

GUJARAT TECHNOLOGICAL UNIVERSITY

CHEMICAL TECHNOLOGY (36)

SUBJECT NAME: REFRACTORIES II

SUBJECT CODE: 2173614

B.E. VIIth SEMESTER

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 and GC07.

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 | | Theory Marks | | | Practical Marks | | | |
| | | | ESE (E) | PA (M) | | PA(V) | | PA (I) | | |
| PA | ALA | ESE | | OEP | | | | | | |
| 4 | 0 | 3 | 7 | 70 | 20 | 10 | 20 | 10 | 20 | 150 |

L-Lectures; T-Tutorial/TeacherGuidedStudentActivity;P-Practical;C-Credit;ESE-EndSemesterExamination; PA-Progressive Assessment, ALA- Active Learning Assignment, OEP- Open Ended project

Content:

| Sr. No. | Topic | Teaching Hours | Module Weightage (%) |
|---------|---|----------------|----------------------|
| 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. | 10 | 25 |
| 2 | Classification of Castables: Conventional, Low cement, Ultra low cement No or zero cement, Gel bonded and self floor castables, Silica free and Basic castables. Manufacture of Castables/Monoliths, Installation techniques, Applications. Refractory Cement, Mortars, Concrete, Ramming Mass | 10 | 25 |
| 3 | Non Oxide Refractories : i) Silicon Carbide - Fabrication Properties and applications. ii) Nitride refractories – Silicon nitride, boron nitride, Fabrication, properties and application iii) Pure oxide refractories - Alumina, Magnesia, and zirconia based refractories. | 10 | 25 |
| 4 | Carbon bearing refractories: Importance of carbon bearing refractories. Advantages of these refractories, | 10 | 25 |

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|--|---|--|--|
| | Properties variation with the amount of carbon in basic refractories, Properties of pitch, tar and resin used in brick manufacturing, tempering of these bricks, application of antioxidants, wear mechanism in LD converter. | | |
|--|---|--|--|

Suggested Specification table with Marks (Theory):

| Unit No | Unit Title | Distribution of Theory Marks | | | | | |
|---------|-----------------------------|------------------------------|---------|---------|---------|---------|-------|
| | | R Level | U Level | A Level | N Level | E Level | Total |
| 1 | Monolithics, ramming mass | 6 | 10 | 6 | 1.5 | 1.5 | 25 |
| 2 | Classification of castables | 6 | 10 | 6 | 1.5 | 1.5 | 25 |
| 3 | Nonoxide refractories | 6 | 9 | 7 | 1.5 | 1.5 | 25 |
| 4 | Carbon bearing refractories | 7 | 10 | 5 | 1.5 | 1.5 | 25 |

Legends: R: Remembrance; U: Understanding; A: Application; N: Analyze; E: Evaluate 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

References:

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:

1. To express their technical knowledge over fundamentals of the subject
2. To choose batch composition for different glasses and ceramic products.
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
4. To be able to apply this knowledge in their higher study, research work with related technical subjects.
5. To build a bridge between theoretical and practical concept used in industry.

List of Experiments:

| | |
|----|--|
| 1. | Differential Thermal Analysis : Studies with Ceramic Raw Materials like China clay, Ball clay, Fireclay, Pyrophyllite, Quartz, Magnesite |
| 2. | Differential Thermal Analysis : Dolomite, calcite, Aluminium hydroxide, Magnesium hydroxide etc. Interpretation of data. |
| 3. | Thermo Gravimetric Analysis : Studies with some important raw materials like China clay, Ball clay, Fireclay, Pyrophyllite, Quartz, Cement samples, dolomite, calcite, magnesite, Copper sulphate etc. Interpretation of data & DTGA curves from TGA data. |
| 4. | Particle size distribution by Andreasen pipette. |

Open Ended Project fields:-

Students are free to select any area of science and technology based on chemical technology applications to define Projects.

1. Some suggested projects are listed below:
2. Industrial practices for synthesizing monolithic refractories
3. Industrial practices for preparing low cement castables
4. Industrial practices for silicon carbide/ silicon nitride refractories
5. Industrial practices for preparing carbon bearing refractories

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

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide.