

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

**COURSE CURRICULUM
COURSE TITLE: ANALYTICAL TEXTILE CHEMISTRY
(COURSE CODE: 3362804)**

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

1. RATIONALE

In textile process industry, diploma graduate in textile processing, are supposed to test various textile fibres and chemicals for quality parameters. They should therefore have sufficient knowledge and skills to select and carryout requisite tests to ascertain required parameters. This course therefore attempts to provide the detail knowledge of analytical testing aspects of various chemicals. It also provides the clear concept of techniques of identification of various dyes in powder form and on the fibre. The students will also learn about the techniques of identification of various fibres and their blends qualitatively and quantitatively. The students will also get opportunity to use various instruments needed for Analytical testing.

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:

- **Determine the composition of fibers and textile chemicals such as dyes using analytical testing methods.**

3. COURSE OUTCOMES

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:

- Analyse textile chemicals.
- Analyse textile fibres and their blends.
- Analyse textile dyes in powder form and on fibre
- Perform instrumental analysis techniques.
- Identify stains in fabrics to remove them.

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		
			C	ESE	PA	ESE	PA	
4	-	4	8	70	30	40	60	200

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 Analysis of Textile Chemicals	1a. Describe different methods of analysis 1b. Select the method for test analysis of the various textile chemicals for their percentage purity	1.1 Different methods of analysis: Types of Titrations: Acid-Base, redox, iodometry and choice of indicators for titrations. 1.2 Analysis of textile chemicals: Calculation of equivalent weight of textile chemicals, percentage purity of different textile chemicals: Organic acids, inorganic acids, alkalis, oxidizing agents, reducing agents.
Unit– II Analysis of Textile Fibres	2a. Describe different physical and chemical methods of identification various textile fibres. 2b. Describe the quantitative method of analysis used for various blends.	2.1 Physical methods of fibre identification: burning test, microscopic examination, density, melting point and moisture regain. 2.2 Identification of fibres by their solubility test using various solvents. 2.3 Quantitative analysis of various blends: polyester/cotton, cotton/wool, polyester/viscose, polyester/wool, nylon/ acetate, polyester/nylon, CDPET/nylon, acrylic/cotton, cotton/viscose
Unit– III Analysis of Textile Dyes	3a. Describe the method of identification of various textile dyes. 3b. Describe the various methods of analysis of different textile dyes.	3.1 Identification of textile dyes in their powder form and on textile fibres 3.2 testing of various textile dyes for their strength such as chemical method, colorimetric method and laboratory dyeing trials method
Unit– IV Instrumental Analytical Methods	4a. Describe various Chromatographic analysis methods. 4b. Describe various spectroscopy analysis methods. 4c. Explain various instruments used in textile chemical analysis.	4.1 Chromatographic analytical techniques: as Paper chromatography, thin layer chromatography, gas chromatography and liquid chromatography. 4.2 Spectroscopy analytical techniques: UV spectroscopy, Infra red spectroscopy and near Infra red spectroscopy. 4.3 Instruments used in textile chemical analysis: Digital pH meter, spectrophotometer and Red wood viscometers.
Unit – V Stain Identification and Their Removal	5a. Describe the various methods of identification and removal of fabric/yarn stains .	5.1 Stains on yarn/fabric and their identification. 5.2 Chemical methods for removal of different stains from the fabric/yarn.

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	Analysis of Textile Chemicals	16	4	8	6	18
II	Analysis of Textile Fibres	14	4	6	6	16
III	Analysis of Textile Dyes	10	2	6	6	14
IV	Instrumental Analytical Methods	12	4	8	4	16
V	Stain Identification and Their Removal	04	2	2	2	06
	Total	56	16	30	24	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	Determine purity of various inorganic acids (HCl, H ₂ SO ₄)	4
2	I	Determine the percentage purity of various organic acids (CH ₃ COOH, HCOOH, H ₂ C ₂ O ₄ , 2H ₂ O)	6
3	I	Determine percentage purity of various alkalis (NaOH, Na ₂ CO ₃ , NaHCO ₃)	6
4	I	Determine the percentage purity of various Oxidising agents (H ₂ O ₂ , NaNO ₂ , Resist salt)	6
5	I	Determine percentage purity of various chlorinated oxidizing type bleaching agents (Hypochlorite, Bleaching powder, Sodium chlorite)	6

6	I	Determine percentage purity of various reducing agents (Sodium hydrosulphide, Stannous Chloride, Sodium sulphide, Rongalite-C)	8
7	II	Identify various textile fibres	10
8	II	Perform Quantitative analysis of various blended textiles	10
9	III	Identify various textile dyes (in powder form)	10
10	III	Identify various textile dyes on dyed fibres	10
11	IV	Measure pH unknown solutions by using pH meter.	04
12	IV	Measure viscosity solutions/pastes by using viscometer.	04
Total			84
Note: Perform any of the practical exercises from above list for total of minimum 56 hours depending upon the availability of resources so that skills matching with the most of the outcomes of every unit are included.			

8. SUGGESTED STUDENT ACTIVITIES

- i. Survey literature/internet to collect and study the various analytical testing methods used for different chemicals, dyes and fibres and their blends and prepare a report
- ii. Collect data for various possible stains occurred on fabric and make Power point Presentation.

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- i. Arrange Industrial Demonstration for various analytical testing methods as per unit I,II,III
- ii. Visual demonstration of various analytical testing methods used for different chemicals, dyes, fibres and blends.
- iii. Arrange Group discussion on recent trends and awareness in Analytical textile chemistry.
- iv. Arrange Seminar/Quiz/Presentation on recent developments in the field of Analytical textile chemistry.
- v. Arrange guest lecturers from industry experts for contemporary practices going on in industries.

10. SUGGESTED LEARNING RESOURCES

A) Books

S. No.	Author	Title of Books	Publication
1.	Bhattacharya I.	Comprehensive Test Methods - Textile Processing	Colour Publications pvt. Ltd., Mumbai
2	Desai N. F.	Profiles in Analysis of Chemicals	Gokul Publishers, Mumbai
3	Luthara G. Deshpande B.	Process House Laboratory – A Handbook	MANTRA – Surat
4.	Mantra	Textile Testing System and Procedure Part- IV(Chemical)	NITRA, Ghaziabad
5.	Vaishnav N. A. Joshi H. D.	Textile Testing and Analysis	Popular Prakashan, Surat

B) Major Equipment/ Instrument with Broad Specifications

i.	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)
ii.	pH Meter	<ul style="list-style-type: none"> • pH range:- 0.00 to 14.00 • Resolution:- 0.01 pH • Accuracy:- 0.01 pH \pm 1 digit • Temperature control:- 0-100°C • Polarity and Decimal:- Automatic
iii.	Viscometer	<ul style="list-style-type: none"> • Comprises glass U-tube with two bulbs • Connected by a capillary tube approximately 120 X 1 mm. (length X internal diameter)
iv.	Laboratory Glass ware	<ul style="list-style-type: none"> • Burette • Pipette • Conical Flask • Measuring Cylinder

C) Software/Learning Websites

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

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

- **Prof. R G Patel**, I/C Head, Textile Processing Dept., Dr. S and S S Ghandhy College of Engg. and Tech., Surat.
- **Prof. J H Thakker**, I/C Head, 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 Engg. and Tech., Surat.

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