GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)
Semester-III

Course Title: Textile Chemical Processes -I
(Course Code: 4335906)

Diploma programme in which this course is offered	Semester in which offered
Textile Design	Third

1. RATIONALE

Processing of the textiles is one of the important stages in designing textiles. Textile designers need to design & develop various textile products. This demands to have certain knowledge of chemical processing for textiles including colouration & finishing processes. Hence this course aims to gain basic knowledge & hands-on practice to perceive fabric defects, various preparatory processes for colouration, various dyes and their application techniques on suitable fibres and it also makes aware of machineries used for preparatory and coloration processes.

2. COMPETENCY

The purpose of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Apply basic knowledge of chemical processes to design & develop textile materials.**

3. COURSE OUTCOMES (COs)

The practical exercises, the underpinning knowledge and the relevant soft skills associated with this competency are to be developed in the student to display the following COs:

- Analyze and identify fabric defects and fabric grading system.
- Choose appropriate preparatory processes before colouration.
- Classify various dyes and select their application techniques on suitable fibres.
- Demonstrate and describe basics of preparatory and dyeing machineries.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T/2+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CA	ESE	CA	ESE	
3	0	4	5	30*	70	50	50	200

(*): Out of 30 marks under the theory CA, 10 marks are for assessment of the micro-project to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessing the attainment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P -Practical; C – Credit, CA - Continuous Assessment; ESE -End Semester Examination.

5. SUGGESTED PRACTICAL EXERCISES

The following practical outcomes (PrOs) that are the sub-components of the COs. Some of the PrOs marked '*' are compulsory, as they are crucial for that particular CO at the 'Precision Level' of Dave's Taxonomy related to 'Psychomotor Domain'.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1.	Analyse fabric defects & stains and Perform Grey inspection of fabric	I	04
2.	Perform desizing of sized fabrics/yarns	II	04
3.	Perform scouring of desized fabric	II	04
4.	Perform bleaching of scoured fabric	II	04
5.	Perform optical whitening of bleached fabric	II	04
6.	Apply Direct dye on cellulosic (cotton) material	IV	04
7.	Apply Cold Reactive dye on cellulosic (cotton) material	IV	04
8.	Apply Hot Reactive dye on cellulosic (cotton) material	IV	04
9.	Apply Azoic dye on cellulosic (cotton) material	IV	04
10.	Apply Vat dye on cellulosic (cotton) material	IV	04
11.	Apply Solubilised Vat dye on cellulosic (cotton) material	IV	04
12.	Apply Acid dye / Pre-metallised acid dyes on suitable textile material	IV	04
13.	Apply Basic dyes on suitable textile material	IV	04
14.	Apply Disperse dye on polyester material	IV	04
		56Hrs	

Note

- More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list.
- The following are some **sample** 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed Practical Exercises of this course required which are embedded in the COs and ultimately the competency..

S. No.	Sample Performance Indicators for the PrOs	Weightage in %
1	Prepare of experimental setup	20
2	Perform the practical procedure according to instructions	20
3	Follow safe practices and measures during working on machine	10
4	Observe the outcomes correctly	20
5	Interpret the result and conclude	30
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

These major equipments with broad specifications for the PrOs is a guide to procure them by the administrators to usher in uniformity of practicals in all institutions across the state.

S. No.	Equipment Name with Broad Specifications	PrO. No.
1.	Electronic weighing balance	2 to14
2.	Glass-wares: Beaker, Pipette, Glass-rods	2 to14
3.	Dye pots	6 to14
4.	Water Heating Bath	6 to14
5.	Padding Mangle	6 to14
6.	Laboratory Oven/steamer	6 to14
7.	Electric iron/Hot blower	6 to14

7. AFFECTIVE DOMAIN OUTCOMES

The following ***sample*** Affective Domain Outcomes (ADOs) are embedded in many of the above mentioned COs and PrOs. More could be added to fulfil the development of this competency.

- Work as a leader/a team member.
- Follow ethical practices.
- Practice environmental friendly methods and processes. (Environment related)

The ADOs are best developed through the laboratory/field based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organization Level' in 2nd year.
- 'Characterization Level' in 3rd year.

8. UNDERPINNING THEORY

Only the major Underpinning Theory is formulated as higher level UOs of Revised Bloom's taxonomy in order development of the COs and competency is not missed out by the students and teachers. If required, more such higher level UOs could be included by the course teacher to focus on attainment of COs and competency.

Unit	Unit Outcomes (UOs) (4 to 6 UOs at Application and above level)	Topics and Sub-topics
Unit – I **Importance of chemical processing**	1a. Analyze the problems associated to grey fabrics 1b. Describe the importance of chemical processing on fabric 1c. Define Fabric defects 1d. Analyze different types of Fabrics defects	1.1 Drawbacks of grey fabric 1.2 Definition of fabric defect 1.3 Identification, causes & remedies of fabric defects 1.4 Grey inspection method & grading systems
Unit – II	2a. Describe importance of preparatory processes	2.1 Objectives & Importance of preparatory processes.

Wet Preparatory	2b. Suggest preparatory process flow as per the end product 2c. Derive objectives of various preparatory processes 2d. Describe the preparatory processes	2.2 Different sequences of preparatory processes 2.3 Stitching process 2.4 Brushing & Shearing process 2.5 Singeing process 2.6 Desizing process 2.7 Scouring process 2.8 Bleaching process 2.9 Mercerization process 2.10 Whitening process
Unit– III **Colouration & Dyeing principles**	3a. Define COLOUR, DYE & PIGMENTS 3b. Classify the colouring matters (Dyes & Pigments) 3c. Describe dyeing principle/ theory 3d. Define important terms related to dyeing 3e. Classify the dyeing methods	3.1 Definition of COLOUR, DYE & PIGMENTS 3.2 Classification of the colouring matters (Dyes & Pigments) 3.3 Dyeing principle 3.4 Dyeing related terms 3.5 Dyeing methods
Unit– IV **Dyeing process**	4a. Describe properties and nature of different dyes. 4b. Describe applications of different dyes 4c. Describe different auxiliaries used for dyeing process 4d. Explain various parameters affecting the dyeing processes.	4.1 Properties and nature of various dyes 4.2 Dyeing with Direct dye 4.3 Dyeing with Reactive dye 4.4 Dyeing with Vat dye & Solubilised Vat dye 4.5 Dyeing with Azoic dye 4.6 Dyeing with Sulphur dye 4.7 Dyeing with Acid dye 4.8 Dyeing with Basic dye 4.9 Dyeing with Disperse dye 4.10 Role of Different Chemicals and auxiliaries used for different dyeing processes 4.11 Various parameters affecting the dyeing processes
Unit– V Dyeing Machineries	5a. Explain principle, construction & working of machines used for dyeing of yarn & fabrics. 5b. Compare yarn & fabric dying machines. 5c. Describe various faults, causes and remedies in dyeing	5.1 Principle, construction and working of loose fibre, yarn and fabric dyeing machines 5.2 Advantages & disadvantages of dyeing machines 5.3 Dyeing faults with their causes and remedial processes

Note: *The UOs need to be formulated at the 'Application Level' and above of Revised Bloom's Taxonomy' to accelerate the attainment of the COs and the competency.*

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A	Total Marks
I	Importance of chemical processing	04	2	4	4	10
II	Wet Preparatory	10	4	4	4	12
III	Colouration & Dyeing principles	08	4	4	6	14
IV	Dyeing process	14	6	8	10	24
V	Dyeing Machineries	06	2	4	4	10
Total		**42**	**18**	**24**	**28**	**70**

***Legends**: R=Remember, U=Understand, A=Apply and above (Revised Bloom's taxonomy)*

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions assess the attainment of the UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary slightly from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Select various chemical processes according to the end product.
- Explore library/internet for processing technologies being used for production of different fabrics and make a report.
- Visit to textile industry and preparing report with sketches.
- Prepare line diagram of processing machineries.
- Undertake micro-projects in teams.
- Give seminar on any relevant topic.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- Guide student(s) in undertaking micro-projects.
- 'L' in ***section No. 4*** means different types of teaching methods that are to be employed by teachers to develop the outcomes.

- About ***20% of the topics/sub-topics*** which are relatively simpler or descriptive in nature is to be given to the students for ***self-learning***, but to be assessed using different assessment methods.
- With respect to ***section No.11***, teachers need to ensure to create opportunities and provisions for co-curricular activities.
- Guide students on how to address issues on environment and sustainability
- Guide students for using data manuals.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be ***individually*** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than ***16 (sixteen) student engagement hours*** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. This has to match the competency and the COs. Similar micro-projects could be added by the concerned course teacher:

- **Classify chemical processes**: Collect samples of differently dyed fabrics and prepare analytical report based on the processes involved for manufacturing. (**Duration: 6-8 hours**)
- **Preparatory Machine study:** Prepare a report on various machines involved in preparatory processing. (**Duration: 8-10 hours**)
- **Dyeing Machine study:** Prepare a report on various machines involved in dyeing. (**Duration: 8-10 hours**)

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Chemistry of Dyes and Principles of Dyeing (VOLUME-II)	Dr. V. A. Shenai	Sevak Publication, 1973
2	Technology of Dyeing (VOLUME-VI)	Dr. V. A. Shenai	Sevak Publication, 1983
3	Dyeing and Chemical Technology of Textile fibre	E. R. Trotman	Published by Wiley, U.S.A. (1985) ISBN 10: 0471809101 ISBN 13: 9780471809104

4	Cotton Piece Dyeing	S. V. Gokhale	Ahmedabad Textile Industry's Research Association ISBN : B00Q1R6F8C
5	Bleaching, Mercerising & Dyeing of Cotton Material	R. S. Prayag	Shree J. Printers, Pune , 1990
6	Handbook of Textile Processing Machinery	R. S. Bhagwat	Colour Publication PVT. LTD., Mumbai ISBN - 8175250771, 9788175250772
7	Chemical Technology in the Colouration of Textiles VOL – 1	S. R. Karmakar	Colour Publication PVT. LTD., Mumbai ISBN - 8190259407, 9788190259408
8	HANDBOOK of Textile Fibers, Dyes & Finishes	Howard L. Needles	Garland STPM press (November 1, 1980), ISBN-10 : 0824070461 ISBN-13 : 978-0824070465
9	Textile Science - An Introductory Manual	J. T. Marsh	Read Books (15 April 2011) ISBN-10 : 144740128X ISBN-13 : 978-1447401285

14. SOFTWARE/LEARNING WEBSITES

- https://nptel.ac.in/courses/
- http://www.textileworld.com/
- www.learningseed.com
- http://www.teonline.com/knowledge-centre/
- http://www.sitra.org.in
- http://www.btraindia.com
- www.nitratextile.org/
- http://www.textileassociationindia.org/
- http://www.nitma.org/
- www.itamma.org/
- http://www.uttaindia.org/
- http://en.wikipedia.org/wiki/Textile_dyeing
- http://textilelearner.blogspot.in
- http://www.elearning-textiles.co.uk/CatalogueofModules/
- https://textilestudycenter.com/
- https://www.fibre2fashion.com/
- http://karlmayer.com

15. PO-COMPETENCY-CO MAPPING

Semester II	Fundamentals of Fabric Technology (Course Code: 4335906)								
	POs and PSOs								
Competency & Course Outcomes	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ development of solutions	PO 4 Engineering Tools, Experimentation & Testing	PO 5 Engineering practices for society, sustainability & environment	PO 6 Project Management	PO 7 Life-long learning	PSO 1	PSO 2
Competency	***Apply basic knowledge of chemical processes to design & develop textile materials***								
Course Outcomes CO a)	3	2	2	1	1	1	2	1	1
CO b)	3	2	2	1	2	1	2	2	1
CO c)	3	1	2	1	2	1	2	2	2
CO d)	2	1	1	1	3	1	2	1	1

Legend: '3' for high, '2' for medium, '1' for low or '-' for the relevant correlation of each competency, CO, with PO/ PSO

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

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