



# GUJARAT TECHNOLOGICAL UNIVERSITY

**Bachelor of Engineering**  
**Subject Code: 3173614**  
**Semester – VII**  
**Subject Name: Refractories- II**

**Type of course:** Chemical Technology

**Prerequisite:** The students should have a clear concept on basic chemistry, geology and Mineralogy that will help them to have an easy grasp of the subject.

**Rationale:** The main objective of this subject is to offer an overview over the fundamentals and basics of monolithic refractory materials, their manufacturing processes, the raw feed materials for batch preparation, their availability, their properties, their beneficiation processes, process of recovery and their application.

Teaching and Examination Scheme:

Teaching Scheme		Credits		Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	Introduction of Monolithic Refractories, Shaped and Unshaped Refractories Advantages and Disadvantages, Classification of Unshaped Refractories Aggregates used in monoliths. Refractory cement and other additives, Additives for ramming and gunning materials	08
2	Classification of Castables: Conventional, Low cement, Ultra low cement, No or zero cement, Gel bonded and self flow castables, Silica free and Basic castables. Manufacture of Castables/Monoliths, Installation techniques, Applications. Refractory Cement, Mortars, Concrete, Ramming Mass	08
3	Non Oxide Refractories: Silicon Carbide - Fabrication Properties and applications. Nitride Refractories – Silicon nitride, boron nitride, Fabrication, properties and application Pure oxide Refractories - Alumina, Magnesia, and zirconia based Refractories.	06
4	Carbon bearing Refractories: Importance of carbon bearing Refractories. Advantages of these Refractories, Properties variation with the amount of carbon in basic Refractories	08
5	Properties of pitch, tar and resin used in brick manufacturing, tempering of these bricks, application of antioxidants, wear mechanism in LD converter.	08
6	Chromite and mullite refractories. Carbon bearing refractories: MgO – C and Al <sub>2</sub> O <sub>3</sub> – MgO – C etc. Alumino-silicate Refractories: Significance of Phase diagram in the development of different phases –High alumina refractories.	07



# GUJARAT TECHNOLOGICAL UNIVERSITY

## Bachelor of Engineering

Subject Code: 3173614

### Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
19	36	13	11	11	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

### Reference Books:

1. Steel Plant Refractories:- J. H. Chester
2. High temperature oxides, Part I to IV – A. M. Alper
3. Recent Trend in Refractory Monolithics:- Dr. Subrata Banerjee

### Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	To express their technical knowledge over fundamentals of the subject	30
CO-2	To choose batch composition for different glasses and ceramic products.	28
CO-3	To be able to utilize their knowledge and skills for the preparation of other related highly technical subjects in the Glass & Ceramic Technology course curriculum	27
CO-4	To be able to apply this knowledge in their higher study, research work with related technical subjects..	5
CO-5	To build a bridge between theoretical and practical concept used in industry.	5
CO-6	To investigate deep into the research scope over the glass materials, their fabrication and various properties	5

### List of Experiments:

- 1 Powder Preparation – Crushing of fireclay grog. Size separation of grog.
- 2 Determination of Packing Density of refractory raw materials
- 3 Fabrication of refractory bodies using best packed refractory raw materials
- 4 . Firing of refractory bodies at different temperatures
- 5 Study of effect of Composition, Forming pressure & Firing temperature on some properties of refractory bodies.
- 6 Spalling Resistance Test (Thermal Shock Resistance) of refractory bodies.



# GUJARAT TECHNOLOGICAL UNIVERSITY

**Bachelor of Engineering**  
**Subject Code: 3173614**

**List of OEPs :**

1. Industrial practices for synthesizing monolithic refractories
2. Industrial practices for preparing low cement castables
3. Industrial practices for silicon carbide/ silicon nitride refractories
4. Industrial practices for preparing carbon bearing refractories
1. Industrial practices for preparation of whitewares bodies
2. Industrial practices for drying of whitewares bodies
3. Industrial practices for glazing of triaxial bodies
4. Industrial practices for detection of drying and glazing defects
5. Industrial practices for testing of glazes

**List of Open Source Software/learning website:**

- 1) Literature available on internet
- 2) Glass & Ceramic dictionaries
- 3) Delnet
- 4) Literature available under R&D in Ceramic & Glass industry.
- 5) Ceramic & Glass journals