GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3133905
Semester – III
Subject Name: Elements of Nanochemistry

Type of course: Material Science and Technology

Prerequisite: Basics of chemistry, surface chemistry and some properties of materials from 12th science level syllabus.

Rationale: The purpose of this course is to develop comprehension of the rapidly changing technological scenario and the requisite expertise for appropriate selection of materials and its basic and fundamental knowledge.

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)	
4	0	0	4	70	30	0	0	100

Contents:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	Introduction of Nano chemistry: 1.1 Basics of Nanoscale science and Technology 1.2 Implications for Physics, Chemistry, Biology and Engineering 1.3 Classifications of nanostructured materials, nano particles 1.4 Properties of Nanomaterials 1.5 Size effects on structure and morphology of nanoparticles	7	20
2	Basics of Nanoparticles and Synthesis 2.1 Types, compositions, and structures, 2.2 Metal and semiconductor nanocrystals 2.3 Porous inorganic nanoparticles, Organic (latexes), 2.4 Carbon-based nanoparticles (carbon nanotubes, grapheme), Porous inorganic nanoparticles, Organic (latexes) and carbon-based nanoparticles (carbon nanotubes, graphene) 2.5 Basic synthesis and fabrication methods for nanomaterials (CVD, sol-gel, microemulsion, template, hydrothermal)	6	20
3	Classical Colloid Theory 3.1 Nucleation and growth 3.2 Ostwald ripening 3.3 Homogeneous vs. heterogeneous nucleation and applications of nanomaterials 3.4 Anisotropic growth and shape control 3.5 Catalyzed (seeded) growth	7	20

	3.6 Nanocrystal doping		
4	Chemistry of small surfaces 4.1 Curvature and neighboring-charge effects on chemical reactivity and equilibria (pKa's, redox potentials) 4.2 Applications in structural materials, lighting, energy conversion (Solar Cells) and catalysis applications	7	20
5	Environmental safety in Nanotechnology 5.1 Clean rooms: specifications and design, air and water purity, requirements for particular processes, Vibration 5.2 Free environments: Services and facilities required. Working practices, sample cleaning, chemical purification, chemical and biological contamination, Safety issues, flammable and toxic hazards, biohazards.	7	20

Reference Books:

1 C Brechignac, P Houdy, M Lahmani, Nanomaterials and Nanochemistry, 2011, Wiley, ISBN: 0444593977
2 Kenneth. J, Klabunde, "Nanscale materials in chemistry", Wiley Interscience Publications 2001.
3 Processing & properties of structural naonmaterials - Leon L. Shaw Nanochemistry: A Chemical Approach to Nanomaterials, Royal Society of Chemistry, Cambridge UK 2005.

Course Outcome:

Sr. No.	CO statement	Marks % weightage
CO-1	The student will gain knowledge of basic chemistry of materials	**20**
CO-2	The student will demonstrate understanding the basic principles and basic approach of synthesis of nanoparticles	**20**
CO-3	The student will demonstrate the understanding of basic principles of Classical Colloid Theory.	**20**
CO-4	The student will demonstrate understanding of features of surface chemistry	**20**
CO-5	The student will demonstrate understanding of basic principles and Environmental safety in Nanotechnology	**20**

Bloom's Taxonomy for Cognitive Domain	Marks % weightage
Recall	30
Comprehension	40
Application	30
Analysis	0%
Evaluate	0%
Create	0%