



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3173628

Semester – VII

Subject Name: Advanced Ceramics

Type of course: Chemical Technology

Prerequisite: The students should have a clear concept on basic chemistry, geology, materials sciences 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 advanced Ceramic materials, typical concepts of materials science, engineering ceramics materials 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)	ESE (V)	PA (I)		
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	Engineering Ceramics: Carbides: Boron carbide, Silicon carbide, Titanium carbide, Zirconium carbide, Hafnium carbide & Uranium carbide. Nitrides: Boron, Silicon & Aluminum nitrides. Silicides: Molybdenum disilicide. Borides. Sialon. Graphites. Cermets & Composites.	8
2	Ceramics used in advanced applications: Nuclear energy, Magneto- hydrodynamic generation, Gas turbine blades, Abrasives, Aerospace, Diesel engines, Heat Exchangers, Cutting Tools, Wear Applications	8
3	Ceramics for Medical and Scientific products: Tissue attachment mechanism, Bio- active materials, nearly inert crystalline ceramics, porous ceramics, bioactive glass and glass ceramics, calcium phosphate ceramics, carbon base implant materials, ceramics for dental applications	7
4	Ceramics for optical applications: CRT and TV picture tubes, Telecommunication and related uses, Information display, Laser, Fiber optics, Electromagnetic windows.	8
5	Ceramics in Electrochemical cells: Sodium sulphate cell (with β -alumina), Electrical ceramics for fuel cell and high energy batteries.	8
6	Effect of temperature on intrinsic semiconductors, N type and P type semiconductors, Doping, Mass action law, Charge densities in intrinsic semiconductors. Electronic & Ionic conduction, Ceramic conductors like varistors, thermistors, resistors etc. Piezoelectricity, Ferroelectricity.	6



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Suggested Specification table with Marks (Theory): (For BE only)

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. Ceramic Whitewares – Dr. Sudhir Sen
2. Industrial Ceramics – Singer & Singer
3. Fine Ceramics – F.H. Norton.
4. The Technology of Ceramics and Refractories – P.P. Budnikov

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. Preparation of Soda-Lime-Silica glass with different colouring oxides, e.g. CoO, FeO etc
2. Preparation of Borosilicate glass with alkali & alkaline earth oxides.
- 3 Preparation of Opal glass with different opacifying agents -- Fluoride & Phosphate opal.
4. Preparation of low melting Phosphate glass in various systems.



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5. Determination of Alkali resistance of glass
6. Determination of alkalinity of glass
7. Determination of density of glass

List of OEPs :

1. Industrial practices for synthesizing thermal barrier coating
2. Industrial practices for synthesizing emissivity refractory coating
3. Industrial practices for preparing enamel slip
4. Industrial practices for preparing frit
5. Industrial practices for firing technique of unfired coating material

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