GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

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

Course Title: Elements of Textile Processing
(Course Code: 4342905)

Diploma program in which this course is offered	Semester in which offered
Textile Manufacturing Technology	4th Semester

1. RATIONALE

Wet processing of textiles has specific aspects because it increases aesthetic as well as wearable value of different textiles as per requirements. The processing of textiles is a vast complex area in itself and hence there is a separate branch of engineering known as textile processing technology. This course provides only basic and brief knowledge about textile wet processing of various types of textiles. This course also provides the clear concept about the physical & chemical behaviour of various textiles.

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,

- **Identify and understand specific processes used to improve wearable as well as aesthetic properties of various textiles as per requirements.**

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) Apply fundamental & mathematical aspects of textile processing.
b) Understand appropriate pretreatments of various textiles.
c) Understand appropriate dyeing of various textiles.
d) Understand appropriate printing of various textiles.
e) Understand appropriate finishing of various textiles.

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	Desizing of cotton fabric.	II	02
2	Scouring of cotton/viscose rayon fabric.	II	02
3	Scouring of polyester fabric.	II	02
4	Scouring of nylon fabric.	II	02
5	Bleaching of cotton fabric using hydrogen peroxide.	II	02
6	Bleaching of polyester using sodium chlorite.	II	02
7	Dyeing of cotton fabric with direct dyes.	III	02
8	Dyeing of polyester fabric with disperse dyes.	III	02
9	Dyeing of nylon fabric with acid dyes.	III	02
10	Printing of cotton fabric with direct dyes.	III	02
11	Printing of polyester fabric with disperse dyes.	III	02
12	Printing of nylon fabric with acid dyes.	III	02
13	Stiffening of cotton fabric.	IV	02
14	Delustring of viscose rayon.	IV	02
15	Heat setting of polyester fabric.	IV	02
16	Softening of cotton fabric.	IV	02
	Total Hours		**32**

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	All
2	Glass rod / Steel rod	All
3	Beaker: 100 ml, 250 ml, 500 ml	All
4	Measuring Cylinder of capacity 10 ml, 25 ml, 100 ml	All
5	Water bath	All
6	Electric Iron: 230V, 1000W	All
7	Laboratory Pressure Steamer: 30 psi and 150°C	NA
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	All
9	Laboratory Padding Mangle: Horizontal	NA
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 **Fundamentals of Textile Processing**	1a. Describe importance textile processing 1b. Describe mathematical aspects 1c. write process sequences for various textiles.	1.1 Importance of textile wet processing. 1.2 Mathematical aspects of textile wet processing. 1.3 Processing sequences for cotton, viscose rayon, polyester and nylon. 1.4 Difference between textile manufacturing and textile wet processing.
Unit– II **Pretreatment Technology**	2a. Explain objectives and importance of pretreatment. 2b. Describe various Pretreatments for natural textiles. 2c. Describe various pretreatments for synthetic textiles.	2.1 Importance of pretreatment of textiles. 2.2 Objectives of shearing & cropping, singeing, desizing, scouring and bleaching process. 2.3 Grey inspection 2.4 Shearing & cropping 2.5 Gas singeing 2.6 Enzymatic Desizing of cotton 2.7 Scouring of cotton, viscose rayon, polyester & nylon textiles. 2.8 Classification of bleaching agents 2.9 Bleaching of cotton with H_2O_2. 2.10 Bleaching of polyester with sodium chlorite. 2.11 Pretreatment machineries such as close kier machine, Cold-Pad batch machine and J-box.
Unit– III	3a. Describe purpose of dyeing of textiles.	3.1 Requirements of dyeing of textiles. 3.2 Classification of textile dyes

Dyeing Technology	3b.Classify textile dyes. 3c.Explain dyeing of natural & synthetic textiles.	3.3 Dyeing of cotton & viscose rayon fabric with direct dyes 3.4 Dyeing of polyester with disperse dyes 3.5 Dyeing of nylon with acid dyes 3.6 Dyeing machineries such as Jigger dyeing machine, Jet dyeing machine, 2 & 3 bowl padding mangle.
Unit– IV **Printing Technology**	4a.Describe purpose of printing of textiles. 4b.Classify methods & styles of printing. 4c.Explain printing of natural & synthetic textiles.	4.1 Requirements of printing of textiles. 4.2 Methods of textile printing. 4.3 Styles of textile printing. 4.4 Printing of cotton & viscose rayon fabric with direct dyes 4.5 Printing of polyester with disperse dyes 4.6 Printing of nylon with acid dyes 4.7 Printing machineries such as Flat bed screen printing machine and Rotary screen printing machine.
Unit– V **Finishing Technology**	5a.Describe purpose of finishing of textiles 5b.Classify textile finishes. 5c.Explain different Finishing of textiles	5.1 Requirements of textile finishing 5.2 Objectives of textile finishing 5.3 Classification of textile finishes 5.4 Cylinder drying 5.5 Stiffening 5.6 Delustring 5.7 Heat setting 5.8 Softening

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	Fundamental of textile processing	04	2	2	2	06
II	Pretreatment technology	10	4	8	6	18
III	Dyeing technology	10	4	8	6	18
IV	Printing technology	10	4	8	6	18
V	Finishing technology	08	2	4	4	10
Total		**42**	**18**	**28**	**24**	**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 used for Various Textile Fabrics.
- Collection and Study of various grey textiles samples from different industries.
- Visit textile industries and prepare process sequences for various textiles.
- Poster presentation on textile processing machineries.
- Collection of pictures related to textile processing & makes Power point Presentation.
- Seminar/Quiz/Presentation on natural and synthetic textile processing.

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 chemicals used for textile processing.

b) **Need of Pretreatment:** Collect the data for various pretreatment processes through industrial survey and internet search.

c) **Sample collection:** Visit Textile Industries / Market shops and collected dyed samples.

d) **Textile machines:** Prepare a short video of different textile machines by visiting industries and arrange as per process.

e) **Finishing:** Prepare a report on finishing of textiles and collect samples from industries.

f) **Printing:** Collected printed textile samples from industries and compile them.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Bleaching, Mercerizing & Dyeing of cotton materials	R. S. Prayag	Shree J. Printers, Pune
2	Dyeing of wool, silk & manmade fibres	R. S. Prayag	Shree J. Printers, Pune
3	Technology of printing	R. S. Prayag	Shree J. Printers, Pune
4	Textile Finishing	R. S. Prayag	Shree J. Printers, Pune
5	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 IV	Elements of Textile Processing – 4342906

	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	Identify and understand specific processes used to improve wearable as well as aesthetic properties of various textiles as per requirements.						
Course Outcomes CO a) Apply fundamental & mathematical aspects of textile processing.	3	0	0	0	0	0	2
CO b) Understand appropriate pretreatments of various textiles.	3	0	2	2	0	0	2
CO c) Understand appropriate dyeing of various textiles.	3	0	2	2	0	0	2
CO d) Understand appropriate printing of various textiles.	3	0	2	2	0	0	2
CO e) Understand appropriate finishing of various textiles.	3	0	2	2	0	0	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 Engineering & Technology, Surat	9879479424	ddvyas4edu@gmail.com
2)	Mr. R. D. Joshi Lecturer	R. C. Technical Institute, Sola, Ahmedabad	9426387274	rdjrcti@gmail.com