GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3143616
Semester – IV
Chemistry of dyes intermediates

Type of Course: Chemical Technology

Prerequisite: Basic knowledge of chemistry of colourants.

Rationale: The main objective of this subject is to study chemistry of dyestuff intermediates & organic pigments.

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)	
4	0	2	5	70	30	30	20	150

Content:

Sr. No.	Topic	Teaching Hours
1	**Chemistry of intermediates :** Introduction to intermediates, Coal tar primaries like benzene, xylene, toluene, Market value of coal tar primaries classes of intermediates, Importance of intermediates, concept of pricing of intermediates.	04
2	**Chemistry & Technology of Dyestuff Intermediates:** **A. Basic Unit processes** a. Sulphonation b. Nitration c. Reduction d. Halogenation **B. Sulphonation:** (i) Reaction mechanism and conditions (ii) Sulphonating Agents and solvents (iii) Work up and Material of construction (iv) Substitution in benzene and substituted benzene (v) Plant and process flow (vi) Safety and process control parameters **C. Nitration** (i) Reaction phenomenon and conditions (ii) Nitrating agents and solvents (iii) Work up and Material of construction (iv) Substitution in benzene and substituted benzene (v) Plant and process flow (vi) Safety and process control parameters, Run away reactions **D. Reduction:** (i) Reducing agents (ii) Reduction methods (iii) Selection of best method for Benzene and substituent (iv) Process and workup (v) Safety aspect **E. Halogenation**	16

	(i) Basic nucleophilic and Electrophilic substitution (ii) Reaction and Material of construction	
3	**Chemistry of dyestuff intermediates:** **Nitration:** Mechanism of nitration, Nitration of toluene, anthraquinone, chloro derivatives, aromatic sulphonic acid, Nitosation reaction, Skraup's synthesis, Fridel-craft's reaction.	08
4	**Heterocyclic Intermediates:** Skeletons of heterocyclic system, Ethylene oxide Epichlorohydrin, Phthalamide, carbazole, pyrazolones and its derivatives, Pyridiene and its derivatives quinacridone and its derivatives and their uses etc.	08
5	**Chemistry & Technology of Organic pigments-I:** **Azo pigments:** Diazo components & its derivatives, Coupling compounds and its derivatives, Monoazo yellow and Orange pigments, Bisazo pigments, β- Napthol pigments, Napthol AS pigments, BONA Pigments, Benzimidazolone pigments, Bisazo condensation pigments, Metal complex pigments	08
6	**Chemistry & Technology of Organic pigments-II:** **Polycyclic pigments :** Phtahlocyanine pigments, Quinacridone pigments, Perylene and Perinone pigments, Daketopyrrolo-pyrole pigments, Thioindigo pigments, Aminoanthraquinone pigments, Hydroxyanthraquinone pigments, Dioxazine pigments, Quinophthalone pigments etc.	08

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks

R Level	U Level	A Level	N Level	E Level	C level
20	15	15	10	5	5

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze, E: Evaluate, C: Create (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

Reference Books:

1. Chemistry of synthetic dyes Vol 1 to 5, Venkatraman K., NY 1952
2. Synthetic Dyes, Dr. G. R. Chatwal, Himalaya Publications, 2009
3. Unit processes in organic synthesis,P.H. Groggins, 5th edition, 2001
4. Industrial Organic Pigments, Second, G. Buxbaum (Ed.), ISBN 3-527-28878-3, 1998
5. Chemistry of Synthetic Dyes and Pigments, Lubs H. A., Robert E Krieger Publishing Company, New York, 1977

List of Experiments:

1. Measurement of colour and molar extinction coefficient.
2. Determination of the concentration and λmax. of given colour solution by using U-visible spectrophotometer.
3. Analysis of amines from diazotization & coupling components.
4. Separation of acids, amines based on acidity-basicity difference.
5. Preparation of p-Nitro acetanilide.
6. Identification of pigments.
7. Determination of oil absorption value of given pigment.

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Course Outcomes:

Sr. No.	CO statement	Marks % Weightage
CO-1	To understand the basics of dyestuff industry in terms of raw materials utilized	10
CO-2	To understand chemistry & technology of dyestuff intermediates	20
CO-3	To analyze the various methods for synthesis of different intermediates used in dyes	20
CO-4	To know the various technology and safety aspects for reactions.	20
CO-5	To analyze the various methods for synthesis of different organic pigment	15
CO-6	To apply the knowledge of dyes & pigment in industry.	15

o express basic introduction to dyes

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