

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

**Course Title: Fundamental of Refractory
(Code:-3335203)**

Diploma Programme in which this course is offered	Semester in which offered
Diploma Ceramic Technology	3rd semester

1. RATIONALE

Apart from the knowledge of Raw Materials Diploma ceramic students should have knowledge of Basic Refractory and their utilization in industries. It is essential foundation for next curriculum of Refractory-2 and Advance Refractory.

2. COMPETENCY

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the following competencies.....

Plan the detailed process for production of refractory for given application

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	200
3	0	4	7	70	30	40	60	

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit; ESE - End Semester Examination; PA - Progressive Assessment

4. COURSE DETAILS

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I Introduction about refractory industries	1a. Explain status of refractory industries in india.	1.1 Brief history and scope of refractory industries in India. 1.2 Present status of refractory industries in India.
Unit – II Refractory Raw Materials	2a Identify different Raw Materials with their properties.	2.1 Types of refractory raw materials. 2.2 Detail study of refractory raw materials, such as fire clay, china clay etc. 2.3 Study of properties and uses of silica, sillimanite and a kynite, andalucite, mullit and bauxite etc. 2.4 Study of physical properties of magnetite, dolomite, zirconia, chromites, graphite etc.
Unit – III Properties with occurrences of Raw materials.	3a. Explain various physical properties with occurrences of Raw materials.	3.1 Details of physical properties chemical composition, molecular formula of the refractory materials with their occurrences in Gujarat and India regions. 3.2 Study regarding grog and its use in refractory making. 3.3 Manufacturing methods of grog. 3.4 Grading of grog and their use in refractory making
Unit – IV Classification of refractory	4a. Classify refractory	4.1 Introduction. 4.2 Study regarding natural and synthetic refractory. 4.3 Classification of refractory like acid, basic and neutral refractory on the basis of chemical characteristics of raw materials.
Unit – V Processing of raw materials	5a Explain Different Process for Processing of raw materials 5b Explain construction and Function of Equipments.	5.1 Methods of crushing, grinding, mixing, ageing of refractory materials. 5.2 Details of machines used for crushing and grinding, of refractory materials such as disintegrator, edge runner, ordinary pug mill, de-airing pug mill, etc. 5.3 Details of mixing machines and equipments such as muller and pan roller mixer, elevator, hopper etc. 5.4 Details of body making and formulation
Unit – VI Shaping, Drying, Firing method of refractory	6a Perform shape of refractory articles. 6b Carry out Drying and Firing Technique of the Article.	6.1 Various methods of shaping of refractory. 6.2 General principles of drying and Firing. 6.3 Brief details regarding Dryers used for Drying refractory bricks 6.4 Brief details regarding kilns used for firing refractory bricks

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1.	Introduction about Refractory industries	5	3	3	0	06
2.	Refractory raw materials	7	3	4	4	11
3.	Properties and occurrences of refractory raw materials	7	3	4	4	11
4.	Classification of refractory	6	2	5	5	12
5.	Processing of raw materials	8	2	6	6	14
6.	Shaping, Drying, Firing method of refractory	9	3	7	6	16
Total		42				70

6. SUGGESTED LIST OF EXERCISES/PRACTICAL

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills so that students are able to acquire the competency.

Following is the list of experiments for guidance.

S. No.	Unit No.	Practical/Exercise	Apprx. Hrs. Required
1	Unit – 6	Prepare fire bricks & cut in to various shapes.	4
2	Unit – 2,3,5	Prepare I.S. 6 bricks containing 32% of alumina.	6
3	Unit – 2,3,5	Prepare I.S. 7 bricks with 28% Al ₂ O ₃ content.	6
4	Unit – 2,3,5	Prepare I.S. 8 bricks containing 42% Al ₂ O ₃ .	6
5	Unit – 2,3,5	Prepare Insulating Brick.	6
6	Unit – 3,6	Determine the moisture content of a given sample of refractory.	4
7	Unit – 3,6	Determine porosity of given sample of refractory.	4
8	Unit – 3,6	Determine the bulk density of given refractory brick.	4
9.	Unit – 3,6	Determine water absorption of a given refractory sample.	4
10	Unit – 3,6	Determine Drying and Firing Shrinkage of given refractory sample.	4
11	Unit – 3,6	Determine P.C.E Value of a given sample.	4

S. No.	Unit No.	Practical/Exercise	Apprx. Hrs. Required
12	All Unit	Industrial visit Report for refractory industry 1. Prepare flow chart for manufacturing process 2. Identify different suitable raw materials for Refractory Product. 3. Explain processing for refractory raw materials 4. Explain shaping techniques 5. Explain drying and firing process for refractory 6. Identify different types of defects in refractory product.	6

7. SUGGESTED LIST OF STUDENT ACTIVITIES

1. Collection of different raw materials used in Refractory industry.
2. List out different Refractory products used in Industry.
3. Identify different shaping process for different products.
4. Visit different Refractory maker's website.

8. SUGGESTED LEARNING RESOURCES

(A) List of Books:

S. No.	Title of Books	Author	Publication
1	Refractories, Their Manufacture, Properties and Uses	M.L.MISRA	M.L.MISRA
2	Refractories	F.H.Norton	McGraw-Hill
3	Refractories and its Applications	Kenneth Shaw	Halsted Press Div., Wiley

B. List of Major Equipment/Materials

1. Different types of Refractory clays and Minerals
2. Lab type Jaw Crusher, Gyrotory Crusher
3. Lab Type Ordinary Pug Mill, De-arising Pug Mill, Mixer
4. Lab Type Toggle press, Hydraulic Press
5. Lab Type Tray dryer, Rapid moisture Meter
6. Lab Type Chamber Kiln

C List of Software/Learning Websites

1. http://en.wikipedia.org/wiki/Category:Refractory_materials
2. http://nptel.iitm.ac.in/courses/113104059/lecture_pdf/Lecture%209.pdf
3. <http://www.cosmile.org/Manual/pdf/chapter12.pdf>

9. COURSE CURRICULUM DEVELOPMENT COMMITTEE**Faculty Members from Polytechnics**

1. Shri B.B.Patel (Lecturer L.E.College, Morbi)
2. Shri H.B.Dedania (Retired Lecturer L.E.College, Morbi)
3. Shri S.Prasaad (Retired Lecturer L.E.College, Morbi)