



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3153620
Semester – V
Subject Name: Synthetic Colourants

Type of course: Chemical Technology

Prerequisite: The student should have studied the chemistry of colorants.

Rationale: The main objective of this subject is to study the synthesis of various types of dyes and pigments used in 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)	
4	0	2	5	70	30	30	20	150

L-Lectures; T-Tutorial/Teacher Guided Student Activity; P-Practical; C-Credit; ESE-End Semester Examination; PA-Progressive Assessment

Content:

Sr. No.	Content	Total Hrs
1	Azo Dyes: Diazotisation, Methods of diazotisation, Diazo coupling. Acid azo dyes: Methyl orange, Methyl red, Orange dyes, Fast red A, Metanil yellow etc. Basic Azo dyes: Aniline yellow, Butter yellow, Chrysodine G, Bismark brown, Acid red. Direct or Substantive Azo dyes: Congo red, Direct deep black, Benzopurpurin, Rosanthrene O, Procion Dyes, Ramazol Mordant Azo Dyes: Diamond black F, Chromotrope 2B, Erichrome Black T, Erichrome Red B etc.	10
2	Reactive Dyes: Introduction, Chemical Constitution of Reactive Systems, Dye Classes (Chromogens) for Reactive Dyes, Synthesis & applications. Chemistry of reactive dyes with special emphasis on environmental issues. High fixation, low salt, highly substantive reactive dyes. Neutral fixing & acid fixing reactive dyes. Heterocyclic reactive systems & multifunctional reactive dyes. Reactive basic dyes.	10
3	Disperse Dyes: Introduction, Chemical Constitution: Azo Dyes; Anthraquinone Dyes; Other Chromophores; Synthesis & applications. Chemistry of disperse dyes with special emphasis on environmental safety. Dispersant free disperse dyes. Replacement of anthraquinone disperses dyes – Heterocyclic diazo & coupling components. Styryl & extended styryl disperse dyes	10



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4	Synthesis and applications of Organic pigments-I: Azo pigments: Diazo components & its derivatives, Coupling compounds and its derivatives, Monoazo yellow and Orange pigments, Disazo pigments, Diarylide pigments, Disazopyrazolone pigments, β - Naphthol pigments, Naphthol AS pigments, BONA Pigments, Benzimidazolone pigments, Disazo condensation pigments, Metal complex pigments, Isoindolinone and Isoindoline pigments and its derivatives.	10
5	Synthesis and applications of Organic pigments-II: Polycyclic pigments : Phtalocyanine pigments, Quinacridone pigments, Perylene and Perinone pigments, Diketopyrrolo-pyrole pigments, Thioindigo pigments, Aminoanthraquinone pigments, Hydroxyanthraquinone pigments, Dioxazine pigments, Quinophthalone pigments etc.	10

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	20	10	5	5	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. Synthetic Dyes, Dr. G. R. Chatwal, Himalaya Publications, 2009
2. Industrial Organic Pigments, Second, G. Buxbaum (Ed.), ISBN 3-527-28878-3, 1998
3. Industrial Organic Chemistry, Arpe H.J.VCH, Weinheim, Weissermal K.1993
4. Organic Synthesis, Smith M.B., Tata McGraw Hill, New York, 2nd Ed., 2004
5. Chemistry of Synthetic Dyes, Lubs H.A., Robert E Krieger Publishing Company New York, 1995
6. Organic Chemistry, Clayden, Greeves, Warren, Oxford Univ. Press, 2001
7. Chemistry of Synthetic Dyes, Lubs H.A., Robert E Krieger Publishing Company New York, 1st Ed., 1995

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	To study the synthesis of azo dyes.	20
CO-2	To introduce the chemistry and synthesis of reactive dyes.	20
CO-3	To know the chemistry and synthesis of disperse dyes.	20
CO-4	To understand the synthesis and applications of Organic pigments	20
CO-5	To be able to utilize this knowledge in industries	10
CO-6	To build a bridge between theoretical and practical concept used in industry.	10



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List of Experiment:

- 1) Preparation of acid azo dye.
- 2) Preparation of basic azo dye.
- 3) Preparation of direct azo dye.
- 4) Preparation of mordant azo dye.
- 5) Preparation of reactive dye
- 6) Preparation of Disperse dye.
- 7) Preparation of Monoazo yellow pigment.
- 8) Preparation of Diarylide pigments.
- 9) Preparation of Phtahlocyanine pigments
- 10) Preparation of Quinacridone pigments

Major Equipment:

- 1) Three neck flask
- 2) Mixing apparatus with stirrer
- 3) Water condenser

List of Open Source Software/learning website:

- 1) Chemical weekly
- 2) Dyes and pigment journal
- 3) Scifinder online
- 4) Science direct
- 5) espacenet
- 6) Delnet