ray, Professor	IIT Kharagpur, Kharagpur- 721302, West Bengal	Member
9.	S. S. Maity, MD	Central Tool Room & Training Centre (CTTC), Bhubaneswar	Member
10.	Dr. Ramesh Babu N, Professor	IIT Madras, Chennai	Member
11.	R.K. Sridharan, Manager/HRDC	Bharat Heavy Electricals Ltd, Ranipet, Tamil Nadu	Member
12.	N. Krishna Murthy Principal Scientific Officer	CQA(Heavy Vehicles), DGQA, Chennai, Tamil Nadu	Member
13.	Sunil Khodke Training Manager	Bobst India Pvt. Ltd., Pune	Member
14.	Ajay Dhuri	TATA Motors, Pune	Member
15.	Uday Apte	TATA Motors, Pune	Member
16.	H B Jagadeesh, Sr. Manager	HMT, Bengaluru	Member
17.	K Venugopal Director & COO	NTTF, Peenya, Bengaluru	Member
18.	B.A.Damahe, Principal L&T Institute of Technology	L&T Institute of Technology, Mumbai	Member
19.	Lakshmanan. R Senior Manager	BOSCH Ltd., Bengaluru	Member
20.	R C Agnihotri Principal	Indo- Swiss Training Centre Chandigarh, 160030	Member
Mentor			
21.	Sunil Kumar Gupta (Director)	DGET HQ, New Delhi.	Mentor
Members of Core Group			
22.	N. Nath. (ADT)	CSTARI, Kolkata	Co-ordinator

23.	H.Charles (TO)	NIMI, Chennai.	Member
24.	Sukhdev Singh (JDT)	ATI Kanpur	Team Leader
25.	Ravi Pandey (V.I)	ATI Kanpur	Member
26.	A.K. Nasakar (T.O)	ATI Kolkata	Member
27.	Samir Sarkar (T.O)	ATI Kolkata	Member
28.	J. Ram Eswara Rao (T.O)	RDAT Hyderabad	Member
29.	T.G. Kadam (T.O)	ATI Mumbai	Member
30.	K. Mahendar (DDT)	ATI Chennai	Member
31.	Shrikant S Sonnavane (T.O)	ATI Mumbai	Member
32.	K. Nagasrinivas (DDT)	ATI Hyderabad	Member
33.	G.N. Eswarappa (DDT)	FTI Bangalore	Member
34.	G. Govindan, Sr. Draughtsman	ATI Chennai	Member
35.	M.N.Renukaradhya, Dy.Director/Principal Grade I.,	Govt. ITI, Tumkur Road, Banglore, Karnataka	Member
36.	B.V.Venkatesh Reddy. JTO	Govt. ITI, Tumkur Road, Banglore, Karnataka	Member
37.	N.M.Kajale, Principal,	Govt. ITI Velhe, Distt: Pune, Maharashtra	Member
38.	Subrata Polley, Instructor	ITI Howrah Homes, West Bengal	Member
39.	VINOD KUMAR.R Sr.Instructor	Govt.ITI Dhanuvachapuram Trivendrum, Dist., Kerala	Member
40.	M. Anbalagan, B.E., Assistant Training Officer	Govt. ITI Coimbatore, Tamil Nadu	Member
41.	K. Lakshmi Narayanan, T.O.	DET, Tamil Nadu	Member
Other industry representatives			
42.	Venugopal Parvatikar	Skill Sonics, Bangalore	Member
43.	Venkata Dasari	Skill Sonics, Bangalore	Member
44.	Srihari, D	CADEM Tech. Pvt. Ltd., Bengaluru	Member
45.	Dasarathi.G.V.	CADEM Tech. Pvt. Ltd., Bengaluru	Member
46.	L.R.S.Mani	Ohm Shakti Industries, Bengaluru	Member