

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

**COURSE CURRICULUM
COURSE TITLE: THEORY OF DYEING
(COURSE CODE: 3362803)**

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

1. RATIONALE

This course provides the knowledge and skills regarding fundamental dyeing behavior of different dyes on various textiles and dyeing rate. It also provides the clear concept of physical chemistry involved in dyeing mechanism. This course also provides the information about novel dyeing approaches. Thus it is an important course for textile process engineers.

2. COMPETENCY

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

- **Plan application of appropriate kind of dyes on fabrics based on properties of fibres and requirement of fabric.**

3. COURSE OUTCOMES (COs)

The theory should be taught and practical should be carried out in such a manner that students are able to acquire required learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

- Employ theory of dyeing in textiles.
- Use Adsorption Isotherms in colouration in textiles
- Use dye fibre bond for colouration in textiles.
- Use diffusion of dyes for colouration in textiles.
- Use compatibility in dyes and fabrics for colouration

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	150
4	-	2	6	70	30	20	30	

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 the Cognitive Domain)	Topics and Sub-topics
Unit – I Basics of Theory of Dyeing	1a. Describe importance of physical properties of fibres in relation to dyeing 1b. Explain various effects of physical terms on dyeing rates.	1.1 Physical properties of fibres 1.2 Denier, count, drawing, heat setting, twist, electrolyte, temperature and pH on dyeing rate 1.3 Surface charge (Zeta Potential)
Unit – II Physical Chemistry in Colouration	2a. Explain thermodynamic aspects 2b. Describe various Isotherms	2.1 1 st and 2 nd law of thermodynamics 2.2 Entropy and Heat of Dyeing 2.3 Adsorption Isotherms: Langmuir, Partition, Freundlich
Unit– III Dye-Fibre Linkages	3a. Describe various chemical bonds 3b. Explain affinity of dyes for different fibres	3.1 Affinity of dyes for different fibres 3.2 Stages of Theory of Dyeing 3.3 Different dye fibre bonds: Hydrogen bond, Ionic bond, Covalent bond, Van-der waal's forces
Unit– IV Behavior of Dyes in Colouration	4a. Describe diffusion of dyes 4b. Explain diffusion Co-efficient 4c. Discuss Purification of dyes	4.1 Importance of diffusion in dyeing 4.2 Diffusion of simple ions 4.3 Diffusion co – efficient of disperse dyes on polyester 4.4 Impurities found in various dyes 4.5 Estimation and Purification of various dyes
Unit – V Compatibility of Dyes	5a. Describe compatibility 5b. Explain dyeing with different dyes	5.1 Compatibility of Acid dyes on nylon, direct dyes on cotton, disperse dyes on polyester, cationic dyes on CDPET

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
I.	Basics of Theory of Dyeing	06	2	4	2	08
II.	Physical Chemistry in Coloration	16	6	8	6	20
III.	Dye-Fibre Linkages	14	6	8	6	20
IV.	Behavior of Dyes in Coloration	10	4	6	4	14
V.	Compatibility	10	2	4	2	08
	Total	56	20	30	20	70

Legends: R = Remember, U = Understand, A= Apply and above Level (Bloom's revised 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 EXERCISES/PRACTICAL

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills (**outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

*Note: Here only outcomes mainly in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes** (as given in a common list at the beginning of curriculum document for this programme) would be assured.*

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

S. No.	Unit No.	Practical /Exercise (Outcomes in the Psychomotor Domain)	Approx. Hours Required
1	I	Check effect of temperature on the rate of dyeing of various dyes on natural/semi synthetic/ synthetic fibres	08
2	I	Check effect of count, denier, tex on dyeing with different dyes on different fibres	06
3	I	Check effect of organic and inorganic acids on the percentage exhaustion of an acid dye on nylon	04
4	I	Check effect of carrier on the dye uptake during the dyeing polyester with disperse dye	04
5	I	Check effect of electrolyte on the dyeing behavior of CDPET	06
6	III	Check effect of pH on dye fibre bond between reactive dye and cotton/viscose fabric	04
Total			32

8. SUGGESTED STUDENT ACTIVITIES

- i. Survey literature about different dye fibre bonds.
- ii. Collect and Study of dyed sample of various fibres. (in terms of physical quality)
- iii. Collect dyed sample of various fibres (and data about them in terms of chemical quality) and make a power point Ppresentation.
- iv. Make a report on compatibility of different dyes with different types of fibers.

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- i. Visual demonstration of dyed sample (in terms of physical and chemical quality)
- ii. Guest lecturers from industry experts for contemporary practices of industries.
- iii. Arrange group discussion on recent trends and awareness about theory of dyeing.
- iv. Arrange Seminar/Quiz/Presentation on recent developments in the field of theory of dyeing.

10. SUGGESTED LEARNING RESOURCES

A) Books

S. No.	Author	Title of Book	Publication
1.	Peters R. H.	Textile Chemistry Vol. III	Elsevier Scientific Publishing Company, New York, 1975
2	Bird C. L. Boston W. S.	Theory of colouration of textiles	Society of Dyers and Colorists, 1975
3	Vickerstaff T.	Physical Chemistry of Dyeing	Oliver and Boyd, London, 1954
4.	Dr. Gandhi R. S. Dr. Shah H. S.	Instrumental Colour Measurement and Computer Aided Colour Matching for Textile	Mahajan Book Distributors, Ahmedabad, 1990

B) Major Equipment/ Instrument with Broad Specifications

i.	Water heating bath	<ul style="list-style-type: none"> • Jacketed doubled wall, inner and outer walls are made of SS • Insulating material:- Glass wool • Temperature range:- 5 – 99°C • Thermostatic control with digital display • Power requirement:- 220-230V
ii.	Laboratory Oven	<ul style="list-style-type: none"> • Temperature up to 250°C • Heat up time:- 45 min • Digital Display Electronic Controller • Internal Chamber:- SS 304 • External :- Mild steel powder coated • Insulation:- Glass Wool 65 mm • Ventilator:- Adjustable type (Aluminium)
iii.	Padding Mangle	<ul style="list-style-type: none"> • Maximum Working Width:- 300mm • Material of Coating on bowl:- Synthetic rubber • Rubber hardness:- 65°/70° shore hardness • Bowl dimension:- 120 mm dia X 350 mm length • Cloth speed:- variable speed. Max up to 10 mts/min • Machine dimension:- L 850 X W 610 X H 640 • Electrical Supply:- 230 V AC, Single Phase

C) Software/Learning Websites

- i. en.wikipedia.org/wiki/dyeing
- ii. en.wikipedia.org/wiki/adsorption_theory
- iii. <http://textilefashionstudy.com>
- iv. <http://textilelearner.blogspot.in>

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE**Faculty Members from Polytechnics**

- Prof. J. H. Thakker, I/C Head, Textile Processing Dept., R C Technical Institute, Ahmedabad.
- Prof. R. G. Patel, I/C Head, Textile Processing Dept., Dr. S and S S Ghandhy College of Engg. and Tech., Surat.
- Prof. R. M. Pandya, Lecturer, Textile Processing Dept., Dr. S and S S Ghandhy College of Engg. and Tech., Surat
- Prof. J. N. Shah, Assistant Lecturer, Textile Processing Dept., R C Technical Institute, Ahmedabad.

Coordinator and Faculty Members from NITTTR Bhopal

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