GUJARAT TECHNOLOGICAL UNIVERSITY

METALLURGY ENGINEERING (21)
CERAMIC AND POLYMER MATERIALS
SUBJECT CODE: 2182111
B.E. 8th SEMESTER

Type of course: Engineering

Prerequisite: Students must be aware about the basic concept of Metallurgy.

Rationale:
In the present scenario the Metallurgy and Material science is leading to development of new materials and also the replacement of materials to achieve desired properties as per the applications. In present days the metals and alloys are replaced by ceramic and polymers. This syllabus comprises of the basic study of ceramic and polymer material in terms of structure, properties, processing and their utilization in various engineering applications.

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)	
					PA	ALA	ESE	OEP		
4	2	0	6	70	30	0	30	0	20	150

Content:

Sr.no	Content	Total Hrs	%weightage
1	**Introduction to Ceramic materials** Ceramics, Classification based on composition, structure and applications. Ceramic raw materials. Types of bonding, structure of ceramic, factor affecting structure, polymorphic forms and transformations, non crystalline Structure, properties and applications.	10	16
2	**Processing of ceramic material** Raw material selection, Ceramic forming processes (pressing, slip casting, extrusion, Injection Moulding, Glass forming Methods etc.).	10	16
3	**Glasses and optical Fibers**: Basic and application of various types of glasses namely Silica glass, Vycor glass, Opal-Glass. Application of glass fibers in composite materials and telecommunications, Metallic glasses, crystallized glasses.	10	16
4	**Refractories**: Classifications, Applications of refractories in Metallurgical processes, Special refractories, Phase diagrams of Al_2O_3 -SiO_2, MgO-Al_2O_3.	6	10
5	**Ceramic cutting tools**: Properties and applications of ceramic cutting tools such as alumina tools, boron nitride tools, Si_3N_4, Sialon, cermets.	4	8
6	**Introduction to polymer materials**, Introduction, Formation of polymers, classification of polymers, Mechanism of polymerization, Degree of polymerization.	4	8

7	**Polymer Physics** Crystallization of polymer, cross linking, vulcanization of rubber, deformation of polymer, Factor affecting the properties of polymer.	**8**	**13**
8	**Advance polymers** Advance polymers for engineering applications i.e. vinyl copolymer, polymer - clay Nano composite, PTFE, electro active polymers, Biodegradable polymers, High Temperature Polymers.	**8**	**13**
	Total	**60**	**100**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	**20**	**40**	**10**	**5**	**5**

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. Modern Ceramic Engineering :- David W. Richerson Marcel Dekker,Inc., New York, [1982]
2. Introduction to fine Ceramics: - Applications in Engineering. Noborn Ichinose by John Wiley & sons Ltd, Newyork [1987]
3. Advanced Ceramics: - P.Ramkrishnan, Oxoford & IBH Publ.Co. P. Ltd., New Delhi.
4. The science and Engineering of Materials by Donald R .Askland
5. Material Science and Engineering by V.D. Kodgire
6. Physical Chemistry of Polymers, A – Tager.
7. Polymer Science, Gavriker.

Course Outcome:

After learning the course the students should be able to:

1. Share knowledge about the basic concept of ceramic and polymers and its properties
2. Impart the importance of ceramic and Polymers in Engineering application.
3. Describe the processing of ceramic and polymers
4. Apply the knowledge for the selection of ceramic and polymer for the intended applications
5. Select the processing parameter for the manufacturing the engineering component out of ceramic and polymer

List of Open Source Software/ learning website:

www.nptel.in

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 be submitted to GTU.