GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

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

Course Title: Bleaching Technology for Textiles
(Course Code: 4332802)

Diploma program in which this course is offered	Semester in which offered
Textile Processing Technology	Third

1. RATIONALE

The polytechnic graduates are required to supervise pretreatment operations of fibre, yarn & fabric and their dyeing & printing processes in industry. They should have basic knowledge and skills to handle pretreatment processes for different textiles as per the production requirements. This course provides in depth knowledge about purification processes of all type of textiles, chemistry and chemical technology involved in the application of various essential chemicals for pretreatments. The course also provides the clear concept about the physical & chemical behaviour of various textiles and enables to conduct technological set up for various preparatory processes according to their characteristic & requirements.

2. COMPETENCY

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the following competency,

- **Use knowledge and skills for identification and removal of impurities and improving quality of Cellulosic, Natural protein and Synthetic textiles for further processing operations.**

3. COURSE OUTCOMES (COs)

The practical exercises, the underpinning knowledge and the relevant soft skills associated with the identified competency are to be developed in the student for the achievement of the following COs:

a) Conduct appropriate mechanical pretreatments for grey textiles.
b) Conduct chemical pretreatments of Cellulosic textiles.
c) Conduct chemical pretreatments of Synthetic textiles.
d) Conduct chemical pretreatments of Natural Protein textiles.
e) Use relevant machine for chemical pretreatments of textiles based on the design & production.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CA	ESE	CA	ESE	
3	0	2	4	30*	70	25	25	150

(*): 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) are the sub-components of the Cos. *Some of the **PrOs** marked **'*'** (in pprox.. Hrs column) 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. Require
1	Inspection of different Grey textiles. (Cotton, Viscose, Synthetics & their blends, Wool & Silk)	I	02
2	Enzymatic desizing of cotton textile by exhaust method.	II	02
3	Enzymatic desizing of cotton textile by CPB method.	II	02
4	Scouring of Cotton textile.	II	02
5	Scouring of Viscose Rayon textile.	II	02
6	Scouring of Polyester textile.	III	02
7	Scouring of Nylon textile.	III	02
8	Scouring of CDPET textile.	III	02
9	Scouring of Acrylic textile.	III	02
10	Bleaching of Cotton textile using hypochlorite bleaching agents.	II	02
11	Bleaching of Cotton textile using hydrogen peroxide.	II	02
12	Bleaching of Polyester textile using sodium chlorite.	III	02
13	Weight reduction of polyester textile.	III	02
14	Slack mercerization of cotton textile.	II	02
15	Tight mercerization of cotton textile.	II	02
16	Scouring of Polyester/Cellulosic blended fabric.	III	02
17	Scouring of Nylon/Cellulosic blended fabric.	III	02
18	Scouring of Polyester/CDPET blended fabric.	III	02
19	Carbonization of Wool.	IV	02
20	Scouring of Wool.	IV	02
21	Scouring (Degumming) of Silk textile.	IV	02
22	Bleaching of Wool textile.	IV	02
23	Bleaching of silk textile.	IV	02
	Total Hours		46

Note

i. *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.*
ii. *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 experimental set-up.	20
2	Performing the experiment.	20
3	Follow safe practices.	10
4	Record observations correctly.	20
5	Interpret the result and conclude.	20
6	Submission of report in time	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

This major equipment with broad specifications for the PrOs is a guide to procure them by th4e administrators to usher in uniformity of practicals in all institutions across the state.

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Dye Pots: 250 ml, 500 ml	2-23
2	Glass rod / Steel rod	2-23
3	Beaker: 100 ml, 250 ml, 500 ml	2-23
4	Measuring Cylinder of capacity 10 ml, 25 ml, 100 ml	2-23
5	Water bath	2, 4-14, 16-23
6	Electric Iron: 230V, 1000W	All
7	Laboratory Pressure Steamer: 30 psi and 150°C	23
8	Laboratory Drying, Curing and Setting Chamber: Temperature upto 220°C, working width - 450mm, length 1.7 meter, heater capacity - 8/16/24 kilo-watt	2-23
9	Laboratory Padding Mangle: Horizontal	3,15
10	Digital weighing balance: 0.02 gm accuracy (100 gm)	All

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.

a) Work as a leader/a team member.
b) Practice good housekeeping
c) Maintain tools and equipment.
d) Follow ethical practices.

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:

i. 'Valuing Level' in 1st year
ii. 'Organization Level' in 2nd year.
iii. 'Characterization Level' in 3rd year.

8. UNDERPINNING THEORY

The major underpinning theory is given below based on the higher level Uos of *Revised Bloom's taxonomy* that are formulated for development of the Cos and competency. 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 different levels)	Topics and Sub-topics
Unit – I **Mechanical Pretreatments of textiles**	1a Classify various impurities present in to grey textiles. 1b Prepare preparatory process sequences for different grey textiles. 1c Describe mechanical pretreatment of textiles.	1.1 Classification of Impurities 1.2 Preparatory sequences for cotton, Viscose rayon, Polyester, Nylon & their blended textiles. 1.3 Grey Inspection process 1.4 Stitching process 1.5 Gas Singeing process 1.6 Shearing & Cropping process
Unit – II **Chemical Pretreatments of Cellulosic textiles**	2a Describe purposes of Desizing, Scouring & Bleaching and mercerization Processes for cellulosic textiles. 2b Explain technology of Desizing, Scouring & Bleaching and mercerization processes of cellulosic textiles. 2c Describe defects with their remedies for Desizing, Scouring, Bleaching and Mercerization processes of cellulosic textiles.	2.1 Desizing process 2.1.1 Objects & Classification 2.1.2 Mechanism of desizing 2.1.3 Various methods of desizing of cotton textiles 2.1.4 Various defects with their remedies 2.2 Scouring process 2.2.1 Objects & classification of scouring agents 2.2.2 Mechanism of scouring 2.2.3 Scouring of cotton and Viscose Rayon textiles 2.2.4 Solvent assisted scouring 2.2.5 Various defects with their remedies 2.3 Bleaching process 2.3.1 Objects and classification 2.3.2 Mechanism of hypochlorite bleaching and peroxide bleaching 2.3.3 Bleaching of cotton and Viscose Rayon textiles 2.3.4 Various defects with their remedies

		2.4 Mercerization process 2.4.1 Objects and classification 2.4.2 Mechanism of mercerization 2.4.3 Various factors affecting the process of mercerization 2.4.4 Various defects with their remedies
Unit – III **Chemical Pretreatments of Synthetic textiles**	3a Describe purposes of Scouring and Bleaching Processes for synthetic textiles & their blends. 3b Explain technology of Scouring & Bleaching Processes for synthetic textiles & their blends. 3c Describe purpose & technology of weight reduction process of polyester fabrics.	3.1 Scouring process 3.1.1 Scouring of Polyester, Nylon, CDPET, Acrylic and their blended textiles 3.2 Bleaching process 3.2.1 Mechanism of sodium chlorite bleaching 3.2.2 Bleaching of Polyester, Nylon, CDPET, Acrylic and their blended textiles 3.3 Wight reduction process 3.3.1 Objects and Mechanism 3.3.2 Weight reduction of polyester fabrics
Unit – IV **Chemical Pretreatments of Natural Protein textiles**	4a Prepare preparatory process sequences for wool and silk textiles. 4b Describe technology of carbonization, scouring and bleaching of wool textiles. 4c Explain technology of degumming and bleaching of silk textiles.	4.1 Preparatory process sequence for wool textiles 4.2 Carbonization of Wool 4.3 Scouring of wool 4.4 Bleaching of wool 4.5 Preparatory process sequence for Silk textiles 4.6 Degumming of silk 4.6.1 Mechanism of degumming 4.6.2 Various methods of degumming 4.7 Bleaching of Silk
Unit– V **Machineries for Chemical Pretreatments of textiles**	5a Explain Batchwise machineries used for Desizing, Scouring & Bleaching Processes. 5b Explain semi-continuous machineries used for Desizing, Scouring &Bleaching Processes. 5c Explain continuous machineries used for Desizing, Scouring & Bleaching Processes. 5d Explain machineries used for fabric mercerization.	5.1 Batchwise machineries for desizing, scouring & bleaching process such as Kier, Jigger, Soft flow. 5.2 Semi-continuous machineries for desizing, scouring & bleaching process such as Cold-pad-Batch, Hot-Pad-Batch 5.3 Continuous machineries for desizing, scouring & bleaching process such as Continuous bleaching range (CBR). 5.4 Machineries for fabric mercerization process such as Chainless Padless mercerizer, Chain type Pad type mercerizer.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Mechanical Pretreatments of textiles	06	02	04	04	10
II	Chemical Pretreatments of Cellulosic textiles	12	08	10	12	30
III	Chemical Pretreatments of Synthetic textiles	09	03	04	05	12
IV	Chemical Pretreatments of Natural Protein textiles	07	02	04	02	08
V	Machineries for Chemical Pretreatments of textiles	08	04	04	02	10
Total		**42**	**19**	**26**	**25**	**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:

- Literature survey of Preparatory Processes for Various Textile Fabrics.
- Collection and Study of various samples of Preparatory Process for different textile.
- Visit to textile industries to study impurities and improving quality of cotton, silk,wool & synthetic materials and prepare reports.
- Group discussion on recent innovation in pretreatment (preparatory) processes.
- Collection of data of various textiles pretreatment processes & Power point Presentation.
- Seminar/Quiz/Presentation on recent developments in the field of preparation of textiles.

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:

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

d) 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.
e) With respect to ***section No.10***, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
f) Encourage students to refer different websites for having a deeper understanding of the subject.
g) Assign unit wise assignment to group of 4 to 5 students.
h) Use of video, animations, to explain concepts, facts and application related to printing.

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 (group of 3 to 5). However, **in the fifth and sixth semesters**, 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 duration of the micro-project should be about **14-16** ***(fourteen to sixteen) student engagement hours*** during the course. The students 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:

a) **Data sheet:** Prepare a data sheet for various combinations of chemicals and their quantities required for various chemical processing of textiles.
b) **Pretreatment:** Collect the data for various pretreatments processes applying industrial survey and internet search.
c) **Scoured sample collection:** Visit Textile Industries / Market shops and collect scoured sample of different types of textiles.
d) **Bleached sample collection:** Visit Textile Industries / Market shops and collect bleached sample of different types of textiles.
e) **Pretreatment machines:** Prepare a short video of different pretreatment machines by visiting industries and arrange as per process sequences.
f) **Green chemicals:** Prepare a report on chemicals currently consumed for pretreatments of textiles in textile chemical processing industries and suggest eco-friendly substitute for them.
g) **Biotechnology:** Compile a report related to scope of biotechnology in pretreatments of textiles.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Bleaching, Mercerizing & Dyeing of Cotton Material	R. S. Prayag	Shree J. Printers, Pune
2	Chemical Technology in the pre-	S. R. Karmakar	Elsevier Publication

S. No.	Title of Book	Author	Publication with place, year and ISBN
	treatment process of Textiles		
3	Technology of Bleaching (Vol-III)	Dr. V. A. Shenai	Sevak Publication
4	Textile Scouring & Bleaching	E. R. Trotman	B. I. Publication Pvt. Ltd.
5	An introduction to Textile Bleaching	J. T. Marsh	J. Wiley & Sons, New York
6	Handbook of Textile Processing Machinery	R. S. Bhagwat	Colour Publication PVT. LTD., Mumbai

14. SOFTWARE/LEARNING WEBSITES

a) https://nptel.ac.in
b) www.youtube.com
c) www.fibre2fashinon.com
d) www.textilelearner.net
e) www.textiletutorials.com
f) www.textilefashionstudy.com

15. PO-COMPETENCY-CO MAPPING

Semester III	Technology of Printing – I – 4332804						
	Pos						
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
Competency	Use knowledge and skills for identification and removal of impurities and improving quality of Cellulosic, Natural protein and Synthetic textiles for further processing operations.						
Course Outcomes							
CO a) Conduct appropriate mechanical pretreatments for grey textiles.	3	1	1	--	--	1	2
CO b) Conduct chemical pretreatments of Cellulosic textiles.	3	3	2	3	3	2	2
CO c) Conduct chemical pretreatments of Synthetic textiles.	3	3	2	3	3	2	2
CO d) Conduct chemical	3	3	2	3	2	2	2

pretreatments of Natural Protein textiles.							
CO e) Use relevant machine for chemical pretreatments of textiles based on the design & production capacity.	3	1	1	3	--	1	2

*Legend: '**3**' for high, '**2**' for medium, '**1**' for low and '**-**' for no correlation of each CO with PO.*

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

S. No.	Name and Designation	Institute	Contact No.	Email
1)	Mr. D. D. Vyas Lecturer	Dr. S. & S. S. Ghandhy College of Engg. & Tech., Surat	9879479424	ddvyas4edu@gmail.com
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