GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3163911
POLYMER AND NANO COMPOSITES

B.E. 6th SEMESTER

Type of course: Material Science, Chemistry

Prerequisite: Fundamental of Chemistry, Synthesis of Nano materials, Physics of Nano materials

Rationale: The purpose of this course is to provide a review of timely concepts in the rapidly emerging field of nanoparticle based emulsions.

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)	
3	0	0	3	70	30	0	0	100

Content:

Sr. No.	Content	Total Hrs.	% Weig
1	IMPORTANCE OF POLYMERS: BASIC CONCEPT Classification of polymers on the basis of microstructures macrostructures and properties, application Chain structure and configuration Homo and heteropolymers - copolymers-chemistry of polymerization Characterization of polymers-molecular, solution, melt, elastomer, solid state, surface, interface Properties: glass transition temperature (Tg) and melting point (Tm),Factors affecting Tg and Tm, Importance of Tg Molecular weights and degree of polymerization- reactions and kinetics of polymerization Properties- mechanical, dielectric constant, polarization; Dissipation factor Polymeric nanostructure- ordered polymer, block co-polymer, surface micelles	**13**	**20%**
2	**POLYMER NANOCOMPOSITES** Physical and chemical properties of nanosized metal particles Metal containing polymers: cryochemical synthesis, structure and physio-chemical properties Controlled pyrolysis of metal containing precursors	**13**	**20%**

	Nanostructured polymer nanoreactors for metal particle formation Metal-polymer nanocomposite synthesis, Ex-situ, In-situ Plasmon absorption of embedded nanoparticles Magnetooptics of granular nano materials, New optical method of magnetic nanoparticles and nanostructures imaging Optical extinction of metal nano particles synthesized in polymer by ion implantation Optically anisotropic metal polymer nanocomposites		
3	**Polymer Matrix Nanocomposites** Polymer/ clay nanocomposites: synthesis of NCH composites and characterization Crystal structure of NCH, properties of NCH Polypropylene layered silicate nanocomposites Epoxy nanocomposite system, future trends Biodegradable polymer/layered silicate nanocomposites- categories, properties, drawback Polymer layer silicate nanocomposites- technology, structure, properties and characterisation Poly(ethyl acrylate)/bentonitenano composites and Poly(butylene terephthlate) (PBT) based nanocomposites Polymer/calcium carbonate nanocomposites	**13**	**20%**
4	**METAL MATRIX NANOCOMPOSITES** Introduction to metal matrix composites, reinforcements, matrix materials Mechanism of reinforcement- long fiber, short fiber, particulate Interlayer in metal matrix composites-characterization and relevance to material properties Processing of nanocomposites- Liquid Processes, Semi-Solid Processes, Solid Processes Production of composite by thermal coating process Structure and properties of sprayed coatings, adhesion of thermally sprayed coating Machinability aspects of metal matrix composites, Mechanical behavior and fatigue properties of MMC Strengthening mechanisms, application	**13**	**20%**
5	**CERAMIC MATRIX NANOCOMPOSITES** Introduction to ceramic matrix composites, fibrous monolithic ceramic, fiber reinforced Whisker reinforced ceramic matrix composite Particulate reinforced, graded and layered ceramic composite Nanophase ceramic composites Processing- microstructural control of metal reinforced ceramic matrix nanocomposites Refractory and speciality ceramic composites and interface in non-oxide ceramic composites Machinable nanocomposite ceramics- Silicon nitride and silicon carbide based ceramics Functionally graded ceramics- clay nanocomposites	**13**	**20%**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks				
Remembrance R Level	**Understanding U Level**	**Application A Level**	**Analyze N Level**	**Evaluate E Level**
30	35	35	-	-

Legends: R: Remembrance; U: Understanding; A: Application 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 AND REFERENCES

Gowariker V.R., Viswanathan N.V., Sreedhar J., "Polymer Science", New age International publications,2005

Alfred Rudin, "The elements of polymer science and engineering", 2nd edition, Academic press publication,1999

Luigi Nicolais, Gianfranco Carotenuto,"Metal–polymerNanocomposites",Wiley-Interscience,2005

Yiu-Wing Mai,Zhong-Zhen yu, "Polymernanocomposites",CRC press,2006

Karl U. Kainer, "Metal Matrix Composites",Wiley-VCH publisher, 2005

Low I. M., "Ceramic matrix composites: Microstructure, properties and applications",Woodhead ,Publishing Limited, 2006

Course Outcome:

1. Demonstrate the understudying of Polymer Nanocomposite
2. Describe and compare various formulation Polymer Nanocomposite
3. Gain insight about the importance of polymers in nanotechnology