



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3153624

Semester- V

Subject Name: Material Science & Technology

Type of course: Chemical Technology

Prerequisite: The students should have a clear concept on material used in various chemical industries.

Rationale: The objective of this core course is to provide essential concepts in material science with an emphasis on particulate solids, their behavior and processing in various chemical industries.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	00	00	100

Content:

Sr. No.	Content	Total Hrs
1	Metallic and ionic bonds, Atomic structure of solids, Crystalline and amorphous materials, crystalline structure, unit cell and crystal faces, Materials of construction, Corrosion resistance, fatigue, long term properties – medicine, dyes and pigment, polymers, ceramics.	05
2	Materials processing: Crystallization, sintering, calcination, sol-gel methods Catalytic Materials Types of catalysts, structure, properties, porous catalysts, pore diffusion, adsorption, adsorption isotherms,	08
3	Polymeric Materials, polymer melts and solutions behavior – macromolecules, Polymer processing, Processing of Particulate solids Fracture mechanics, attrition, breakage, size reduction, size enlargement, Colloidal and nano-particle systems, Definition, properties, types and classification forces of interaction – van der Waals and electrostatic interactions Aggregation, Settling of aggregates	08
4	Smart materials: Electrical, electronic and optical properties of materials. Piezoelectric, actuators, shape memory alloys and polymers, electro and magneto-rheological materials, carbon nanotube (CNT), fullerene, graphene, 3D printing.	08
5	Material design: Mini projects on design of products based chemical Technology like Pharma, Dyes & pigment, Polymer & Rubber and Glass & ceramics and material science concepts.	08
6	Formulation of paints and ink, Containers for encapsulation of drugs, aroma any active compounds, Coatings for different applications, Development of catalysts/supports, Materials from waste and other novel materials.	08



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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
20	30	20	10	10	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.

Text Books:

- 1) Materials Science and Engineering an Introduction. William D. Callister, Jr. Fifth Edition, John Wiley and Sons, Inc. 1999.
- 2) Unit Operations of Chemical Engineering. McCabe W., J. Smith, and P. Harriott,., 7th Ed., McGraw-Hill, New York, 2004.
- 3) Principles of colloid and surface chemistry. P.C Hiemenz, R. Rajagopalan. M.Dekker, New York, 1997

Reference Books:

- 1) M. Rhodes, Introduction to particle technology, John Wiley & Sons, 19982. V. Raghavan, Materials Science and Engineering, Prentice-Hall of India Pvt. Ltd., 2004

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	To identify the fundamentals materials	15
CO-2	To processed the material by using different techniques.	15
CO-3	To study the knowledge of polymeric materials and Colloidal and nano-particle systems.	15
CO-4	To ascertain and correlate the knowledge of smart materials.	15
CO-5	To design the smart materials.	15
CO-6	To formulate the smart material used in chemical industry.	25

List of Open Source Software/learning website:

1. NPTEL



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2. MIT Open course lecture available on Internet etc
3. Delnet

List of Open Source Software/learning website:

1. Chemical weekly
2. Scifinder online
3. Science direct
4. espacenet
5. Delnet