GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3173627
Semester – VII
Subject Name: New developments in Pigments

Type of course: Chemical Technology

Prerequisite: Basic knowledge of Engineering of pigmented dispersion.

Rationale: The main objective of this subject is to study the pigments dispersion technology and dispersion machineries.

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)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs.
1	**Stages of Pigment Dispersion:** Immersion & wetting of pigments, penetration and separation of agglomerates, statistical considerations of mechanical deagglomeration, Stabilization of colloidal pigment dispersion- entropic & charged double layer mechanism of stabilization, variables affecting stabilization, adhesion & cohesion phenomenon associated with dispersion; initial dispersion, mill base & letdown compositions; flow point curves, instrumental analysis of fineness of dispersion.	08
2	**Dispersion mills:** **High speed mixers:** underlying fluid mechanics, mill base rheology, tank & impeller dimensions, different impeller geometries & orientations, power input, **Heavy duty & miscellaneous mills:** sigma kneaders, pug mixers, planetary mixers.	10
3	**Ball mill:** Cascading principle, size, speed & design of ball mill; size, shape & composition of balls; mill base composition, power consumption, batch & continuous operation. **Roll mills:** single, Double, Triple roll mills, flow of mill base through rolls, material balance, mill base composition, roll design & power inputs.	10
4	**Attritor:** mechanism of attrition, batch & & continuous operation, design aspects, comparison with ball mill. **Micro bead mill:** vertical open, vertical closed & horizontal mills, mechanism of bead milling; effect of retention time/ flow rate, grinding media size, shape & composition, pigment size and size distribution, nature of premix processing, mill base composition on fineness and stability of micro bead dispersion,	10
5	**Fire, explosion & health hazards:** General industrial hazards, prime causes of fire & explosion, safety considerations in arrangement of underground and above ground primary & secondary solvent storage tanks, design of piping, pumps & vessels from safety point of view, cleaning & disposal considerations, safety norms & regulations	07

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R level	U level	A level	N level	E level	C level
15	15	25	25	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

1. 'Organic coatings : Science and Technology', Edited by Zeno W. Wicks, Jr., Frank N. Jones, S. Peter Pappas; Douglas A. Wicks,Third Edition, John Wiley & Sons, Inc., Hoboken, New Jersey. 2007.
2. Morgans, W.M., 'Outline of Paint Technology', 3rd Edition, CBS Publishers and Distributors, New Delhi, 1996
3. "Surface Coatings" Volume 1 "Raw material and their usages" Oil and Colour Chemists' Association, TAFE Educational Books, NSW, Australia,1987.
4. Paul Swaraj, "Surface Coatings –Science and Technology", Wiley Interscience Publishers, John Wiley and Sons, Inc.1986.
5. 'Paints, Coatings and Solvents', Dieter Stoye; Werner Freitag (ed.), 2nd. Edition,Wiley-VCH.Weinheim ; (1998).

Course Outcome:

Sr. No.	CO statement	Marks % weightage
CO-1	To get an knowledge of stages of pigmented dispersion	15
CO-2	To know the high speed mixer & heavy duty mills	15
CO-3	To be able to utilize the knowledge and skills for dispersion in pigment by using ball mill & roll mill.	20
CO-4	To enhance the knowledge of attitor & micro-bead mill.	20
CO-5	To describe the methods for Fire, explosion & health hazards	20
CO-6	To build a bridge between theoretical and practical concept used in pigment application industry	10

List of Experiments:

1. To determine fineness of grind.
2. To determine the percentage of resin required by using daneial flow point methods.
3. Preparation of primer in ball mill
4. Preparation of primer in planetary ball mill
5. Preparation of undercoat in ball mill
6. Preparation of undercoat in planetary ball mill
7. Preparation of pigment concentrates/tinters in planetary ball mill
8. Preparation of anticorrosive paint.

9 Preparation of antifouling paint.

10 Preparation of paint remover.

Open Ended Project fields:-
Students are free to select any area of science and technology based on chemical technology applications to define Projects.

Some suggested projects are listed below:

1. Literature survey on recent development in pigment tinters.
2. Carry out synthesis of pigment tinters.
3. Report preparation on pigment tinters.
4. PPT on pigment tinters.

List of Open Source Software/learning website:

1. Literature available on internet
2. Pigments dictionaries
3. Delnet
4. Literature available under R&D in Pigments & Paints industries
5. Dyes & Pigments, Pigments & Resin & Paint India journals