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

COMPETENCY BASED CURRICULUM

REFRACTORY TECHNICIAN

(Duration: Two Years)

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL- 5

SECTOR – PRODUCTION & MANUFACTURING

REFRACTORY TECHNICIAN

(Engineering Trade)

(Revised in 2018)

Version: 1.0

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL- 5

Developed By

Ministry of Skill Development and Entrepreneurship
Directorate General of Training
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
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List of Expert members participated/ contributed for finalizing the course curriculum of Refractory Technician Trade.

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CONTENTS

1. COURSE INFORMATION

During the two-year duration of Refractory Technician trade, a candidate is trained on Professional Skill, Professional Knowledge, Engineering Drawing, Workshop Calculation & Science and Employability Skill. In addition to this, a candidate is entrusted to undertake project work and extracurricular activities to build up confidence. The broad components covered related to the trade are categorized in four semesterseach of six months duration. The semester wise course coverage is categorized as below:

1st Semester – In this semester, the trainee learns about safety and environment, use of fire extinguishers, artificial respiratory resuscitation to begin with. He gets the idea of trade tools & its standardization, familiarize with basics of electricity, test the cable and measure the electrical parameter. Skilling practice on Arc welding gas cutting and welding process, fitting jobs of solid metal and pipes. Identify and test manufacturing process.

2nd Semester – In this semester, the candidate will be able to ensure quality control, handling of raw materials, checking consistency of mixed material, monitoring of moulding and pressing operation, drying bricks and dryer operation, loading / unloading of finished productandperfor operation and maintenance of kiln and waste utilisation.

3rd Semester – In this semester, the trainee will be able to perform brick cutting and joining, basic application of monolithic refractory, fitting of scaffold, operate gunning machine, ramming, patching. In addition, they can perform computer operation and packaging of refractory.

4th Semester – In this semester, the candidate will be able to prepare heating chart and perform opening repair, testing, checking of vibrator and identify physical defects, parts of furnaces, construct refractory lining, prepare technical report and documentation as per industrial need and operational function and maintenance of supporting tools and machines.

2. TRAINING SYSTEM

2.1 GENERAL

The Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers a range of vocational training courses catering to the need of different sectors of 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.

The Refractory Technician Trade under CTS is delivered nationwide through a network of ITIs. The course is of two-year (04 semesters) duration. It mainly consists of Domain area and Core area. The Domain area (Trade Theory & Practical) imparts 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.

Trainee broadly needs to demonstrate that they are able to:

- Read & interpret technical parameters/documentation, plan and organize work processes, identify necessary materials and tools.
- Perform tasks with due consideration to safety rules, accident prevention regulations and environmental protection stipulations;
- Apply professional knowledge, core skills & employability skills while performing the job, and repair & maintenance work.
- Check the task/ job for functioning, identify and rectify errors in task/job.
- Document the technical parameters in tabulation sheet related to the task undertaken.

2.2 CAREER PROGRESSION PATHWAYS

- Can join Apprenticeship programs in different types of industries leading to a National Apprenticeship certificate (NAC).

- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming an instructor in ITIs.

2.3 COURSE STRUCTURE:

Table below depicts the distribution of training hours across various course elements during a period of two year (04 semesters):

S No.	Course Element	Notional Training Hours
1	Professional Skill (Trade Practical)	2266
2	Professional Knowledge (Trade Theory)	528
3	Workshop Calculation & Science	176
4	Engineering Drawing	264
5	Employability Skills	110
6	Library & Extracurricular Activities	176
7	Project Work	200
8	Revision & Examination	440
	Total	**4160**

2.4 ASSESSMENT & CERTIFICATION

The trainee will be tested for his skill, knowledge and attitude during the period of the course and at the end of the training program as notified by the Government of India (GoI) from time to time. The employability skills will be tested in the first two semesters 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 has to maintain an 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 at the end of each semester as per the guideline of Government 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 the basis for setting question papers for final assessment. The examiner during final examination will also check** the individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

2.4.1 PASS REGULATION

The minimum pass percentage for practical is 60% & minimum pass percentage of theory subjects is 40%. For the purposes of determining the overall result, 25% weightage is applied to the result of each semester examination.

2.4.2 ASSESSMENT GUIDELINE

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

Assessment will be evidence based comprising 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 semester examination for audit and verification by examining body. The following marking pattern to be adopted while assessing:

Performance Level	Evidence
(a) Weightage in the range of 60%-75% to be allotted during assessment	
For performance in this grade, the candidate should produce work which demonstrates attainment of an acceptable standard of craftsmanship with occasional guidance, and due regard for safety procedures and practices	• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment. • Below 70% tolerance dimension achieved while undertaking different work with those demanded by the component/job. • A fairly good level of neatness and consistency in the finish. • Occasional support in completing the project/job.
(b) Weightage in the range of 75%-90% to be allotted during assessment	
For this grade, a candidate should produce work which demonstrates attainment of a reasonable standard of craftsmanship, with little guidance, and regard for safety procedures and practices	• Good skill levels in the use of hand tools, machine tools and workshop equipment. • 70-80% tolerance dimension achieved while undertaking different work with those demanded by the component/job.

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

3. JOB ROLE

Refractory Technician; builds and repairs furnaces, ovens, kilns, fireboxes, fire places and other high temperature structures by laying and setting firebricks and refractory blocks, using chemical heat resistant cement, fireclay, mortar etc. with hand tools. Receives instructions from appropriate authority regarding nature and type of work to be done. Spreads minimum possible fireclay mortar evenly over furnace with trowel and lays and taps fire bricks or refractory blocks in position in correct alignment according to specification. Seals joints with fireclay mortar or chemically resistant cement to bind bricks together making provision for expansion of joints in furnace in linings. Prepares support to proper curvature to replace arched roofs of furnaces or to construct new ones as directed or specified. Patches portions of furnaces with fireclay, as necessary and removes excess of mortar. May specialize in building and repairing particular type of high temperature construction. May replace linings of ladles or tapping sports of furnaces. May build new smoke tunnels.

Reference NCO-2015:

a) 7112.0300 - Bricklayer, Refractory

4. GENERAL INFORMATION

Name of the Trade	**Refractory Technician**
NCO - 2015	7112.0300
NSQF Level	Level-5
Duration of Craftsmen Training	2 Years (4 Semesters having duration of six months each)
Entry Qualification	Passed 10th class examination under 10+2 System of education with Science and Mathematics.
Unit Strength (No. Of Students)	20 (Max. supernumeraries seats: 6)
Space Norms	130 Sq. m (Max. L:B :: 2:1)
Power Norms	3 KW
Instructors Qualification for:	
1. Refractory Technician Trade	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 the trade with 3 years' post qualification experience in the relevant field. **Desirable:** Preference will be given to a candidate with CIC (Craft Instructor Certificate) in relevant trade. ***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-year experience. **Desirable:**

	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-year experience. **OR** NTC/ NAC in the Draughtsman (Mechanical/ Civil) with three-year experience. **Desirable:** Craft Instructor Certificate in RoD& A course under NCVT.
4. Employability Skill	MBA OR BBA with two-year experience OR Graduate in Sociology/ Social Welfare/ Economics with two-year experience OR Graduate/ Diploma with two-year 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	Workshop Cal. &Sc.	Engg. Drawing	Employability Skills	Extra-curricular activity
40 Hours	25 Hours	6 Hours	2 Hours	3 Hours	2 Hours	2 Hours

5. NSQF LEVEL COMPLIANCE

NSQF level for **Refractory Technician** trade under CTS: **Level 5**

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
e. Responsibility

The broad Learning outcome of **Refractory Technician** trade under CTS mostly matches with the Level descriptor at Level- 5.

The NSQF level-5 descriptor is given below:

Level	Process Required	Professional Knowledge	Professional Skill	Core Skill	Responsibility
Level 5	Job that requires well developed skill, with clear choice of procedures in familiar context.	Knowledge of facts, principles, processes and general concepts, in a field ofwork or study	A range of cognitive and practical skills required to accomplish tasks and solve problem by selecting and applying basic methods, tools, materials and information.	Desired mathematical skill, understanding of social, political and some skill of collecting and organizing information, communication.	Responsibility for own work and learning and some responsibility for other's work and learning.

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. Apply safe working practices.
2. Comply with environment regulation and housekeeping.
3. Interpret & use company and technical communication
4. Demonstrate basic mathematical concept and principles to perform practical operations.
5. Understand and explain basic science in the field of study including simple machine.
6. Read and apply engineering drawing for different application in the field of work.
7. Understand and apply the concept in productivity, quality tools, and labour welfare legislation in day-to-day work to improve productivity & quality.
8. Explain energy conservation, global warming and pollution and contribute in day-to-day work by optimally using available resources.
9. Explain personnel finance, entrepreneurship and manage/organize related task in day-to-day work for personal & societal growth.
10. Utilize basic computer applications and internet to take benefit of IT developments in the industry.

6.2 SPECIFIC LEARNING OUTCOME

Semester I

11. Perform basic workshop operations using suitable tools for fitting, riveting, drilling etc. observing suitable care & safety.
12. Perform forging, piercing, bending, riveting, punching and edge cutting operation.
13. Perform sheet metal work.
14. Perform checking and measuring components with precision instrument.
15. Make different fit of components for assembling observing principle of interchangeability and check for functionality.
16. Perform Arc welding process.
17. Perform gas cutting and welding process.
18. Use proper taps and dies for making internal and external threads on solid metal and pipes.
19. Perform basic electrical measurement.
20. Identify the various types of refractories.

21. Identify the major forms and sources of pollution and control techniques in refractory industry.
22. Practice operation and maintenance of various fuel handling plant.

Semester II

23. Identify the different raw material and handling.
24. Ensure the quality control.
25. Demonstrate the manufacturing processes.
26. Identify the different grain size, mixing machine – operation and adjustment and checking consistency of mixed material.
27. Perform operation and monitoring of moulding and pressing (manual / hydraulic).
28. Practice on drying bricks and dryers.
29. Identify the different temperature measuring instrument and maintenance.
30. Ensure proper loading/ unloading, drying schedule, firing schedule and inspect the finished product.
31. Perform the operation and maintenance of kiln and waste utilisation.

Semester III

32. Demonstrate the basic application of monolithic refractory.
33. Perform brick cutting and joining.
34. Perform fitting of scaffold.
35. Perform gunning, ramming and poatching.
36. Demonstrate the energy conservation followed by industry.
37. Perform basic computer operation.
38. Perform the method of packaging in refractory.
39. Perform installation and repair brick work.

Semester IV

40. Perform opening, repair, testing, checking of vibrator and identify the physical defect.
41. Identify the parts of furnaces.
42. Ensure skill in the model workshop / fields.
43. Create report observing heating chart.
44. Construct refractory lining.
45. Prepare technical report and documentation as per industrial need.
46. Demonstrate operational function and maintenance of supporting tools and machines.

7. LEARNING OUTCOME WITH ASSESSMENT CRITERIA

GENERIC LEARNING/ ASSESSABLE OUTCOME	
LEARNING / ASSESSABLE OUTCOME	**ASSESSMENT CRITERIA**
1.Apply safe working practices	1.1 Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements and according to site policy.
	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 of dangerous goods and substances according to site policy and procedures following safety regulations and requirements.
	1.5 Identify and observe site policies and procedures withregard 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.
2.Comply with environment regulation and housekeeping.	2.1 Identify environmental pollution & contribute to the avoidance of instances of environmental pollution.
	2.2 Deploy environmental protection legislation & regulations.
	2.3 Take opportunities to use energy and materials in an environmentally friendly manner.
	2.4 Avoid waste and dispose waste as per procedure.
	2.5 Recognize different components of 5S and apply the same in the working environment.
3. Interpret & use	3.1 Obtain sources of information and recognize information.

company and technical communication.	3.2Use and draw up technical drawings and documents.
	3.3 Use documents and technical regulations and occupationally related provisions.
	3.4 Conduct appropriate and target oriented discussions with higher authority and within the team.
	3.5 Present facts and circumstances, possible solutions &use special English terminology.
	3.6 Resolve disputes within the team.
	3.7 Conduct written communication.
4. Demonstrate basic mathematical concept and principles to perform practical operations.	4.1 Semester examination to test basic skills on arithmetic, algebra, trigonometry and statistics.
	4.2 Applicationswill be assessed during execution of assessable outcome and will also be tested during theory and practical examination.
5. Understand and explain basic science in the field of study including simple machine.	5.1 Semester examination to test basic skills on science in the field of study including friction, heat, temperature and simple machine.
	5.2 Applications will be assessed during execution of assessable outcome and will also be tested during theory and practical examination.
6. Read and apply engineering drawing for different application in the field of work.	6.1 Semester examination to test basic skills on engineering drawing.
	6.2 Applicationswill be assessed during execution of assessable outcome and will also be tested during theory and practical examination.
7. Understand and apply the concept in productivity, quality tools, and labour welfare legislation in day-to-day work to improve productivity & quality.	7.1 Explain the concept of productivity and quality tools and apply during execution of job.
	7.2 Understand the basic concept of labour welfare legislation and adhere to responsibilities and remain sensitive towards such laws.
	7.3 Knows benefits guaranteed under various acts.
8. Explain energy conservation, global warming, pollution and contribute in day-to-day work by optimally using available resources.	8.1 Explain the concept of energy conservation, global warming, pollution and utilize the available recourses optimally & remain sensitive to avoid environment pollution.
	8.2 Dispose waste following standard procedure.

9. Explain personnel finance, entrepreneurship and manage/organize related task in day-to-day work for personal & societal growth.	9.1 Explain personnel finance and entrepreneurship.
	9.2 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 familiarize with the Policies/Programmes & procedure & the available scheme.
	9.3 Prepare Project report to become an entrepreneur for submission to financial institutions.
10. Utilize basic computer applications and internet to take benefit of IT developments in the industry.	10.1 Semester examination to test knowledge on basic computer working, basic operating system and uses internet services.
	10.2 Their applicationswill be assessed during execution of assessable outcome.

SPECIFIC LEARNING/ ASSESSABLE OUTCOME	
Semester-I	
LEARNING/ ASSESSABLE OUTCOME	**ASSESSMENT CRITERIA**
11. Perform basic workshop operations using suitable tools for fitting, riveting, drilling etc. observing suitable care & safety	11.1 Identify basic hand tools for fitting, riveting, drilling etc. with due care and safety.
	11.2 Use tool and job holding devices for metal sawing.
	11.3 Mark on the job with the help of marking tools.
	11.4 Cut metal piece by hacksaw, file the flat surfaces and check dimensions.
	11.5 Chip flat surface along the marked line.
	11.6 Drill holes on MS plate as per tap drill size and make thread by taping.
	11.7 Check flatness, squareness and measure dimension of the job.
12. Perform forging, piercing, bending, riveting, punching and edge cutting operation.	12.1 Prepare a hearth for forging.
	12.2 Make a centre punch by forging.
	12.3 Make a flat chisel.
	12.4 Make a screw driver.
	12.5 Make a cube from a MS round bar by a jack hammer.
	12.6 Perform piercing, bending, riveting punching and edge cutting in press tool.
13. Perform sheet metal work.	13.1 Cut geometrical shapes from metal sheet.
	13.2 Make a funnel of metal sheet.
	13.3 Use of flat scraper to make the surface even of a dove tail fitting.
14. Perform checking and measuring components with precision instrument.	14.1 Check surface roughness of a surface plate.
	14.2 Perform Angular Measurement using Bevel protector and Sine bar.
	14.3 Measure distance / clearance using dial test indicator.
	14.4 Perform Gear and Screw Thread Measurement. (two wire method and screw pitch gauge).
	14.5 Perform checking work piece by limit gauges.

15. Make different fit of components for assembling observing principle of interchangeability and check for functionality.	15.1 Make Step fit, angular fit, angle, surfaces.
	15.2 Scrap on flat surfaces, curved surfaces and parallel surfaces and test.
	15.3 Scrap a cylindrical bore.
	15.4 Locate accurate holes & make accurate hole for stud fit.
16. Perform Arc welding process.	16.1 Practice Arc welding process.
	16.2 Striking straight beads left to right and right to left.
	16.3 Weld a square butt joint.
	16.4 Weld a Lap joint.
	16.5 Weld a Tee joint.
	16.6 Weld a Corner joint.
17. Perform gas cutting and welding process.	17.1 Practice of Gas cutting and Gas welding.
	17.2 Cutting of straight and curved metal pieces.
	17.3 Fusion runs on a M.S. Sheet Left to Right.
	17.4 Fusion runs on a M.S. Sheet Right to Left.
18. Use proper taps and dies for making internal and external threads on solid metal and pipes.	18.1 Use of dies and making of external threads.
	18.2 Use of tap and prepare tapped holes.
	18.3 Make threads on various dia. MS rods and fit the threaded rods on previous tapped holes.
	18.4 Use of Pipe fittings and prepare joints.
	18.5 Threading of pipes with the use of pipe die.
	18.6 Prepare a pipe line using different types of pipe joints.
19. Perform basic electrical measurement.	19.1 Measure AC, DC by usingmultimeter.
	19.2 Measure AC voltageusing step up & step down transformer.
	19.3 Measure resistance, Voltage &current.
20. Identify the various types of refractories.	20.1 Ensure the different types of bricks and chemical composition.
	20.2 Practice various types of refractories and shapes.

21. Identify the major forms and sources of pollution and control techniques in refractory industry.	21.1 Operate water spray gun, vacuum sweepers, Dry fog nozzles, watersprinkler.
	21.2 Practice on prevention ofvarious health hazards occurring from refractory materials.
	21.3 Identify sources of pollution & various control techniques .
22. Practice operation and maintenance of various fuel handling plant.	22.1 Practice on handling various fuels.
	22.2 Operation & maintenance of Producer gasplant.
Semester-II	
23. Identify the different raw material and handling.	23.1 Identify the different raw materials used in manufacturing refractory.
	23.2 Identify the physical and chemical properties of refractory materials.
24. Ensure the quality control.	24.1 Identify the basic concept of 5S, Kaizen, TPM, TQM and ISO:9000.
	24.2 Ensure the quality control for refractory items.
25. Demonstrate the manufacturing processes.	25.1 Demonstrate & practice different manufacturing processes at plant/video demonstration.
26. Identify the different grain size, mixing machine – operation and adjustment and checking consistency of mixed material.	26.1 Demonstrate & practice on Sieve Analysis of different grain size.
	26.2 Identification of parts of mixing machine & operation of mixing machine.
	26.3 Practice on changing adjusting scrapper, adjustment of roller height.
	26.4 Checking consistency of mixed material and workability.
27. Perform operation and monitoring of moulding and pressing (manual / hydraulic).	27.1 Practice on weighing of material, filling the mould & operating the pressing (Mechanical & Hydraulic) and gauging of the bricks.
	27.2 Physical inspection of bricks for cracks, lamination & wrecks, warpage.
	27.3 Checking of bulk density of bricks.
	27.4 Practice on operation /monitoring parameters of press.

	(Manual/Hydraulic).
	27.5 Identify the Segregation, Sizes, Edges & corner and any other physical defects.
28. Practice on drying bricks and dryers.	28.1 practice on drying of bricks.
	28.2 Practice on operating dryers.
29. Identify the different temperature measuring instrument and maintenance.	29.1 Demonstrate / practice of different temperature measuring instrument.
	29.2 Measure temperature by pyrometer reading.
	29.3 Perform the steps of preventive maintenance.
30. Ensure proper loading/ unloading, drying schedule, firing schedule and inspect the finished product.	30.1 Observe the loading and unloading.
	30.2 Monitor the drying schedule and firing schedule.
	30.3 Inspect physically the finished product.
	30.4 Practice on loading/unloading of bricks.
31. Perform the operation and maintenance of kiln and waste utilisation.	31.1 Practice on operation & maintenance of kiln.
	31.2 Practice on firing schedule.
	31.3 Practice on brick checking
	31.4 Demonstration waste utilization.
Semester-III	
32. Demonstrate the basic application of monolithic refractory.	32.1 Practice different applicationmethod of monolithic refractoryat plant
	32.2 Inspect defects follow the acceptance criteria.
33. Perform brick cutting and joining.	33.1 Perform brick laying of shaped refractory.
	33.2 Perform brick cutting and brick joining by hand or machine.
34. Perform fitting of scaffold.	34.1 Practice on fitting scaffolding.
	34.2 Identify the materials used in scaffolding.
	34.3 Maintain the safety aspect in scaffolding.
35. Perform gunning, ramming	35.1 Practice with gunning machine.

and patching.	35.2 Practice in ramming, patching, shot crating, coating and hot repair.
36. Demonstrate the energy conservation followed by industry.	36.1 Demonstration on energy conservation.
	36.2 Practice on 5S.
	36.3 Acquire practical knowledge on kiln maintenance.
37. Perform basic computer operation.	37.1 Familiarization & Identification of computer parts.
	37.2 Practice on computer for MS word, MS power point, MS Excel.
38. Perform the method of packaging in refractory.	38.1 Perform packaging of refractory.
	38.2 Arrange to load of different shapes in pallet.
39. Perform installation and repair brick work.	39.1 Cut brick in machine.
	39.2 Check perpendicularity of lining using plumb.
	39.3 Prepare mortar.
	39.4 Monitorthickness of mortar during installation.
	39.5 Demolish existing / used lining.
	39.6 Use of levelling tool, Sprit level, water level.
	39.7 Use of wooden hammer for adjusting brick level.
	39.8 Measure, cutting & Installation of Key brick.
	39.9 Practice on hand grinding.
	39.10 Use of brick holder & brick.
	39.11 Use of skew brick & Arch making, use of screw jack.
Semester-IV	
40. Perform opening, repair, testing, checking of vibrator and identify the physical defect.	40.1 Opening & repair of vibrator needle, rammer, pneumatic breaker, replacement of chisel.
	40.2 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.
	40.3 Preparation & Fixing of shuttering, Checking Vibrator for capability, vibration time, Height of Castable for vibration, Roding practice.
	40.4 Sprinkling water on casted segment for natural/wet

	curing.
	40.5 Identifying & reporting physical defects after Dry out.
41. Identify the parts of furnaces.	19.1 Identify the parts of furnaces
42. Ensure skill in the model workshop / fields.	42.1 Practical training in the modelworkshop / fields.
43. Create report observing heating chart.	19.1 Preparation of heating chart & reportmaking.
	19.2 Perform curing, preheating and dry out.
44. Construct refractory lining.	19.1 Practice on refractory lining.
	19.2 Construction of vertical wall, brick laying, gunning, anchor welding, fixing of shuttering & formers, vibro casting,Ramming, Patching/Troweling,fettling.
45. Prepare technical report and documentation as per industrial need.	19.1 Prepare different Types of documentation as per industrial need by different methods of recordinginformation.
46. Demonstrate operational function and maintenance of supporting tools and machines.	19.1 Demonstration & practice Tools, Tackles and Operation.
	19.2 Perform operation of fixing devices and extraction devices.
	19.3 Maintenance of Refractory lining. : Different types ofrefractory practices like LD converter, Laddle, Tundishes, Slide gate refractory, rotary kiln,Mills, Reheating furnace.

SYLLABUS FOR REFRACTORY TECHNICIAN TRADE			
FIRST SEMESTER - 6 MONTHS			
Week No.	**Reference Learning Outcome**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
1	• Apply safe working practices	**Trade and Orientation** 1. Visit to various sections of the institute and identify location of various installations. 2. Identify safety signs for danger, warning, caution & personal safety message. 3. Use of personal protective equipment (PPE). 4. Practice elementary first-aid. 5. Preventive measures for electrical accidents & steps to be taken in such accidents. 6. Use of Fire extinguishers.	Familiarization with the working of Industrial Training Institute system. Importance of safety and precautions to be taken in the industry/shop floor. Introduction to PPEs. Introduction to First-Aid. Response to emergencies e.g. power failure, fire, and system failure. Importance of housekeeping & good shop floor practices. Occupational Safety & Health**:** Health, Safety and Environment guidelines, legislations & regulations as applicable.
2-3	• Perform basic workshop operations using suitable tools for marking, drilling, chipping and fitting observing suitable care & safety.	**Hand tools and their uses** 7. Identify the different hand tools. 8. Use of vice, clamps, holding the job in the vice and practice of metal sawing. 9. Marking practice using hermaphrodite caliper, surface gauge, engineers" try square, marking off table etc. 10. Marking out lines, gripping suitably in the vice jaw, hacksawing to given dimensions 11. Workshop practice on filing flat surfaces and hacksawing. 12. Practice of checking flatness and squareness.	Identification, specifications, uses and maintenance of commonly used hand tools,such as:- Steel rule, Divides, Calipers, Centre punch, Dot punch, Prick punch and hammers, V-block, marking off table. State the correct shape of files for filing different profiles. Bench vice, types, use, care and maintenance, vice clamp, hacksaw frame and blade, their types, uses. Method of sawing.

		13. Filing four edges, checking all dimensions with outside caliper and steel rule.	
4-6		14. Marking of straight, arcs and parallel lines with odd leg calipers, scribing block and steel rule . 15. Marking practice with divider. (Circles, arcs and parallel lines). 16. Chipping flat surfaces along a marked line. 17. Finding and marking centre line of cylindrical system, with the help of "spirit level and plumb". 18. Drilling of various sizes of holes on a MS plate. 19. Tapping of different sizes tapped holes on drilled job. 20. Measurement of different dimensions using Vernier height gauge, verniercaliper and micrometer.	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. 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. Vernier height gauge, vennier caliper its leastcount, use, care and maintenance. Outside and inside micrometer. It's reading leastcount, use, care and maintenance. Gaugeand indication classification. Types ofgauges and their use. Use of slip gauge. Ringing action. Working principle of dial gauge.
7	• Perform forging, piercing, bending, riveting, punching and edge cutting operation.	**Forging:** 21. Preparation of hearth. 22. Making of centre punch. 23. Making of flat chisel. 24. 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		**Press Tool** 25. Practice on pneumatics tools like jack hammer, rammer & pressure gauge. 26. Piercing, bending, riveting punching and edge cutting in press tool machine.	Mechanism of force transmission in presses. Details of hydraulic and pneumatic presses.
9	• Perform sheet metal work.	**Sheet metal work** 27. Cutting various types of Geometrical shapes. 28. 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	• Perform checking and measuring components with precision instrument.	29. Check surface roughness of a surface plate. 30. Perform Angular Measurement using Bevel protector and Sine bar. 31. Measure distance/clearance using dial test indicator. 32. Perform Gear and Screw Thread Measurement.(two wire method and screw pitch gauge). 33. Perform checking work piece by limit gauges.	Definition of accuracy, precision and error. Principle of vernier scale and least count. Measuring methods with Vernier calliper, Micrometers (inside & outside), Telescopic gauge, Height gauge, Depth gauge, Slip gauge. Major parts, functions and measuring methods of Bevel Protector, Sine bar, Angle gauges, Spirit level, Clinometers, Auto collimator. Application of Dial Test Indicator/gauge. Measuring methods of Straightness, Flatness, Squareness, Parallelism, Perpendicularity, Roundness, Concentricity, Cylindricity, run out, ovality.
11	• Make different fit of components for assembling observing principle of interchangeability and check for functionality .	**Fitting Joints** 34. File and make Step fit, angular fit, angle, surfaces (Bevel gauge accuracy 1 degree) 35. Scrap on flat surfaces, curved surfaces and parallel surfaces and test. 36. Scrap cylindrical bore.	Fasteners: Kinds of fastening Bolts, their typesand uses, Nuts, their types and uses, Washers, types and uses, Screws, Key and Key way,types and uses. Studs. Pins and cotters.

		37. Locate accurate holes & make accurate hole for stud fit.	
12 - 13	• Perform Arc welding process.	**Welding** 38. Practice Arc welding process. 39. Striking straight beads leftto right and right to left. 40. Weld a square butt joint. 41. Weld a Lap joint. 42. Weld a Tee joint. 43. Weld a Corner joint.	Arc welding process: Welding method, weldingmachines, electrode, coding, polarity, edge preparation, types of welding joints and beads.
14	• Perform gas cutting and welding process.	**Gas Cutting** 44. Practice of Gas cutting and Gas welding. 45. Cutting of straight and curved metal pieces. 46. Fusion runs on a M.S. Sheet Left to Right 47. Fusion runs on a M.S. Sheet Right to Left.	Gas welding methods: Oxy-acetylene welding, Flames, Gas and Arc welding tools, Oxygenand Acetylene cylinder, Gas regulator, Gas welding equipment, backward and rightwardwelding. Welding positions.
15-16	• Use proper taps and dies for making internal and external threads on solid metal and pipes.	48. Use of dies and making of external threads. 49. Use of tap and prepare tapped holes. 50. Make threads on various dia. MS rods and fit the threadedrods on previous tapped holes.(05 hrs.) 51. Use of Pipe fittingsand prepare joints. 52. Threading of pipes with the use of pipe die. 53. Prepare a pipe line using different types of pipejoints.	Dies and its use: Types of dies, die handle,method of using a die, Reamer parts, kinds ofreamer, stud extraction. Pipe and pipe fittings: Different types of pipes, Pipe Accessories, G.I Pipeaccessories, Tools and signs (symbols) of pipefitting.
17	• Perform basic electrical measurement.	54. Measure AC, DC by usingmultimeter. 55. Measure AC voltageusing step up & step down transformer. 56. Measure 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	• Identify the various types of refractories.	54. Demonstrate & practice of various types ofrefractories.	Definition of refractory. Classification of refractory.

			Properties of refractories. Bricks classification, chemical composition and its application area wise, insulation , Bricks expansionmaterial (ceramic fibre, Hysil block etc.), Different Shapes: • Regular Straight shapes. • Side Arch Shape. • End Arch Shape. • Key and Mini key Shape. • Semi Universal Shape. • Circular Bricks. Skewback Shape. • Checkers Bricks. Other refectory product like castable, motaretc.
20-21	• Identify the major forms and sources of pollution and control techniques in refractory industry.	55. Practice on operation of water spray gun,vacuum sweepers, Dry fog nozzles, watersprinkler etc. 56. Demonstrate &practice on prevention ofvarious health hazards.	Safety and environment measures. Major formsof pollution in refractory industry. Sources ofpollution & various control techniques. Occupational health hazards and its control. Different hazards in refractory industry. Prevention of occupational diseases.
22-23	• Practice operation and maintenance of various fuel handling plant.	57. Practice on handling various fuels. 58. Operation & maintenance of Producer gasplant.	Types of fuel used in refractory industry: • Coal • Coke • Producer Gas • Furnace oil • LPG Safety & occupational hazard aspect inhandling Producer gas plant.
24-25	**Revision**		
26	**Examination**		

SYLLABUS FOR REFRACTORY TECHNICIAN TRADE			
SECOND SEMESTER – 06 Months			
Week No.	**Reference Learning Outcome**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
27	• Identify the different raw material and handling.	59. Demonstrate & practice of different raw material & handling of same.	Different raw materials used in manufacturingrefractory &their basic physical & chemical properties.
28	• Ensure the quality control.	60. Demonstrate & practice on quality control.	Quality assurance, Definition & importanceof Quality control, quality circle. BasicConcept of 5S, Kaizen, TPM, TQM & ISO 9000.
29-30	• Demonstrate the manufacturing processes.	61. 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.
31-33	• Identify the different grain size, mixing machine – operation and adjustment and checking consistency of mixed material.	**Crushing & grinding** 62. Demonstrate & practice on Sieve Analysis ofdifferent grain size. 63. Identification of parts of mixing machine & operation of mixing machine. 64. Practice on changingadjusting scrapper, adjustment of roller height. 65. Checking consistency of mixed material and workability.	**Crushing & grinding**: Knowledge ofadjustment for fineness of the output. Various types/parts of Mixing machine. Maintenance of mixing machines. Mixing sequence of different qualitymixtures. Physical check of mixture to ensurecompletion of mixing. Unloading of mixtureto bucket and moisture content of mixture.
34-36	• Perform operation and monitoring of moulding and pressing	**Moulding and pressing** 66. Practice on weighing of material, filling the mould & operating the pressing	**Moulding and pressing**: Types of press &sequence of operation of press machine. Presscapacity linked with bulk

	(manual / hydraulic).	(Mechanical & Hydraulic) and gauging of the bricks. 67. Physical inspection of bricks for cracks, lamination &wrecks, warpage. 68. Checking of bulk density of bricks. 69. Practice on operation /monitoringparameters of press.(Manual/Hydraulic).	density. Different defects, identification & reporting.
37-38		70. Segregation, Sizes, Edges & corner and anyother physical defects.	Shaping/Moulding methods. The variousprocesses of shaping/moulding and theirlimitation. The process of release from mould andhandling of bricks to prevent damage. Pre weighing of mixture for consistent product.
39-40	• Practice on drying bricks and dryers.	71. Demonstrate/practice on drying of bricks. 72. Practice on operating dryers.	Drying of bricks. The objectives of drying. Classification of dryers. The various dryersused in refractory industries and the processinvolved in these.
41	• Identify the different temperature measuring instrument and maintenance.	73. Demonstrate / practice of different temperaturemeasuring instrument. 74. Reading of temperature. 75. Practice on preventive maintenance.	Temperature, Measurement & instrumentsused in measuring temperature. Thermocouple & its application in measuringtemperature (Pyrometer). Maintenance system. Types of maintenance. Importance of preventive maintenance. Preventive maintenance steps on various plant& machinery.
42-44	• Ensure proper loading/ unloading, drying schedule, firing schedule and inspect the finished product.	76. Observation and practice on loading/unloading. 77. Drying schedule, monitoring of firing schedule. 78. Physical Inspection of finished product. 79. Practiceon loading/unloading of bricks.	Types of kilns for calcinations of rawmaterials. Different zones of kiln, Fuel usedin the kiln.

45-49	• Perform the operation and maintenance of kiln and waste utilisation.	80. Practice on operation & maintenance of kiln. 81. Practice on firing schedule. 82. Practice on brick checking. 83. Demonstration waste utilization	Firing of bricks. Kilns for firing of refractoryand loading pattern of bricks. Firing schedule& Maturing temperature. Different types of kilns used for firing ofbricks. • Tunnel kiln. • Chamber kiln. • Shuttle kiln. • Down Draught (DD) kiln. Checking of bricks after firing: Sizes,lamination / Cracks, Spongy / Segregationand Edge and corner breakage and other physical defects. **Waste Utilization**: Recycling of refractory. Control of dust and gasses leakage during theprocess. Efficient utilization of resources. Optimization of kiln loading Mill house. Operational discipline & control, Firingcriteria.
50	**Project work**		
51	**Revision**		
52	**Examination**		

SYLLABUS FOR REFRACTORY TECHNICIAN TRADE			
THIRD SEMESTER - 06 MONTHS			
Week No.	**Reference Learning Outcome**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
53-54	• Demonstrate the basic application of monolithic refractory.	84. Demonstrate & practice different applicationmethod 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 monolitics 14.Curing 15. Dry out 16. Criteria for acceptance Cracks 17.Defects and acceptance criteria 18. Inspection.
55-56	• Perform brick cutting and joining.	85. 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.
57	• Perform fitting of scaffold.	86. Practice on fitting scaffolding	Scaffolding. Purpose of scaffolding. Materialsused in scaffolding & safety aspect in it.
58-60	• Perform gunning, ramming and patching.	87. Practice with gunning machine, ramming, patching.	Gunning, Ramming, Shot crating, Patching,Coating, hot repair.
61	• Demonstrate the	88. Demonstration on energy	Energy conservation. Concerns for

	energy conservation followed by industry.	conservation. 89. Practice on 5S.	energyconservation. Energy conservation drive. Areasof improvement. Best practices to be adoptedfor energy conservation.
62-63		90. Industry visit to get practical knowledge of kiln maintenance	Maintenance of kilns. Preventive, Periodical &break down maintenance. Various parameters tobe checked during maintenance. Melting practice of Pig Iron. Melting practice of Grey Cast Iron
64-65	• Perform basic computer operation.	**Introduction to computer basics** 91. Familiarization & Identification of computer parts. 92. Practice on computer for MS word, MS power point, MS Excel.	Introduction to computer basics: Basics ofcomputer, MS word, MS power point, MSExcel. Report writing as per Proforma.
66-68	• Perform the method of packaging in refractory.	93. Practice on packaging.	Packaging of refractory : Design of pallets. Pallet dimensions. Arrangement of loading of different shapes inthe pallets. Outer packaging for containershipment. Stretch wrapping. Primary packing. Secondary packing. Final packing.
69-73	• Perform installation and repair brick work.	94. Operation of brick cutting m/c, 95. Checking perpendicularity of lining using plumb 96. Mortar preparation 97. Monitoring thickness of mortar during installation 98. Demolition of existing/ used lining. 99. Use of levelling tool, Sprit level, water level. 100. Use of wooden hammer for	**Sorting tools** • Hand tools to remove packing materials **Survey tools** • Levelling tools • Length level 2 m1 • Marking paint red **Carpenter tools** • Hammer; nails; wood; electric/handsaw **Demolishing / wrecking** • Wrecking Machine, wrecking

		adjusting brick level. 101. Measuring, cutting & Installation of Key brick. 102. Practice on hand grinding. 103. Use of brick holder & brick. 104. Use of skew brick & Arch making, use of screw jack	hammers **Brickwork tools** -- 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.
74-75	**Project work (work in a team)**		
76-77	**Revision**		
78	**Examination**		

SYLLABUS FOR REFRACTORY TECHNICIAN TRADE			
FOURTH SEMESTER – 06 Months			
Week No.	**Reference Learning Outcome**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
79-82	• Perform opening, repair, testing, checking of vibrator and identify the physical defect.	105. Opening & repair of vibrator needle, rammer, pneumatic breaker, replacement of chisel. 106. 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. 107. Preparation & Fixing of shuttering, Checking Vibrator for capability, vibration time, Height of Castable for vibration, Roding practice. 108. Sprinkling water on casted segment for natural/wet curing. 109. Identifying & reporting physical defectsafter Dry out	1. Storage 2. Worksite 3. Equipment 4. Installation • Steel surface • Anchoring • Formwork / shuttering • Water quality • Mixing • Sampling • Vibrating / Rodding • Application • Joints in monolitics 5.Curing 6. Dry out 7. Criteria for acceptance • Cracks • Defects and acceptance criteria 8. Inspection.
83	• Identify the parts of furnaces.	110. Demonstration on different parts of thefurnaces.	**Application of refractory**: Nomenclature of different parts of the furnaces. The industries of application of refractory: • Iron & Steel • Aluminium& non-ferrous • Foundry • Cement • Thermal Power/Inclinator • Petrochemical/Refinery • Chemical/Fertilizer

			• Glass.
84-85	• Ensure skill in the model workshop / fields.	111. Practical training in the modelworkshop / fields	Iron & steel:- Hot metal transfer Ladle, Torpedo Ladles, Sponge iron kilns. Video/Visual display(audio visual display) Induction furnace, Electric Arc furnace, LD converter,Ladles, Tundish.
86-87	• Create report observing heating chart.	112. Preparation of heating chart & reportmaking.	Curing, Preheating/Dry out, tempering schedule/cycle of furnaces after refractory installation.
88-89	• Construct refractory lining.	113. Refractory lining practices.	Study of the refractory lining drawings.
90-93		114. 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. Iron & steel: Slide gate fixing, Porous plug fixing, Fixing of CCrefractories.
94-95	• Prepare technical report and documentation as per industrial need.	115. Prepare different Types of documentation as per industrial need by different methods of recordinginformation.	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.
96-99	• Demonstrate operational function and maintenance of supporting tools and machines.	116. Demonstration & practice Tools, Tackles and Operation.	Tools, Tackles and Operation: Trainings : (Understanding different parts, function and operation), Gunning machine, Spray machine, Fixing devices – PP, SGP, CC Extraction devices – PP, SGP, CC; PneumaticRammer, Pencil Vibrator, Vibrating & Castingmachines. Maintenance of Refractory

			lining. : Different types of refractory practices like LD converter, Laddle,Tundishes, Slide gate refractory, rotary kiln,Mills,Reheating furnace. Occupational Health Hazards and its control. Types of hazards. Knowledge about hazardousmaterials 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).
100-101	**Project work (work in a team)**		
102-103	**Revision**		
104	**Examination**		

Note: -

1. *The instructor may design their own project and also inputs from local industry may be taken in designing such new project.*
2. *The project should broadly cover 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 to a group (Group of at least 4 trainees). The group should demonstrate Planning, Execution, Contribution and Application of Learning. They need to submit a project report.*
3. *If the instructor feels that for the execution of specific project more time is required than he may plan accordingly to produce components/ sub-assemblies in appropriate time, i.e., may be in the previous semester or during execution of normal trade practical.*

9. SYLLABUS - CORE SKILLS

9.1 WORKSHOP CALCULATION SCIENCE & ENGINEERING DRAWING

S No.	Workshop Calculation and Science	EngineeringDrawing
First Semester		
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 a 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.	**Square Root**: Square and Square Root, method of finding out square roots, Simple problem using a calculator.	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.	**Ratio &Proportion**: Simple calculation on related problems.	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.

5.	**Percentage**: Introduction, Simple calculation. Changing percentage to decimal and fraction and vice-versa.	Lettering and Numbering as per BIS SP46-2003: - Single Stroke, Double Stroke, inclined, Upper case and Lower case.
6.	**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.	Dimensioning: - Definition, types and methods of dimensioning (functional, non-functional and auxiliary) - Types of arrowhead - Leader Line with text
7.	**Mass, Weight and Density**: Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density, specific gravity of metals.	Freehand drawing of: - Lines, polygons, ellipse, etc. - Geometrical figures and blocks with dimension - Transferring measurement from the given object to the free hand sketches.
8.	**Speed and Velocity**: Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation, equations of motions, simple related problems.	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)
9.	**Work, Power and Energy**: Work, unit of work, power, unit of power, Horsepower of engines, mechanical efficiency, energy, use of energy, potential and kinetic energy, examples of potential energy and kinetic energy.	Method of presentation of Engineering Drawing: - Pictorial View - Orthogonal View - Isometric view
10.	-----	Symbolic Representation (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

Second Semester		
1.	**Algebra**: Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	Construction of Scales and diagonal scale
2.	**Mensuration:** Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi-circle. Volume of solids – cube, cuboids, cylinder and Sphere. Surface area of solids – cube, cuboids, cylinder and Sphere.	Practice of Lettering and Title Block
3.	**Trigonometry:**Trigonometrical ratios, measurement of angles. Trigonometric tables	Dimensioning practice: - Position of dimensioning (unidirectional, aligned, oblique as per BIS SP:46-2003) - Symbols preceding the value of the dimension and dimensional tolerance. - Text of dimension of repeated features, equidistance elements, circumferential objects.
4.	**Heat & Temperature**: Heat and temperature, their units, difference between heat and temperature, boiling point, melting point, scale of temperature, relations between different scale of temperature, Thermometer, promoter, transmission of heat, conduction, convection, radiation.	Construction of Geometrical Drawing Figures: - Different Polygons and their values of included angles. Inscribed and Circumscribed polygons. - Conic Sections (Ellipse& Parabola)
5.	**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, Horsepower, energy, unit of	Drawing of Solid figures (Cube, Cuboids, Cone, Prism, Pyramid, Frustum of Cone and Pyramid) with dimensions.

	electrical energy.	
6.	**Levers and Simple Machines:**Levers and its types. Simple Machines, Effort and Load, Mechanical Advantage, Velocity Ratio, Efficiency of machine, Relationship between Efficiency, velocity ratio and Mechanical Advantage.	Free Hand sketch of hand tools and measuring tools used in the respective trades.
7.	–	Projections: - Concept of axes plane and quadrant - Orthographic projections - Method of first angle and third angle projections (definition and difference) - Symbol of 1st angle and 3rd angle projection as per IS specification
8.	–	Drawing of Orthographic projection from isometric/3D view of blocks
9.	–	Orthographic Drawing of simple fastener (Rivet, Bolts, Nuts & Screw)
10.	–	Drawing details of two simple mating blocks and assembled view.
Third Semester		
1.	**Elasticity:** Stress, strain, Modulus of elasticity, elastic limit, Hooks law, young's modulus.	**CRO:** Block diagram of Cathode Ray Oscilloscope (CRO). Block diagram of Digital storage Oscilloscope(DSO). Front panel view of CRO & DSO.
2.	**Material:** Introduction, types and properties. Uses of Conducting, Semi-conducting and insulating materials.	**Surface Mounting devices (SMD):** Front panel view of SMD station. IC package of SMD. Freehand drawing of Logic gates and circuits.
3.	**Magnetism:** Magnetic material, magnetic field, flux density, magnetic moment, m.m.f. Reluctance, permeability, susceptibility, electromagnet, solenoid	**Electrical Protective Devices:** Symbol of MCB (Miniature Circuit Breaker), ELCB (Earth Leakage Circuit Breaker), DOL starter, Relays.

	and its practical applications.	
4.	**Pressure:** Pneumatic pressure, PSI, bar, atmospheric pressure, pressure gauge and absolute pressure, Heat treatment process.	**Microcontroller:** Block diagram of 8051. Pin configuration of 8051.
5.	**Indices:** Laws of indices related problems. **Quadratic Equation:** Introduction, solution of simple Quadratic equation and related problems.	**Modulation:** Block diagram of super Heterodyne Radio Receiver. Block diagram of AM and FM receiver. Sketches of analog and digital modulation waveforms
6.	Solution of simple A.C. Circuit with R.L.C. Calculation of power factor, etc.	**Generator:** Front panel control for function Generator, IC tester, power supply, Remote control, In plane switching
7.	**A.C Waveform Calculation:** Calculation of r.m.s, average, instantaneous value, peak value. Peak to peak value, frequency and wavelength calculation and their relationship	-----
8.	**Series And Parallel Connection of Electrical and Electronic components:** 1. Calculation Series and parallel connection of Resistors. 2. Calculation Series and parallel connection of Capacitors. 3. Calculation Series and parallel connection of Inductors. 4. Calculation Series and parallel connection of Batteries. Conversion of power flow to H.P. Calculation of KVA.	-----
Fourth Semester		
1.	**Power supply:** Calculation of SMPS, regulation, Calculation of load and wattage for selection of UPS, calculate of back up time of Battery related to UPS and Load, calculate of voltage regulation, firing angle calculation of ripple factor, voltage regulation of DC voltage. Calculate the regulation of solar power.	**Symbol of electronic component:** A. Thermocouple B. Strain Gauge C. LVDT(Linear variable differential transformer) D. Proximity Sensor E. Free hand sketches of computer ports
2.	**Motor parameters &calculation:** Speed and frequency calculation of ACmotors**,** D.C motors.	**DTH System:** Block diagram connections of Home system. Direct To Home (DTH).

3.	**Modulation:** AM/FM modulation index calculation, calculation of Bandwidth, Percentage of modulation in FM/AM.	**Cell Phone:** Block diagram of cell phone receiver system.
4.	**Number Systems:** Introduction, Decimal, Binary, Octal, Hexadecimal, BCD code, ASCII code, Bit, Byte, KB, MB, GB, Conversion, Addition, Subtraction, Multiplication, Division, 1st and 2s complement method, 9s and 10s complement method.	**Power supply:** Block diagram of SMPS. Block diagram of UPS-ONLINE, OFFLINE, LINE INTERACTING.
5.	**Boolean Algebra:** Simplification of Boolean Algebra equations.	**Project related Drawings:** A. Dancing LEDs B. Smoke detector C. Mobile charger D. Metal detector
6.	**Project costing:** Project selection, cost of project, Simple estimation, simple problems on profit and loss , Balance sheet etc.	**Solar power:** Solar power generation block diagram.
7.	Power transmission by shaft, belts and ropes.	**Fiber-optic communication:** Block diagram of fiber-optic communication.
8.	**Friction:** Law of friction, co-efficient of friction, angle of friction, advantage and disadvantage of friction.	
9.	**Force:** Resolution and composition of forces. Representation of forces by vectors, simple problems on lifting tackles like Jib wall, crane solution of problems with the aid of vectors, General condition of equilibrium for series of forces on a body.	
10.	**Gravity:** Centre of gravity, simple experiments, stable, unstable and neutral equilibrium.	

9.2 CORE SKILL - EMPLOYABILITY SKILLS

CORE SKILL – EMPLOYABILITY SKILL	
First Semester	
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 known people, 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 on messages and filling in message forms, Greeting and introductions, office hospitality, Resumes or curriculum vita essential parts, letters of application reference to previous communication.
2. IT Literacy	**Duration : 20 hrs.** **Marks : 09**
Basics of Computer	Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of the 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, WebsSite, 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
Second Semester	
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 & Marketing Analysis	Qualities of a good entrepreneur, SWOT and risk analysis. Concept &Application of PLC, Sales &Distribution management. Difference between small scale &large scale business, Market survey, Method of marketing, Publicity and advertisement, Marketing mix.
Institution's 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 familiarize 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 it improves or slows down productivity.
Comparison with Developed Countries	Comparative productivity in developed countries (viz. Germany, Japan and Australia) in select 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, vibroacoustichazards, mechanical hazards, electrical hazards, thermal hazards. occupational health, occupational hygiene, 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. The 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 housekeeping, Practice of good housekeeping.
Quality Tools	Basic quality tools with a few examples.

ANNEXURE-I

LIST OF TOOLS & EQUIPMENT			
REFRACTORY TECHNICIAN (For Batch of 20 Candidates)			
S No.	**Name of the Tools and Equipment**	**Specification**	**Quantity**
TRAINEES TOOL KIT			
1.	Steel Rule	12"	21 Nos.
2.	Hammer Ball Pin	0.45 Kg	21 Nos.
3.	Hammer Flat (optional)		21 Nos.
4.	Chisel Cold Flat	2cmX22Cm	21 Nos.
5.	File Flat	300 mm Bastered	21 Nos.
6.	File Flat	300 mm Second Cut	21 Nos.
7.	File Half Round Bastard	200 mm	21 Nos.
8.	Safety goggles		21 Nos.
9.	Googles Furness, Antigua Around Heat Proof		21 Nos.
10.	Head wear anticoncusion Furness		05 Nos.
11.	Pliers	20cm	21 Nos.
12.	Vice bench	12cm Jaw	21 Nos.
13.	Sledge Hammer	5 kg	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	21 Nos.
19.	Bench Grinder		02 Nos.
20.	Hacksaw	30cm adjustable	21 Nos.
21.	Work Bench	2400mm x 1300mm x 800 mm	04 Nos.
22.	Shovel		04 Nos.
23.	Trammel		02 Nos.
24.	Scriber		21 Nos.
25.	Calipers Odd leg		21 Nos.
26.	Caliper inside	150 mm	21 Nos.
27.	Centre Punch	150 mm	21 Nos.
28.	Trowels	(Suare& triangle, 4nos. each)	08 Nos.
29.	Measuring tape	2500mm	05 Nos.
30.	Hand gloves Leather		21 Nos.

31.	Pliers	150mm	21Nos.
32.	Screw driver	100mm	21Nos.
33.	Tester		21Nos.
B. Tools &equipments for Production:			
34.	Jaw crusher		1 No.
35.	Roller crusher		1 No.
36.	Ball Mill/ Vibro mill		1 No.
37.	Sieves		5 Nos.
38.	Mixer machine		1 No.
39.	Press Machine		1 No.
40.	Dryer (Oven hot air)		1 No.
41.	Kiln		1 No.
42.	Moulds(Different shapes)		2 each
43.	Drying furnace (Lab scale) Int. Vol.Im3		1 No.
44.	Rammer		1 No.
45.	Air Compressor	5 bar	1 No.
C. Tools & equipments for Application:			
46.	Brick cutting m/c with cutting wheel		5 Nos.
47.	Stirrer		2 Nos.
48.	Gunning machine		2 Nos.
49.	Models for electric arc furnace		1 No.
50.	Models for Basic Oxygen furnace		1 No.
51.	Models for Rotary kiln		1 No.
52.	Ladle		1 No.
53.	Tundish		1 No.
54.	Jack hammer with drill bits		1 No.
55.	Spirit level		4 Nos.
56.	Water level		4 Nos.
57.	Wooden/aluminiumrapter (optional)		2 Nos.
58.	Plumb		5 Nos.
59.	Masonry hammer		5 Nos.
60.	Slide caliper		5 Nos.
61.	Wooden hammer		5 Nos.
62.	GI Pipe	2" with clamps for scaffolding	As required
63.	Filler Gauge	Min 0.5 mm - 5 mm	1 No.
64.	Laser thermometer (Optional)		1 No.
65.	Pyrometer		1 No.
66.	Joint filler		1 No.
67.	Chisel flat	20X200mm	5 Nos.
68.	Pressure gauge		1 No.
69.	Screw jack		1 No.
70.	Weighing m/c	Min: 10 Kg	1 No.

71.	Wheel barrow		2 Nos.
72.	MS pan		2 Nos.
73.	Measuring flask		2 Nos.
74.	Litmus paper		As required
75.	Thermometer		1 No.
76.	Stop watch		1 No.
77.	Glass biker		1 No.
78.	Star Delta starter		1 No.
79.	Multimeter		2 Nos.
80.	Voltmeter		2 Nos.
81.	Flowmeter		2 Nos.
82.	Vicat apparatus		1 No.
83.	Piano wire/ Wire gauge pad (Optional)		2 nos.
84.	Auto CAD software		1 No.
85.	Hand saw		10 Nos.
86.	Electric hand drill		1 No.
87.	Micrometer	(0-25, 25-50,50-75mm)	1 set each
88.	Vernier calipers	(0-200mm) (.02 discount)	1 No.
89.	Welding transformer (Not required if welder trade exist)		1 No.
90.	C-Clamp	20 cm Perforated Hood	5 Nos.
91.	C-Clamp	30cm Light Duty Steel	5 Nos.
92.	Surface plate	300x300mm	2 Nos.
93.	Drill twist (metric)	3 mm to 12mm	1 sets
94.	Tapes and dies complete set in box BSW,BSF, Metric		2 sets each
95.	Oil Can V_2ft		3 Nos.
96.	Wire Brush		10 nos.
97.	Double ended spanner	10mm to 25mm	5 Nos.
98.	Drill Chuck	0 to 12 morse taper	1 No.
99.	Drill machine to drill	upto 12mm dia	1 No.
100.	Digital multimeter		4 Nos.
101.	AC Motor	single Phase	1 No.
102.	AC Motor	three Phase	1 No.
E. List of additional tools for allied trade in welding			
103.	Transformer welding set	150 amps. - continuous welding current, with all accessories and electrode holder	1 Set
104.	Welder cable to carry 200 amps. With flexible rubber cover		20 Meter
105.	Lugs for cable		12 Nos.
106.	Earth clamps.		2 Nos.

107.	Arc welding table (all metal top) 122 cm X 12 cm X 60 cm with positioner.		1 No.
108.	Oxy - acetylene gas welding set equipment with hoses, regulator and other accessories.		1 Set.
109.	Gas welding table with positioner		1 No
110.	Welding torch tips of different sizes		1 Set
111.	Gas lighter.		2 Nos
112.	Trolley for gas cylinders.		1 No
113.	Chipping hammer.		2 Nos
114.	Gloves (Leather)		2 Pairs
115.	Leather apron.		2 Nos
116.	Spindle key for cylinder valve.		2 Nos.
117.	Welding torches	5 to 10 nozzles.	1 Set.
118.	Welding goggles		4 Pairs.
119.	Welding helmet with coloured glass		2 Nos.
120.	Tip cleaner		10 Sets.
F. Tools for Allied Trade- Sheet Metal Work			
121.	Trammel	30cm.	1 no.
122.	Prick punch		2 nos.
123.	Mallet.		2 nos.
124.	Snips straight	25 cm.	2 nos.
125.	Setting hammers with handle.		2 nos.
126.	Planishing hammer.		2 nos.
127.	Snip bent	25 cm.	2 nos.
128.	Stake hatchet.		2 nos.
129.	Stake grooving.		2 nos.
130.	Gauge imperial sheet.		1 no.
G. General Furniture:			
131.	Almirah	as per required size	2 Nos.
132.	Steel Rack	5'x4'x2'	2 Nos.
133.	Fire Extinguisher		2 Nos.
134.	First aid Box		1 No.

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 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:	**Semester:**		**Duration of the Trade/course:**
Learning Outcome:			

S No	**Candidate Name**	**Father's/Mother's Name**	Safety Consciousness (15)	Workplace Hygiene (5)	Attendance/ Punctuality (10)	Ability to follow Manuals/ Written Instructions (5)	Application of Knowledge (10)	Skills to Handle Tools &Equipment (10)	Economical Use of Materials (5)	Speed in Doing Work (10)	Quality in Workmanship (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														