GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3163912
NANOAND MICRO EMULSIONS

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	INTRODUCTION TO EMULSION Definition of micro and nano emulsion. Theory of emulsion, Micro emulsions. Preparation of microemulsion. Winsor's classification of microemulsions. Stability of micro emulsions. Rheology of microemulsion drops -Applications of emulsions. Ostwald ripening, Flocculation and coalescence of drops. Applications of emulsions	**13**	**20%**
2	PROPERTIES OF EMULSION. A phase diagram approach to microemulsion. Microemulsion formation. Physicochemistry of W/O microemulsion formation. Stability and droplet clustering. Phenomenon in microemulsion. Percolating phenomenon in microemulsion. Effect of external entity - microemulsions with mixed nonionic surfactants. Microemulsions with mixed nonionic surfactants. Properties of microemulsions with mixed nonionic surfactants	**13**	**20%**
3	**Mechanism of Emulsification.** Phase inversion phenomenon. Dynamic behavior of emulsion. Spontaneous emulsification. Recent development with emphasis on self-emulsification. Self-emulsification process. Symmetric thin liquid film with Fluid interfaces Formation emulsified microemulsion and microemulsion properties.	**13**	**20%**

	Characterization of emulsified microemulsion		
4	**Formulation of Nanoemulsion.** Nanoparticle formation in microemulsion. Concept of formation in microemulsion. Mechanism of microemulsion. Nanoparticles uptake from W/O emulsion. W/O emulsion process. TiO2 nanoparticle in mircroemulsion and photophysical properties. Properties of interfacial electron transfer dynamics. Interfacial electron transfer dynamics	**13**	**20%**
5	**Characterization and Application of Microemulsion.** NMR technique for measurement emulsion. Ultrasound characterization for emulsion. Ultrasound characterization for microemulsion. Physicochemical characterization and characterization techniques types. Pharmaceutically applicable microemulsions. Places of microemulsion and emulsion in cancer therapy. In vitro and in vivo evaluation. Biocatalysis in microemulsion	**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

Berg J. C., "An Introduction to Interfaces and Colloids: The Bridge to Nanoscience", World Scientific, 2010
Edited by Sjöblom J., "Emulsions and Emulsion Stability: Surfactant Science Series", Volume 132, Marcel Dekker, 2006

Reference Books/Other Reading Material

Monzerfanun, “Microemulsion properties and application”, Taylor and Francis group, 2009
Ghosh P., “Coalescence of drops in liquid, in Advances in Multiphase Flow and Heat Transfer”, Bentham Science Publishers Ltd., 2012
Edited by Sjöblom J., “Encyclopedic Handbook of Emulsion Technology”, Marcel Dekker, 2001

Course Outcome:

1. Demonstrate the understudying of basic principles in chemistry of micro emulsion
2. Describe and compare various formulation mechanism of emulsions
3. Provide basic knowledge on formulation and characterization of micro emulsions