GUJARAT TECHNOLOGICAL UNIVERSITY

CHEMICAL TECHNOLOGY (36)
PROCESSING OF GLASS & CERAMICS
SUBJECT CODE: 2153615
B.E. 5thSEMESTER

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 GC03.

Rationale: The main objective of this subject is to offer an overview over the fundamentals and basics of processing of glass and ceramic 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
				Theory Marks			Practical Marks			
L	T	P	C	ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	0	3	6	70	20	10	20	10	20	150

Content:

Sr. No.	Topic	Teaching Hours	Module Weightage (%)
01.	Material Characterization: a) Characterization and specification of ceramic materials b) Chemical and Phase compositions c) Particle size and shapes d) Density, pore structure and specific surface area. Particle mechanics and rheology: a) Particle packing characteristics – Models of one, two of spherical balls b) Gap grading, continuous grading c) Rheological behavior of slurries and pastes: -Newtonian fluid, plastic flow, dilatant liquid, thixotropy, Deflocculation, Zeta potential, effect of electrolytes on Zeta potentials, applications in ceramic processings.	15	25
02	Beneficiation Process: Comminution – Equipments, milling, particle size distribution. Batching and mixing: Mixing mechanism and mixing equipments. Particle separation, concentration and washing processes – particle sizing, filtration, washing, particle concentration processes.	10	25
03	Granulation – direct granulation, spray granulation. Forming processes: Dry pressing – powder flow and die filling, compaction behavior, ejection and transfer, die wall effects, control of compaction defects, Cold isostatic Pressing , Plastic forming – Extrusion,	10	25

	Jiggering, Jolleying , Casting process- Slip Casting		
04	Drying –drying processes, Mechanisms in drying, defects Shaping, surface finishing, glazing. Firing – Firing system, Pre sintering processes, sintering, and vitrification and cooling. Glass processing – selection of raw materials, effects of different oxides on glass properties, batch preparation, melting in glass tank furnace, refining of glass.	10	25

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
21%	**40%**	**21%**	**6.5%**	**6.5%**	**5%**

Reference Books:

1. Glasses and the Vitreous State – J. Zarzycki
2. Chemistry of Glasses - A. Paul
3. Handbook of Glasses – R. H. Doremus
4. Spectroscopy & Structure of Glasses – C. A. Angell
5. Handbook of Glass Manufacture - F.V. Tooley
6. Glass Engineering Handbook – E. B. Shand.
7. Handbook of Glass Properties – G. W. Morey.
8. Handbook of Glasses – R. H. Doremus

Course Outcome: After learning this course the students can:

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. Determination of percentage Moisture content of clay
2. Determination of % Grit content of a clay
3. Determination of Water of Plasticity of Clays
4. Determination of Atterberg's Plasticity of clays
5. Determination of % Free iron content in Feldspar & Quartz powder
6. Determination of Water Absorption of Fired Ceramic Bodies
7. Determination of B.D. of fired sample
8. Determination of heat transfer coefficient in turbulent flow regime in a double pipe heat exchanger
9. Measurement of Drying Shrinkage of clays

Design based Problems (DP)/Open Ended Problem:

Application and utility of AMINATION as unit process in Chemical Technology

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. The best three works should submit to GTU.