GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM
COURSE TITLE: CHEMISTRY OF INTERMEDIATES AND DYESTUFFS
(COURSE CODE: 3352804)

Diploma Program in which this course is offered	Semester in which offered
Textile Processing Technology	5th Semester

1. RATIONALE

Diploma graduates are required to use different kinds of colours with materials called intermediates and dyes in variety of Textile processing. They should be aware of of color theory, and structure, properties of dyes and other intermediates, which pertains to Chemistry of these products. This course has been designed to provide basic principle and chemistry of basic chemicals, synthesis of dye intermediates and various dyes with their properties. Students shall understand the fundamentals aspects of colour, relation between colour and chemical constitution of dyes. It provides technical knowhow for colouration and printing of different textiles. Student will able to solve problems during dyestuffs, application as well as its marketing. Students will find this course useful in non-textile fields too.

2. LIST OF COMPETENCY

The course content should be taught and implemented with the aim to develop required skills in students so that they are able to acquire the following competency:

- **Apply knowledge of color theory, chemical composition, structure, properties of dyes and other intermediates and their synthesis for textile processing.**

3. COURSE OUTCOMES

i. Explain various chemicals used for manufacturing for dyestuffs.
ii. Explain different colour theories to prepare and identify colour.
iii. Explain synthesis of dyestuffs using different intermediates.
iv. Describe synthesis of different dyestuffs.
v. Explain environmental aspects and developments of various dye intermediates and dyestuffs.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	
4	0	0	4	70	30	0	0	100

Legends: L-Lecture; **T** – Tutorial/Teacher Guided Student Activity; **P** - Practical; **C** – Credit; **ESE** - End Semester Examination; **PA** - Progressive Assessment.

5. COURSE CONTENT DETAILS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – I Intermediate, Dyestuffs and Pigments	1a. Explain intermediates and dyestuffs. 1b. Classify dyestuffs based on method of application and chemical constitutions 1c. Discuss application of non-textile uses of dyestuffs 1d. Discuss pigments and its applications.	1.1 Intermediate, dye and white dye 1.2 Synthesis of various intermediates used for production of various dyestuffs. 1.3 Dyestuffs: method of application, chemical constitutions (structure) 1.4 Non-textile uses of Dyestuffs. 1.5 Pigments and its applications.
Unit– II Theory of Colour and Chemical Constitution	2a. Differentiate between auxochrome, chromospheres and chromogen. 2b. Distinguish between colour and chemical constitution 2c. Explain Different theories to explain relation between colour and chemical constitutions	2.1 Auxochrome, chromogen, chromophore of colour chemistry, colour and chemical constitutions. 2.2 Theories to explain relation between colour and chemical constitutions: Witt's theory, Armstrong theory, Baeyer's theory, Nietzki's theory, Watson's theory 2.3 Modern theories:Valence bond theory (resonance theory) and Molecular orbital theory.
Unit– III Chemistry and Unit Processes for Dyestuffs	3a. Discuss Raw materials for primaries and its sources 3b. Explain Distillation of coal tar and petroleum 3c. Explain different Unit Processes	3.1Raw materials for primaries and its sources. 3.2Distillation of coal tar and petroleum 3.3Unit processes used in the dyestuff production like nitration, sulphonation, amination by reduction, ammonolysis, oxidation, halogenations, hydrolysis, dehydration, reduction, alkylation, alkali fusion, diazotization etc.
Unit– IV Synthesis of Dyestuffs and Pigments of Various Classes	4a.Explain synthesis of different dyestuffs and pigments.	Chemical Synthesis of : 4.1 Nitro and Nitroso dyes 4.2 Azo dyes such as Direct, Acid, Basic, Mordant, Disperse dye. 4.3 Diphenyl methane dyes (DPM) 4.4 Triphenyl Methane Dyes (TPM) 4.5 Phthalocyanine 4.6 Xanthene dyes 4.7 Heterocyclic dyes such as acridine dyes 4.8 Indigo and Thioindigo 4.9 Solubilised vat dyes 4.10 Anthraquinon dyes such as Mordant,

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
		vat, disperse and acid dyes 4.11 Reactive dyes such as procion dyes and vinyl sulphone dyes
Unit – V Recent Developments	5a. Discuss development in eco friendly dyes 5b. Explain Toxic intermediates and banned colourants 5c. Discuss recent innovations in dyestuff.	5.1 Eco-friendly dyes to satisfy the eco parameters 5.2 Toxic intermediates and banned colourants. 5.3 Recent innovations in various dyestuffs.

6. SUGGESTED SPECIFICATION TABLE WITH HOURS and MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
1.	Intermediates, Dyestuffs and Pigments	08	4	4	4	12
2.	Theory of Colour and Chemical Constitution	08	4	4	2	10
3.	Chemistry and Unit Process for Dyestuffs	12	4	6	4	14
4.	Synthesis of Dyestuffs and Pigments of Various Classes.	22	6	10	12	28
5.	Recent Developments	06	2	2	2	06
	Total	**56**	**20**	**26**	**24**	**70**

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.

7. SUGGESTED LIST OF PROPOSED STUDENT ACTIVITIES

Following is the proposed list of students activities such as:

i. Literature survey of different dyestuffs and pigments.
ii. Visit to different dyestuff industries and prepare list and reports.
iii. Group discussion on eco friendly dyestuffs and latest innovations in its applications.

8. SPECIAL INSTRUCTIONAL STRATEGY (If any)

i. Guest lecturers from industry experts for contemporary practices of industries.
ii. Video clips of manufacturing process of various intermediates and dyestuffs.
iii. Use of internet to visit websites of various dyestuff manufacturers for their novel products' innovations and applications.

9. SUGGESTED LEARNING RESOURCES

A. List of Books

S. No.	Author	Title of Books	Publication
1	Chatwal G. R.	Synthetic Dyes	Himalaya Publishing House, Mumbai – 400004 Latest Publication
2	Yadav M. S.	Synthetic Dyes	Campus Books Internationals, New Delhi – 110002 Latest Publication
3	Shenai V. A.	Chemistry of Dyes and Principles of Dyeing Vol - II	Sevak Pulications, Mumbai – 400031 Latest Publication
4	Agarwal, O. P.	Synthetic Organic Chemistry	Goel Publishing House. Meerut – 250002 Latest Publication
5	Groggins, P. H.	Unit processes in Organic Synthesis	Mc Graw-Hill Ltd., New Delhi. Latest Publication
6	VenkatRaman,K.	Chemistry of Synthetic dyes Vol – I to VI I	Academic Press, New York, USA Latest Publication

B. List of Major Equipment / Instruments

Not Applicable

C. List of Software/Learning Website

i. www.dyes-pigments.com
ii. onlinelibrary.wiley.com/
iii. rushim.ru/books/praktikum/fpdc.pd
iv. www.springerreference.com/docs

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. R. G. Patel**, Lecture, Textile Processing Dept., Dr. S. and S. S. Ghandhy College of Engineering and Technology, Surat.
- **Prof. J. H. Thakkar**, Lecturer, Textile Processing Dept., R. C. Technical Institute, Ahmedabad
- **Prof. R. D. Joshi**, Lecturer, Textile Processing Dept., R. C. Technical Institute, Ahmedabad.
- **Prof. R. M. Pandya**, Lecturer, Textile Processing Dept., Dr. S. and S. S. Ghandhy College of Engineering and Technology, Surat.

Faculty Members from NITTTR, Bhopal

- **Dr. C. K. Chugh**, Professor, Department Mechanical Engineering
- **Dr. Joshua Earnest**, Professor, Department Electrical and Electronics Engineering