

Curriculum
For
Certificate in Kiln & Firing Techniques
(6-months)
Code:VI81S001
(2013)

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INTRODUCTION

The firing of kiln is the final step in any ceramics industry. This course is aimed at introducing and developing the basic skill required to operate the kiln. The Course describe the process parameters of automatic control, indicating how you can troubleshoot your system, identify problems and take steps to correct them_ In addition to developing successful firing cycles for a broad range of clay body and glaze genres using kiln, students will explore alternative firing processes. Health and safety issues are an integral part of all aspects of kiln firing ceramics and will be addressed as an ongoing part of this course.

OVERALL OBJECTIVE OF COURSE

1. The main objective of this course is to produce semi-skilled labor and skilled labor for the ceramic industry to work as Kiln Operator.
2. Semi-skilled and skilled worker produced by this training course would help to reduce unemployment and poverty level in the society.
3. This training course is designed to create job opportunities for the middle pass students on the national and international level so as to impart them the requisite skills to work in different ceramics industries.
4. Students will be able to demonstrate the ability to successfully operate and perform maintenance to the kiln.

COMPETENCIES GAINED AFTER COMPLETION OF COURSE

After completion of this course the student should be able to:

1. Describe the kiln and its main types.
2. Express the knowledge of the different parts of the kiln
3. Describe the different types of kiln furniture used in the kilns
4. Describe the different ceramics products
5. Explain the stacking of different wares.
6. Describe different types of firing like biscuit, glost, oxidizing and reducing firing.

7. Describe the importance of kiln reading.
8. Express the knowledge about the insulation in the kiln.
9. Describe the combustion and complete and incomplete combustion.
10. Describe the different temperature measuring devices like thermocouple, Pyrometers and cones.
11. Describe the different pressure measuring devices like bourdon gauge and manometer.
12. Express the knowledge of firing faults and their remedies.
13. Perform the loading and unloading of the kiln
14. Make proper stacking of different ceramics wares
15. Perform the routine maintenance of the kiln
16. Identify the damaged insulation and replace it properly
17. Control of the kiln
18. Skills in trouble shooting during kiln firing, along with exposure of routine maintenance techniques developing an operator
19. capable enough to work in any ceramics industry
20. Measure and control the kiln parameters like temperature and pressure
21. Adjust the burners in kiln for proper combustion
22. Prepare and maintain the record of kiln reading in logbook
23. Record, identify and perform corrective action during trouble shooting during kiln firing
24. Able to adjust the firing cycle of the kiln
25. Identify the different defects in body and glaze due to kiln firing

- 26. Make grading of the final products
- 27. Apply all safety precautions during kiln firing

Job opportunities available immediately and in the future

The Pass outs of this course may find job / employment opportunities in the following areas:

- ✓ Ceramics (table ware) industry
- ✓ Ceramics (Sanitary ware) Industry
- ✓ Ceramics (Wall and Floor Tiles) Industry
- ✓ Refractory manufacturing factory
- ✓ Ceramics (Insulator) Industry
- ✓ Self Employment

TIME FRAME OF ASSESSMENT

Duration of Course	Six Months
Total Hours	800 Hrs
Theory Hours	160 Hrs
Practical Hours	640 Hrs

Curriculum Salient Points

Trainee Entry Level

Middle

Duration of Course

06 months

Total training hours

800

34 hours (per week)

6 days (week)

Training Methodology

Practical 80 %

Theory 20 %

Medium of Training

Urdu

Min. Qualification of Trainer

Metric with 10 year of experience

Certificate course in respective field with Five years of industrial experience

SCHEME OF STUDIES
Kiln and Firing Techniques

Sr.No	Module	Theory (Hours)	Practical (Hours)	Total
1	Loading of the Kiln	20	100	120
2	Maintenance of the Kiln	22	110	132
3	Control of the Kiln	35	90	125
4	Maintain the record of Kiln	24	80	104
5	Trouble shooting in Kiln	20	80	100
6	Quality Control & Sorting	15	80	95
7	Perform Communications	11	40	51
8	Safety at Work	13	60	73
	Total Hours	160	640	800

Overview about the program –Kiln and Firing Techniques

Module Title and Aim	Learning Units	Theory ¹ Days/ho urs	Workpla ce ² Days/ho urs	Timeframe of modules
<p>Module 1:- Loading of the Kiln</p> <p>The Trainee will be able to ensure the proper loading and unloading of different ceramics wares.</p>	<ol style="list-style-type: none"> 1. Perform inspection of the kiln furniture. 2. Make proper stacking of the wares. 3. Perform Loading for Biscuit Firing 4. Perform Loading for Glost Firing 	8 6 4 2	20 30 30 20	120
<p>Module 2: Maintenance of the Kiln</p> <p>This module develops competency in performing routine inspection of kiln and its related accessories.</p>	<ol style="list-style-type: none"> 1. Perform maintenance of the kiln furniture 2. Perform the maintenance of burners. 3. Perform the lubrication of the mechanical parts in kiln 4. Replace the wear and tear insulation areas in Kiln 5. Ensure the availability of alternate power supply 6. Check and clean the air filter 	8 4 2 4 2 2	42 20 20 10 6 12	132

¹ Learning hours in training provider premises

² Training workshop, laboratory and on-the-job workplace

<p>Module 3 :Control of the Kiln</p> <p>After completing this module , Trainee will be to understand and control the different parameters that affects the control firing of the kiln</p>	<ol style="list-style-type: none"> 1. Check the pressure of the gas 2. Adjust the ratio for gas and air for combustion 3. Control the desire temperature and pressure in kiln 4. Ensure the proper voltage supply to the kiln 5. Check the burners for proper ignition 	<p>2</p> <p>10</p> <p>13</p> <p>5</p> <p>5</p>	<p>5</p> <p>25</p> <p>30</p> <p>10</p> <p>20</p>	<p>125</p>
<p>Module 4: Maintain the Record of Kiln</p> <p>After completion of this module trainee will be able to maintain and understand the record of the Kiln reading.</p>	<ol style="list-style-type: none"> 1. Record the log book 2. Record the firing curve 3. Record the temperature and pressure of each zone 4. Record the Cycle time 5. Record the Production and damaged ware data 6. Record the troubleshooting data 7. Record clearance of the previous shift 	<p>5</p> <p>5</p> <p>4</p> <p>4</p> <p>2</p> <p>2</p> <p>2</p>	<p>15</p> <p>15</p> <p>10</p> <p>15</p> <p>10</p> <p>5</p> <p>10</p>	<p>104</p>
<p>Module 5: Trouble shooting in kiln</p> <p>The Trainee will be able to understand the trouble shooting phenomena during kiln firing and make quick action to minimize them.</p>	<ol style="list-style-type: none"> 1. Adjust the temperature in Under firing or over firing 2. Identify and control the leakage of gas 3. Perform quick action during utility failure 4. Adjust the speed of the kiln 5. Replacement of damaged kiln furniture 	<p>8</p> <p>2</p> <p>2</p> <p>4</p> <p>4</p>	<p>20</p> <p>10</p> <p>10</p> <p>20</p> <p>20</p>	<p>100</p>

<p>Module 6 :Quality Control and Sorting</p> <p>This module develops competency in testing of fired products. Identify the defects due to kiln firing and perform grading of the product as per company policies</p>	<ol style="list-style-type: none"> 1. Identify the glazing defects 2. Identify the defects in Ceramics body. 3. Make grading of the products. 	<p>6 6 3</p>	<p>30 30 20</p>	<p>95</p>
<p>Module 7: Perform Communications</p> <p>This module develop the competency to properly communicate with the peers, engineer /supervisors, senior/junior, electrical and mechanical department and the concerned office</p>	<ol style="list-style-type: none"> 1. Communicate with senior / junior 2. Communicate with peers 3. Communicate with engineer/ Supervisor 4. Communicate with electrical department 5. Communicate with Mechanical department 6. Communicate with concerned office / stakeholder 	<p>2 2 2 2 2 1</p>	<p>7 7 7 7 6 6</p>	<p>51</p>
<p>Module 8: Safety at work</p> <p>The Trainee will be able to describe the safe working environment procedures, precautions and how to cope with hazards during kiln firing</p>	<ol style="list-style-type: none"> 1. Identify the protective procedures 2. Ensure the cleaning of the working area 3. Use of Fire Extinguisher, and safety alarms 	<p>5 4 4</p>	<p>20 20 20</p>	<p>73</p>

KILN AND FIRING TECHNIQUES CURRICULUM CONTENTS (TEACHING AND LEARNING GUIDE)

Module 1: Loading of the Kiln

Objective: The Trainee will be able to understand the types of kiln, different types of kiln furniture, and perform the loading, and setting of different wares.

Duration:120..... Hours **Theory:**20..... Hours **Practice:** ...100..... Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
1. Perform Inspection of the kiln furniture	1.1 Understand the different types of Kilns and their furniture 1.2 Able to identify the damaged kiln furniture in the kiln	<p>Knowledge of:</p> <p>1.1.1 Kiln and its classification Batch & Continues</p> <p>1.1.2 Kiln Furniture Classification Saggers slabs and supports Kiln shelves and setters Rollers and kiln car</p> <p>1.1.3 Defects in Kiln Furniture: Rollers, Cracked & Contaminated Slabs, Warpage in furniture</p> <p>1.1.4 Effects of Contaminated furniture on kiln firing</p> <p>Ability to:</p> <ol style="list-style-type: none"> 1. Understand the different types of kiln 2. Identify different kiln furniture 3. Check the furniture for defects 4. 	8 hrs (Theory) 20 hrs (Practical)	Slides, Whiteboard, Projector, Sheets, pencils, markers Sic Slabs, Supports Saggers, Saya, Shuttle kiln	Class room/Lab

<p>2 Make proper stacking of the wares.</p>	<p>2.1 Understand the stacking of the different ceramics products.</p> <p>2.2 Able to load the different wares to the maximum capacity</p>	<p>Knowledge of:</p> <p>2.1.1 Stacking of Different wares 2.1.2 Arrangement of wares 2.1.3 Distance between the wares 2.1.4 Balance the kiln furniture 2.1.2 Height of setting 2.1.3 Volume of the kiln</p> <p>Ability to:</p> <ol style="list-style-type: none"> 1. Calculate the capacity for loading 2. Proper arrange the wares 3. Balance the supports /Wheel after loading 4. Make Stacking of Sanitary wares, tiles, table wares and refractory bricks in the kiln 	<p>6 hrs (Theory)</p> <p>30 hrs (Practical)</p>	<p>Slides, Models, Whiteboard, Sheets, pencils. markers Sic Slabs, supports Green table wares items, tiles, sanitary, refractory bricks</p>	<p>Class room/Lab</p>
<p>3 Perform Loading for Biscuit Firing</p>	<p>3.1 Understand the biscuit firing its need</p> <p>3.2 Able to identify the biscuit ware and able to arrange the biscuit ware</p>	<p>Knowledge of:</p> <p>3.1.1 Biscuit firing 3.1.2 Stacking for biscuit firing 3.1.3 Moisture level</p> <p>Ability to:</p> <ol style="list-style-type: none"> 1. Identify the wares for biscuit firing 2. Make stacking for biscuit firing 	<p>2 hrs (Theory)</p> <p>20 hrs (Practical)</p>	<p>Slides, Whiteboard Kiln furniture's, Green unglazed table wares and tiles</p>	<p>Class room/Lab</p>

<p>4 Perform Loading for Glost Firing</p>	<p>4.1 Understand the glost firing 4.2 Able to perform the correct arrangement of the glazed wares without sticking to the kiln furniture.</p>	<p>Knowledge of:</p> <p>4.1.1 Glost firing 4.1.2 Kissing of the glazed wares 4.1.3 Sticking problems during loading and its prevention 4.1.4 Defected products</p> <p>Ability to:</p> <ol style="list-style-type: none"> 1. Check the base of the wares 2. Perform stacking of glazed products 3. Identify and remove the damaged product 	<p>4 hrs (Theory)</p> <p>30 hrs (Practical)</p>	<p>Whiteboard Kiln furniture, Green glazed wares items like table wares</p>	<p>Class room/Lab</p>
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Module 2: Maintenance of the Kiln

Objective: The Trainee will be able to perform the routine maintenance of the kiln, for the smooth operation

Duration:132..... Hours **Theory:**22..... hours **Practice:**..110..... hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
1. Perform maintenance of kiln furniture	<p>1.1 Understand the contaminated kiln furniture's like rollers, slabs, and saggars and replace them if necessary.</p> <p>1.2 Able to make and apply the kiln wash to the furniture</p> <p>1.3 Able to make grinding of the furniture if necessary</p>	<p>Knowledge of:</p> <p>1.1.1 1.1.2 Kiln wash Composition 1.1.3 Kiln wash preparation and properties 1.1.4 Grinding of Kiln furniture</p> <p>Ability to:</p> <ol style="list-style-type: none"> 1. Make kiln wash 2. Apply kiln wash to the Slabs 3. Remove Kiln wash after firing 4. Change the Roller 	<p>8 hrs (Theory)</p> <p>42 hrs (Practical)</p>	<p>Whiteboard Kiln furniture's, quartz, feldspar, Sodium silicate, Water, Mill, Grinder</p>	Class room/Lab
2 Perform the maintenance of burners.	<p>2.1 Able to identify the ignition problems in burners, identify different burners, cleaning of spark plug</p>	<p>Knowledge of:</p> <p>2.1.1 Burners for firing 2.1.2 Burner nozzles & Tip 2.1.3 Flame size during firing 2.1.4 Disadvantageous of improper firing 2.1.5 Burners maintenance</p> <p>Ability to:</p> <ol style="list-style-type: none"> 1. Identify the defect in the burners 2. Change the burner nozzle and tip 3. Clean the spark plug 	<p>4 hrs (Theory)</p> <p>20 hrs (Practical)</p>	<p>Slides, Whiteboard Gas fired Burners for kiln, Tool Box,</p>	Class room/Lab

3	Perform the lubrication of the mechanical parts in kiln	<p>3.1 Able to check the movement of the mechanical parts involved in kiln and replace the damaged gear and lubricate the machinery.</p> <p>Knowledge of:</p> <p>3.1.1 Moveable mechanical parts in kiln like rollers and kiln cars 3.1.2 Corroded parts 3.1.3 Lubricating Oil</p> <p>Ability to:</p> <ol style="list-style-type: none"> 1. Identify the need of lubrication in Rollers 2. Properly lubricate the required parts 	<p>2 hrs (Theory)</p> <p>20 hrs (Practical)</p>	<p>Slides, Whiteboard Paper sheets, Shuttle kiln,</p>	Class room/Lab
4	Replace the wear and tear insulation areas in Kiln	<p>4.1 Able to identify the wear and tear insulation, heat loses in kiln and change the insulation of the kiln</p> <p>Knowledge of:</p> <p>4.1.1 Insulations in kiln 4.1.2 Insulating wool and Insulating bricks 4.1.3 Heat loses due to cracks</p> <p>Ability to:</p> <ol style="list-style-type: none"> 1. Identify the cracks , wear and tear in insulation wool and bricks 2. Change the damaged insulation 	<p>4 hrs (Theory)</p> <p>10 hrs (Practical)</p>	<p>Slides, Models, Whiteboard Insulation wool, Shuttle Kiln</p>	Class room/Lab
5	Ensure the availability of alternate power supply	<p>5.1 Understand the importance of the alternate fuel during utility failure</p> <p>Knowledge of:</p> <p>5.1.1 Alternate fuels like LPG and furnace oil. 5.1.2 Store Capacity of</p>	<p>2 hrs (Theory)</p> <p>6 hrs (Practical)</p>	<p>Slides, Whiteboard Paper sheets, Shuttle kiln, LPG Cylinder, Generator attached to</p>	Class room/Lab

		<p>these fuels</p> <p>5.1.3 Generator for electrical power supply</p> <p>Ability to:</p> <ol style="list-style-type: none"> 1. Measure the Available capacity of the alternate fuels 2. Change the oil in the Generator 3. Clean the filter of the generator 		Kiln	
6	<p>Check and clean the air filter</p> <p>6.1 Understand the importance of the clean air supplied for the combustion</p> <p>6.2 Able to identify and clean the Air filter in kiln,</p>	<p>Knowledge of:</p> <p>6.1.1 Impurities in air</p> <p>6.1.2 Requirement of Air for combustion</p> <p>6.1.3 Use of Air filter in kiln</p> <p>6.1.4 Maintenance of Air Filter</p> <p>Ability to:</p> <ol style="list-style-type: none"> 1. Open and clean the clogged filter 	<p>2 hrs (Theory)</p> <p>12 hrs (Practical)</p>	<p>Slides, Models, Whiteboard</p> <p>Gas fired Burners for kiln, Air Filters models</p> <p>Tool Box</p>	Class room/lab

Module 3: Control of the Kiln

Objective: The Trainee will be able to control the different parameters like Temperature, Pressure, and flow rate of the Kiln as per quality standard of the products

Duration:125..... Hours **Theory:**35..... Hours **Practice:** :90..... Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
1. Check the Pressure of the Entering Gas	1.1 Understand the pressure required to fire the kiln	<p>Knowledge of:</p> <p>1.1.1 Natural Gas line to the kiln</p> <p>1.1.2 Gas Measuring devices</p> <p>1.1.3 Pressure required for combustion</p> <p>1.1.4 Servo Motor for flow control</p> <p>Ability to:</p> <ol style="list-style-type: none"> 1. Measure the gas pressure 2. Operate the Servo motor for flow adjustment 	<p>2hrs (Theory)</p> <p>5 hrs (Practical)</p>	Whiteboard Sheets, Shuttle kiln, with thermocouple and peep hole, Pyrometer, Bourdon gauge, Gas line, manometer,	
2. Adjust the ratio for gas and air for combustion	<p>2.1 Understand the complete and incomplete combustion in kiln and kiln atmosphere</p> <p>2.2 Able to control the desire combustion ratio in kiln</p>	<p>Knowledge of:</p> <p>2.1.1 Combustion and it requirements</p> <p>2.1.2 Air and Fuel ratio for complete combustion</p> <p>2.1.3 flow of air and gas in kiln</p> <p>2.1.4 Kiln Atmosphere</p> <p>2.1.5 Instruments for controlling air and gas ratio</p> <p>Ability to:</p>	<p>10hrs (Theory)</p> <p>25 hrs (Practical)</p>	Slides, Models, Whiteboard Sheets, Shuttle kiln, with thermocouple and peep hole, Pyrometer, Bourdon gauge, manometer,	

		<ol style="list-style-type: none"> 1. Understand the combustion process 2. Control the Flow rate of gas in kiln 3. Control the flow rate of air in the kiln 4. Maintain the desire combustion ratio in kiln 			
3. Control the desire temperature and pressure in kiln	<ol style="list-style-type: none"> 3.1 Understand the temperature and pressure measuring devices used in kiln 3.2 Able to control the temperature and pressure in the kiln 	<p>Knowledge of:</p> <ol style="list-style-type: none"> 3.1.1 Temperature measuring devices in kiln: Thermocouple, Optical Pyrometer, Cone 3.1.2 Pressure measuring devices: Bourdon gauge and U tube Monometer Smoke pressure 3.1.3 Flow of pressure in the kiln 3.1.4 Servo motors <p>Ability to:</p> <ol style="list-style-type: none"> 1. Measure temperature reading 2. Change temperature using servo motor 3. Measure smoke pressure 4. Control the pressure in the kiln 	<p>13 hrs (Theory)</p> <p>30 hrs (Practical)</p>	<p>Slides, Models, Whiteboard Sheets, Shuttle kiln, with thermocouple and peep hole, Pyrometer, Bourdon gauge, manometer, Pyrometric cones</p>	Class Room/Lab

<p>4. Ensure the proper voltage supply to the kiln</p>	<p>4.1 Understand the voltage requirements of the electrical operated parts in kiln</p>	<p>Knowledge of:</p> <ul style="list-style-type: none"> 4.1.1 Current and its terminologies 4.1.2 Alternating and Direct Current 4.1.3 Single and three phase 4.1.4 Voltage requirement of the kiln parts 4.1.5 Voltage and current measuring devices on the control panel <p>Ability to:</p> <ul style="list-style-type: none"> 1. Read the Voltage of different devices of the kiln 2. Identify the voltage drop in kiln 	<p>5hrs (Theory) 10 hrs (Practical)</p>	<p>Slides, Models, Whiteboard Sheets, Shuttle kiln, with control panel</p>	
<p>5. Check the burners for proper ignition</p>	<p>5.1 Able to identify the burner failure during kiln firing and perform the cleaning of the burner</p>	<p>Knowledge of:</p> <ul style="list-style-type: none"> 5.1.1 Burners in the zone 5.1.2 Burners problems like smoke in the zone <p>Ability to:</p> <ul style="list-style-type: none"> 1. Identify the burner 2. Open and clean the spark plug of the burner 	<p>5hrs (Theory) 20 hrs (Practical)</p>	<p>Slides, Models, Whiteboard Sheets, Burners</p>	<p>Class Room/Lab</p>

Module 4: Maintain the Record of Kiln.

Objective: The Trainee will be able to read and record the data in the log book

Duration:104..... Hours **Theory:**24..... Hours **Practice:**..80..... hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
1. Record the log book	1.1 Understand the importance of kiln reading during kiln firing 1.2 Understand the importance of log book	Knowledge of: 1.1.1 Kiln reading 1.1.2 Kiln reading methods: Log book and firing curve 1.1.4 Importance of log book 1.1.5 data in log book Ability to: 1. Able to record the required data in log book 2. Record the data in log book	5 hrs (Theory) 15 hrs (Practical)	Slides, Whiteboard log book	Class room/lab
2. Record the firing curve	2.1 Understand the graphical data of kiln firing temperature and describe the reading from the curve.	Knowledge of: 2.1.1 firing curve data 2.1.2 Graph recorder in kiln Ability to: 1. Describe the data from the firing curve 2. Start the Graph recorder in kiln	5 hrs (Theory) 15 hrs (Practical)	Slides, Whiteboard Sheets, Shuttle kiln, with graph Recorder, Graph papers	Class room/lab
3. Record the temperature and pressure of each	3.1 Able to measure the data of temperature and pressure in the	Knowledge of: 3.1.1 Temperature and pressure	4 hrs (Theory)	Whiteboard Sheets, Shuttle kiln, Log book	Class room/lab

zone	different zones of kiln	measuring devices 3.1.2 Log book Ability to: 1. Measure the value of temperature and pressure in kiln 2. Record the data in kiln	10 hrs (Practical)		
4. Record the Cycle time	4.1 Able to describe and record the cycle time in kiln	Knowledge of: 4.1.1 Cycle Time 4.1.2 Fast firing cycle Ability to: 1. Record the cycle time	4 hrs (Theory) 15hrs (Practical)	Whiteboard Sheets, Shuttle kiln, Log book	Class room/lab
5. Record the Production and damaged ware data	5.1 understand the production data of the kiln and also record the damaged pieces in kiln	Knowledge of: 5.1 Products fired in kiln 5.2 Sorting of defected products 5.3 Importance of this data Ability to: 1. Record the production data in log book 2. Record the defected data	2 hrs (Theory) 10 hrs (Practical)	Whiteboard Sheets, Log book	Class room/lab
6. Record the troubleshooting data	6.1 Able to know the trouble shooting phenomena during kiln firing and record each data	Knowledge of: 6.1.1 Trouble shooting issues during kiln firing: Utility failure, , Tile stop in roller Ability to:	2 hrs (Theory) 05 hrs (Practical)	Slides, Models, Whiteboard Sheets, Shuttle kiln, Log book	

		1. Record and analyze trouble shooting data			
7. Record clearance of the previous shift	7.1 understand all the data recorded in kiln, read the data and take corrective action if necessary	Knowledge of: 7.1.1 Complete knowledge of the Log book Ability to: 1. Understand the previous record data of the kiln operator 2. Make necessary action	2 hrs (Theory) 10 hrs (Practical)	Slides, Models, Whiteboard Sheets, Shuttle kiln, Gas burners, Tool kit	

Module 5: Trouble shooting in kiln

Objective: The Trainee will be able to take corrective action in case of trouble shooting like variation in temperature, leakage of gas, power failure and breakage during kiln firing

Duration:100..... Hours **Theory:**20..... Hours **Practice:** 80..... hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
1. Adjust the temperature in Under firing or over firing	1.1 Understand the under firing and over firing in kiln 1.2 Able to change the temperature in such a way to minimize the defect	Knowledge of: 1.1.1 Under firing 1.1.2 Over firing 1.1.3 Defects due to the firing 1.1.4 Remedies of these defects Ability to: 1. identify the defects due to firing 2. Perform Temperature adjustment to remove the defect	8 hrs (Theory) 20 hrs (Practical)	Slides, Models, Whiteboard Sheets, Shuttle kiln with accessories, Gas burners, Tool kit	Class room/lab
2. Identify and control the leakage of gas	2.1 Able to detect and stop the leakage of gas during kiln firing	Knowledge of: 2.1.1 Natural gas Pipe line 2.1.2 Valves types 2.1.3 Tools Ability to: 1. Detect the leakage in line 2. Stop the leakage	2 hrs (Theory) 10 hrs (Practical)	Slides, Models, White Board Sheets, Shuttle kiln, Gas burners, Tool kit	Class room/lab
3. Perform quick action during utility failure	3.1 Able to take corrective action in case of power failure	Knowledge of: 3.1.1 Gas supply failure 3.1.2 Electricity failure	2 hrs (Theory)	Slides, Models, Whiteboard Sheets, Shuttle kiln,	Class room/lab

	to immediate switch to alternate power supply.	<p>3.1.3 Availability of the alternate fuel</p> <p>3.1.4 Control of the Alternate supply in panel</p> <p>Ability to:</p> <ol style="list-style-type: none"> 1. Identify the power failure 2. Perform switch Over Kiln to Generators and LPG during utility failure 	10 hrs (Practical)	Gas burners, Tool kit	
4. Adjust the speed of the kiln	4.1 Able to adjust the speed and RPM of the kiln	<p>Knowledge of:</p> <p>4.1.1 Speed of the kiln</p> <p>4.1.2 Effect of kiln RPM setting</p> <p>4.1.3 Cycle time</p> <p>Ability to:</p> <ol style="list-style-type: none"> 1. Adjust the speed of kiln 	4 hrs (Theory) 20 hrs (Practical)	Slides, Models, Whiteboard Sheets, Shuttle kiln, Gas burners, Tool kit	Class room/lab
5. Replacement of damaged kiln furniture	5.1 Able to identify the damaged roller, slab and replace it	<p>Knowledge of:</p> <p>5.1.1 furniture breakage during kiln firing</p> <p>5.1.2 Tool kit</p> <p>Ability to:</p> <ol style="list-style-type: none"> 1. Identify the damaged furniture 2. Change the furniture during kiln firing 	4 hrs (Theory) 20 hrs (Practical)	Slides, Models, Whiteboard Sheets, Rollers, LN Keys	Class room/lab

Module 6: Quality Control and Sorting

Objective: The Trainee will be able to understand the importance of quality control of and the fired products, identify defects, their remedies and perform sorting

Duration:95..... Hours **Theory:**15..... Hours **Practice:**... ..80..... Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
1. Identify the glazing defects	1.1 Understand the different defects in the glazed body 1.2 Able to identify the different defects of the glazed material of the products like crazing, pin holes, crawling, shivering	Knowledge of: 1.2.1 Glaze Surface 1.2.2 Defects in the glazed surface: Pin holes, Crazing, Shivering, Crawling 1.2.3 Defects due to firing Ability to: 1. Identify the pin hole 2. Identify the crazing 3. Identify the shivering 4. Identify the crawling	6hrs (Theory) 30 hrs (Practical)	Slides, Models, Whiteboard Sheets, Defected glazed products	Class room/lab
2. Identify the defects in Ceramics body.	2.1 Understand the different defects in the body 2.2 Able to identify the different defects of the body material of the products like warpage	Knowledge of: 2.1.1 Final Shape of the product 2.1.2 Defects in the fired body: Warpage Ability to: 1. Identify the warpage	6hrs (Theory) 30 hrs (Practical)	Slides, Models, Whiteboard Sheets, Defected products	Class room/lab
3. Make grading of the	3.1 Able to perform sorting of the	Knowledge of:	3hrs (Theory)	Slides, Models, Whiteboard	Class room/lab

products.	different materials	3.1.1 Defects in fired body 3.1.2 Quality control requirement of the company Ability to: 1. Perform the grading	20 hrs (Practical)	Sheets, Defected products with little defects,	
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Module 7: Perform Communication

Objective : To enable the trainee to properly communicate with the related persons in the Industry

Duration: ..51..... hours **Theory:**11..... hours **Practice:**....40..... hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
1. Communicate with senior / junior	1.1 Understand the communication skill and communicate with senior / junior	<p>Knowledge of:</p> <p>1.1.1 Verbal communication, channel of communication and written communication</p> <p>Ability to:</p> <p>1. Communicate verbally according to the status of senior / junior, select the suitable channel and communicate in written form.</p>	<p>2hrs (Theory)</p> <p>7 hrs (Practical)</p>	Related books, White Board, Papers	Class Room/ Lab
2. Communicate with peers	2.1 Understand the communication	<p>Knowledge of:</p> <p>2.1.1 Communication technique and communication skill</p> <p>Ability to:</p> <p>1. Communication technique and communication skill</p>	<p>2hrs (Theory)</p> <p>7 hrs (Practical)</p>	Related books, White Board, Papers	Class Room/ Lab

3. Communicate with engineer/ Supervisor	3.1 Understand the communication skill and communicate with engineer/ supervisor	<p>Knowledge of:</p> <p>3.1.1 Verbal communication, channel of communication and written communication.</p> <p>Ability to:</p> <p>1. Communication verbally according to the status of engineer / overseer, select the suitable channel and communicate in written.</p>	<p>2hrs (Theory)</p> <p>7 hrs (Practical)</p>	Related books, White Board, Papers	Class Room/ Lab
4. Communicate with electrical department	4.1 Understand the communication skill and communication with electrical department	<p>Knowledge of:</p> <p>4.1.1 Verbal communication, channel of communication and written communication.</p> <p>Ability to:</p> <p>1. Communication verbally according to the status of electrician, select the suitable channel and communicate in written.</p>	<p>2hrs (Theory)</p> <p>7 hrs (Practical)</p>	Related books, White Board, Papers	Class Room/ Lab

5. Communicate with Mechanical department	5.1 Understand the communication skill and communication with mechanical departments	<p>Knowledge of:</p> <p>5.1.1 Verbal communication, channel of communication and written communication.</p> <p>Ability to:</p> <ol style="list-style-type: none"> 1. Communication verbally according to the status of mechanical fault 2. Select the suitable channel and communicate in written. 	<p>2hrs (Theory)</p> <p>6 hrs (Practical)</p>	Related books, White Board, Papers	Class Room/ Lab
6. Communicate with concerned office / stakeholder	6.1 Understand the communication and communicate with office / stakeholder	<p>Knowledge of:</p> <p>6.1.1 Verbal communication, channel of communication and written communication.</p> <p>Ability to:</p> <ol style="list-style-type: none"> 1. Communication verbally according to the status of office / stakeholder, select the suitable channel and communicate in written. 	<p>1hrs (Theory)</p> <p>6 hrs (Practical)</p>	Related books, White Board, Papers	Class Room/ Lab

Module 8: Safety at work

Objective: The Trainee will be able to describe the safe working environment procedures, precautions and how to cope with hazards during accidents during kiln firing

Duration:73..... Hours **Theory:**13..... Hours **Practice:**..60..... hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
1. Identify the protective procedures	1.1 Able to identify the various types of protective clothing/equipment and their uses	<p>Knowledge of:</p> <p>1.1.1 Personnel protective equipment, tools and their uses</p> <ul style="list-style-type: none"> -Overalls -ear defender/plugs -Safety boots -Safety Gloves -Safety Helmets -Safety Masks -Safety Goggles <p>Ability to:</p> <p>1. Protect him from accident</p>	<p>5hrs (Theory)</p> <p>20 hrs (Practical)</p>	<p>Slides, Models, Whiteboard</p> <p>Sheets, safety cloths, ,Overalls, ear defender/plugs, Safety boots, Safety Gloves, Safety Helmets, Safety Masks, Safety Goggles</p>	Class room/lab
2. Ensure the cleaning of the working area	2.1 Able to keep the work place clean and provide the necessary first aid treatment	<p>Knowledge of:</p> <p>2.1.1 importance of safe working environment</p> <p>2.1.2 first aid treatment for accidents</p> <ul style="list-style-type: none"> -Electrical Shock 	<p>4hrs (Theory)</p> <p>20 hrs (Practical)</p>	<p>Slides, Models, Whiteboard</p> <p>Sheets, safety cloths, ,</p>	Class room/lab

		<ul style="list-style-type: none"> -Bleeding -Breakage of bones -Minor burns -Eye Injuries <p>Ability to:</p> <ol style="list-style-type: none"> 1. Deal with minor accidents and injuries 2. Make proper placement of tools in the work place 3. provide first aid treatment 			
3. Use of Fire Extinguisher and safety alarms	3.1 Able to use the fire extinguisher and Safety Alarms at the time of emergency	<p>Knowledge of:</p> <p>3.1.1 Fire Extinguishers and their uses</p> <p>3.1.2 Safety alarms</p> <p>Ability to:</p> <ol style="list-style-type: none"> 1. Use at the time of fire due to electrical short circuit or combustion 2. Use the alarm during fire 	4hrs (Theory) 20 hrs (Practical)	Slides, Models, Whiteboard Sheets, safety cloths, ,Fire Extinguisher	Class room/lab

ASSESSMENT

Module 1: Loading of the Kiln

Learning Units	Theory hours	Workplace Days/hours	Recommended formative assessment	Recommended Methodology	Scheduled Dates
1. Perform inspection of the kiln furniture	8	20	<ol style="list-style-type: none"> 1. Define kiln and explain different kinds of kilns 2. Describe the different types of kiln furniture 3. Identify the given kiln furniture 4. Identify the contaminated kiln furniture 	Short Question and answers, Quiz, Task	
2. Make proper stacking of the wares.	6	30	<ol style="list-style-type: none"> 1. Describe the stacking process. 2. Explain the distance between the wares and wheel balance during loading 3. Demonstrate the stacking of given table wares, tiles, sanitary wares, tiles and refractory's in the given kiln 	Short Question and answers, Quiz,	
3. Perform Loading for Biscuit Firing	4	30	<ol style="list-style-type: none"> 1. Explain biscuit firing its application 2. Demonstrate the stacking for green tiles and table wares 	Short Question and answers, Quiz,	
4. Perform Loading for Glost Firing	2	20	<ol style="list-style-type: none"> 1. Explain glost firing and its uses 2. Explain the importance of the setting height and sticking problems in glazed wares. 3. Demonstrate the stacking for unfired glazed wares items like table wares, tiles and sanitary wares. 	Short Question and answers, Quiz,	

Module 2: Maintenance of the Kiln

Learning Units	Theory hours	Workplace Days/hours	Recommended formative assessment	Recommended Methodology	Scheduled Dates
1. Perform maintenance of the kiln furniture	8	42	<ol style="list-style-type: none"> 1. Describe kiln wash, its preparation and properties 2. Explain the need for grinding the furniture 3. Demonstrate the kiln wash on kiln furniture 4. Identify the visual defects on kiln furniture and demonstrate the removal. 	Short Question and answers, Quiz,	
2. Perform the maintenance of burners.	4	20	<ol style="list-style-type: none"> 1. Describe the gas burners used in kiln firing and explain their working principles and their construction 2. Demonstrate to change the tip of the given burner 3. Demonstrate the removal of carbon in the burners 	Short Question and answers, Quiz,	
3. Perform the lubrication of the mechanical parts in kiln	2	20	<ol style="list-style-type: none"> 1. Explain the different mechanical parts in kiln and their maintenance 2. Demonstrate the lubrication of the gears and rollers. 	Short Question and answers, Quiz,	
4. Replace the wear and tear insulation areas in Kiln	4	10	<ol style="list-style-type: none"> 1. Describe Insulation, its types and applications 2. Identify the visual defects in the given insulation and their replacement 	Short Question and answers, Quiz,	
5. Ensure the availability of alternate power supply	2	6	<ol style="list-style-type: none"> 1. Explain different fuels used for the kiln firing 2. Describe the role of generators and its maintenance 	Short Question and answers, Quiz,	

			<ul style="list-style-type: none"> 3. Demonstrate the availability of LPG Stored quantity by using the panel 4. Demonstrate the maintenance of the generator 		
6. Check and clean the air filter	2	12	<ul style="list-style-type: none"> 5. Describe the disadvantageous of Choked air filter and dust in air 6. Demonstrate the cleaning of air filter in kiln 	Short Question and answers, Quiz,	

Module 3: Control of the Kiln

Learning Units	Theory hours	Workplace Days/hours	Recommended formative assessment	Recommended Methodology	Scheduled Dates
1. Check the pressure of the entering gas	2	5	<ol style="list-style-type: none"> Describe the pressure requirement of gas for combustion in the kiln Demonstrate to note the pressure of the gas line of the given kiln 	Short Question and answers, Quiz,	
2. Adjust the ratio for gas and air for combustion	10	25	<ol style="list-style-type: none"> Describe combustion and the explain complete and incomplete combustion Explain the Oxidizing and reducing atmosphere in kiln Demonstrate the adjustment of the desired ratio of gas and air. 	Short Question and answers, Quiz,	
3. Control the desire temperature and pressure in kiln	13	30	<ol style="list-style-type: none"> Describe the different temperature and pressure measuring devices Describe draught in kiln Explain the role of damper in kiln Describe smoke pressure in kiln Explain the role of servo motor in kiln Demonstrate the temperature and pressure measurement from the thermocouple, Pyrometric cones, Pyrometer, bourdon gauge Demonstrate to increase the temperature in kiln by using servo motor 	Short Question and answers, Quiz,	
4. Ensure the proper voltage supply to the kiln	5	10	<ol style="list-style-type: none"> Describe the Current and Voltage Explain the Voltage requirements of the kiln Make measurement of the voltage in the control panels 	Short Question and answers, Quiz,	

5. Check the burners for proper ignition	5	20	1. Describe the identification of burner failure during kiln firing 2. Demonstrate to resolve the ignition problem of the given burner	Short Question and answers, Quiz,	
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Module 4: Maintain the Record of the kiln

Learning Units	Theory hours	Workplace Days/hours	Recommended formative assessment	Recommended Methodology	Scheduled Dates
1. Record the log book	5	15	<ol style="list-style-type: none"> Describe the importance of recording kiln data, Explain different kiln reading methods Demonstrate to identify the given reading data device 	Short Question and answers, Quiz,	
2. Record the firing curve	5	15	<ol style="list-style-type: none"> Describe the firing curve Explain the data in the firing curve Demonstrate the identification of the cycle time and temperature in the different zones of the kiln in the given firing curve 	Short Question and answers, Quiz,	
3. Record the temperature and pressure of each zone	4	10	<ol style="list-style-type: none"> Explain the temperature and measuring devices in the kiln Demonstrate to record the temperature and pressure data of the kiln 	Short Question and answers, Quiz,	
4. Record the Cycle time	4	15	<ol style="list-style-type: none"> Describe the cycle time of the kiln Demonstrate to record the cycle time of the kiln 	Short Question and answers, Quiz, task	
5. Record the Production and damaged ware data	2	10	<ol style="list-style-type: none"> Explain the importance for recording the production and damaged wares Demonstrate to record the production of the given unload kiln 	Short Question and answers, Quiz, task	
6. Record the troubleshooting data	2	5	<ol style="list-style-type: none"> Explain different trouble shooting issues recorded in the log book Demonstrate to Identify the trouble shooting data in the given log book 	Short Question and answers, Quiz,	

7. Record clearance of the previous shift	2	10	<ol style="list-style-type: none"> 1. Explain the importance of Observing the log book after shift change 2. Demonstrate to describe the important data in the given log book 	Short Question and answers, Quiz,	
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Module 5: Trouble shooting in kiln

Learning Units	Theory hours	Workplace Days/hours	Recommended formative assessment	Recommended Methodology	Scheduled Dates
1. Adjust the temperature in Under firing or over firing	8	20	<ol style="list-style-type: none"> 1. Explain the under firing and over firing in kilns 2. Describe their disadvantageous 3. Demonstrate the adjustment of temperature in under firing or over firing 	Short Question and answers, Quiz,	
2. Identify and control the leakage of gas	2	10	<ol style="list-style-type: none"> 1. Explain the different fitting, valves used in gas line 2. Demonstrate to detect and stop the leakage in the given gas line 	Short Question and answers, Quiz,	
3. Perform quick action during utility failure	2	10	<ol style="list-style-type: none"> 1. Describe the identification of the utility failure and its indication on the control panel 2. Demonstrate to switch over the Kiln to LPG during gas failure 3. Demonstrate to switch over the kiln to the alternate power supply during electricity failure. 	Short Question and answers, Quiz,	
4. Adjust the speed of the kiln	4	20	<ol style="list-style-type: none"> 1. Explain the effect of kiln RPM setting 2. Describe Cycle time 3. Demonstrate to change the speed of roller hearth kiln by adjusting the RPM 	Short Question and answers, Quiz,	

5. Replacement of damaged kiln furniture	4	20	<ol style="list-style-type: none"> 1. Explain the procedure and tools used for removing the burners from the kiln 2. Demonstrate to Identify and change the damaged furniture in kiln during firing 		
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Module 6: Quality Control and Sorting

Learning Units	Theory hours	Workplace Days/hours	Recommended formative assessment	Recommended Methodology	Scheduled Dates
1. Identify the glazing defects	6	30	<ol style="list-style-type: none"> 1. Describe different defects in glazes 2. Explain their causes 3. Demonstrate the identification of glaze defects like pin holes, shivering, color variation, blistering to the given fired products 	Short Question and answers, Quiz,	
2. Identify the defects in Ceramics body.	6	30	<ol style="list-style-type: none"> 1. Describe the different defects of body due to kiln firing 2. Demonstrate the identification of different body defects like warpage 	Short Question and answers, Quiz,	
3. Make grading of the products.	3	20	<ol style="list-style-type: none"> 1. Describe the sorting of the final products 2. Demonstrate the grading of the given products 	Short Question and answers, Quiz,	

Module 7: Perform Communications

Learning Units	Theory hours	Workplace Days/hours	Recommended formative assessment	Recommended Methodology	Scheduled Dates
1. Communicate with senior / junior	2	7	<ol style="list-style-type: none"> 1. Explain communication technique and communications skill with senior/junior. 2. Demonstrate to perform the communication with the related person 	Short Question and answers, Quiz, Task	
2. Communicate with peers	2	7	<ol style="list-style-type: none"> 1. Explain communication technique and communications skill with peers 2. Demonstrate to perform the communication with the related person 	Short Question and answers, Quiz, Task	
3. Communicate with engineer/ Supervisor	2	7	<ol style="list-style-type: none"> 1. Explain communication technique and communications skill with engineer/supervisor. 2. Demonstrate to perform the communication with the related person 	Short Question and answers, Quiz, Task	
4. Communicate with electrical department	2	7	<ol style="list-style-type: none"> 1. Explain communication technique and communications skill with electrician/Electrical department 2. Demonstrate to perform the communication with the related person 	Short Question and answers, Quiz, Task	
5. Communicate with Mechanical	2	6	<ol style="list-style-type: none"> 1. Explain communication technique and communications skill with electrician/Electrical 	Short Question and answers,	

department			department 2. Demonstrate to perform the communication with the related person	Quiz, Task	
6. Communicate with concerned office / stakeholder	1		1. Explain communication technique and communications skill with concerned office/stakeholder 2. Demonstrate to perform the communication with the related person	Short Question and answers, Quiz, Task	

Module 8 : Safety at Work

Learning Units	Theory hours	Workpl ace Days/ho urs	Recommended formative assessment	Recommended Methodology	Scheduled Dates
1. Identify the protective procedures	5	20	<ol style="list-style-type: none"> 1. Describe different protective equipment, tools and their uses 2. Demonstrate to wear the safety equipment for eyes, hands, body and foots 	Short Question and answers, Quiz,	
2. Ensure the cleaning of the working area	4	20	<ol style="list-style-type: none"> 1. Describe the importance of safe working environment 2. Describe first aid treatment 3. Explain different types of injuries 4. Demonstrate the arrangement the tools and equipments for the clean work place 	Short Question and answers, Quiz,	
3. Use Fire Extinguisher and safety alarms	4	20	<ol style="list-style-type: none"> 1. Explain the different types of fire extinguishers. 2. Describe the importance of safety alarms 3. Demonstrate the extinguishing the fire with the help of fire extinguisher 	Short Question and answers, Quiz,	

Supportive Notes

Assessment context:

This unit has to be assessed on the job, off the job, or a combination of on and off the job demonstrated by an individual work.

Critical aspects:-

- ✓ Able to identify the different types of kiln furniture
- ✓ Able to perform the routine maintenance of the kiln
- ✓ Control the kiln related parameters
- ✓ Ability to operate the kiln
- ✓ Ability to record the kiln data
- ✓ Ability to perform quick action during kiln trouble shooting
- ✓ Ability to properly communicate
- ✓ Follow safety rules

Assessment condition:-

Each unit should be assessed separately.

The candidate will have to access all the related tools, Kiln, material and demonstrations required.

The candidate will be required orally or by other methods of communication to answer questions asked by the assessor.

Present evidence related to the skills.

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by criteria and that he possesses the required knowledge and skill.

Resources required for assessment:-

It includes all tools, equipment and related material, listed in the curriculum

List of Tools, Machinery & Equipment

SR. NO.	NOMENCLATURE OF EQUIPMENT / TOOLS	QUANTITY
1.	Shuttle kiln with all accessories Volume:- 500 liter Maximum temperature:- 1300 deg C Fuel- Natural gas fired Blower as per specification of the Kiln , Suitable for oxidizing & Reduction firing Equipped with all temp/fuel control system Kiln Furniture's Sic Slabs, Saggars, Pillar etc	1 No. (Imported)
2.	Optical pyrometer	1 No.

3	Brick and Slab cutter	1 No.
4	Tool kit (tub, gloves, masonry tools etc.)	25 set.
5	Fire Extinguisher	02 No

List of Consumable Supplies

SR. NO.	Consumable Items	QUANTITY
1.	Green wares like <ul style="list-style-type: none">- Plates- Bowls- Dishes- Basins- Commodes- Bricks	100 each
2.	Parametric saggars,cones	20 set
3.	Insulating Wool	10 set
4	Kiln furniture like Sic Slabs, Rollers, Saggars, Pillars etc.	20 No

Reference Books

1. Kimio Kyotani, Ceramic kiln, Punjab Small Industry Co.
2. Henrik Norsker, The Self-Reliant Potter: Refractories and Kilns, Dt. Zentrum für Entwicklungstechnologien GATE, 1987 , ISBN 3-528-02031-8
3. O.P.Gupta: Elements of Fuels, Furnaces and Refractories, Khanna Publishers
4. F. H. Norton: Refractories.(McGraw-Hill, New York 1949)
5. D. Rhodes: Kilns. (Pitman, London 1969)

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