GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

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

Course Title: Textile Chemical Processes -II
(Course Code: 4345902)

Diploma programme in which this course is offered	Semester in which offered
Textile Designing	4th Semester

1. RATIONALE

Colouration on the textiles is inseparable step in textile designing. Textile designers need to design lucrative textile products. This demands to have certain knowledge of colouration techniques for textiles including printing & finishing processes. Hence this course aims to gain basic knowledge & hands-on practice to develop printed fabric using various styles & methods of printing, as well as different finishing processes to improve fabric aesthetics, feel & functional values.

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 printing and finishing to develop the required pattern and design on fabric or garment.**

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 & Identify chemicals for printing paste formulation.
- Select various printing methods & styles to imprint design on fabric.
- Develop print on natural & manmade textiles using specified dyes.
- Identify suitable finishing technique based on end-use requirements.

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	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) 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.	Compare printing & dyeing processes for colouration of textiles.	I	02
2.	Prepare screen for screen printing.	I	
3.	Prepare a Thickening Paste for printing.	I	
4.	Print a design on Cotton fabric using appropriate dyestuff. i.e. Direct/ Reactive/ Azoic/ Vat/ solubilised vat	II	02
5.	Printing of Wool or Silk with appropriate dyestuff. i.e. Acid/ Metal complex dyes/Basic/ Reactive dyes.	II	02
6.	Print a design on Nylon fabrics using appropriate dyestuff. i.e. Acid / metal complex dyes / Reactive / Disperse/ basic dyes	II	02
7.	Print a design on Polyester/Acetate rayon fabric using Disperse dyes.	II	02
8.	Print a design on fabric using pigment colours.	II	02
9.	Create a design by printing on fabric using Resist print style.	III	02
10.	Create a design by printing on fabric using Discharge print style.	III	02
11.	Create a design by printing on fabric using Brasso / Crimp style.	III	02
12.	Create a design by printing on fabric using Khadi / Flock print style.	III	02
13.	Produce a Glitter print/ Foil print/ Metallic print/ Swarovski crystal print on garment.	III	02
14.	Develop at least two samples of finished fabrics.	IV	02
		28Hrs	

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	1 to 13
2.	Dye pots and Glass-wares: Beaker, Pipette, Glass-rods, Measuring Cylinder	1 to 13
3.	Different elements of printing i.e. Block, Stencil, Screen,Rubber Squeegee etc.	1 to 13
4.	Printing table	3 to 13
5.	Laboratory Stirrer (Motorized)	2 to 13
6.	Laboratory Oven / steamer	3 to 13
7.	Electric iron	2 to 14
8.	HTHP dyeing machine	3 to 13
9.	Lab padding mangle	3 to 14
10	Hot blower	3 to 14
11	Heating stove (Gas stoves, electric stoves and induction cook-tops)	3 to 14

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 Fundamentals of printing	1.a Describe Objectives & importance of printing 1.b Differentiate Textile dyeing	1.1 Dyeing and Printing : Purpose and differentiation 1.2 Printing stages

	& Textile Printing. 1.c Describe different stages of textile printing. 1.d Selects specified print paste ingredients for the given dye. 1.e Classify the thickeners based on the source and chemistry.	1.2.1 Fabric preparation 1.2.2 Print paste preparation 1.2.3 Printing 1.2.4 Drying 1.2.5 Fixation of prints 1.2.6 After treatments 1.3 Print paste: Ingredients and their functions 1.4 Thickeners: 1.4.1 Classification 1.4.2 Advantages and limitations
Unit – II Printing of Natural & Man Made Fabrics	3.a Describe the prints development procedure using appropriate dye on natural fibre material with specified style. 3.b Describe the prints development procedure using appropriate dye on synthetic fibre material with specified style.	2.1 Printing of natural textiles using various dyes 2.1.1 Print paste formulation 2.1.2 Process sequence 2.2 Printing of synthetic textiles using various dyes 2.2.1 Print paste formulation 2.2.2 Process sequence 2.3 Pigment printing: 2.3.1 Principle, mechanism, print paste formulation 2.3.2 Process sequence of printing 2.3.3 Advantages and disadvantages.
Unit– III Methods of Textile Printing	3.a Classify the methods of printing. 3.b Describe with sketch the procedure to develop specified printing effects.	3.1 Definition of printing Methods 3.2 Classification of printing Methods 3.3 Methods of printing 3.3.1 Stencil printing 3.3.2 Block printing 3.3.3 Roller printing 3.3.4 Screen printing 3.3.5 Spray printing 3.3.6 Transfer printing 3.3.7 Photographic printing 3.3.8 Digital printing 3.4 Advantages and limitations of above methods. 3.5 Recently developed printing methods
Unit– IV Styles of Printing	4.a Classify the styles of printing. 4.b Choose relevant styles of printing for the given design.	4.1 Definition of Printing Styles 4.2 Classification of Printing Styles 4.1 Styles of Printing 4.4.1 Direct styles 4.4.2 Discharge styles

		4.4.3 Resist styles 4.4.4 Batik style 4.4.5 Khadi style 4.4.6 Flock style 4.4.7 Crimp style 4.5 Recently developed printing styles.
Unit– V Finishing of textiles	5.a State the objects of textile finishing 5.b Classify the textile finishing 5.c Describe various finishing processes.	5.1 Objects of textile finishing 5.2 Classification of textile finishing 5.3 Mechanical finishes i.e. Calendaring, Sanforizing, Raising, Peach finish, Parchmentising, Creeping, Mechanical softening, Heat setting, Sand Blasting, etc. 5.4 Chemical finishes i.e. Delustring, Softening, Stiffening, Starch & Resin, Soil release, Crease resistant, Water Proof, Antistatic, Anti pilling, Mothproof, etc. 5.5 Functional finish i.e. Antimicrobial/Antiseptic, Durable Press, Water repellent, Flame Retardant, Hydrophilic, Perfume / Fragrant, U.V. Protection, etc. 5.6 Recent trends in finishing of textiles i.e. Solvent finishing & Foam finishing, use of Biotechnology & Nanotechnology, Plasma technology used for surface Modification

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 Level	Total Marks
I	Fundamentals of printing	06	6	4	2	12
II	Printing of Natural & Man Made Fabrics	10	4	4	4	12
III	Methods of Textile Printing	10	4	6	8	18
IV	Styles of Printing	10	4	6	8	18
V	Finishing of textiles	06	4	4	2	10
Total		**42**	**22**	**24**	**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:

- Select various chemical processes according to the end product.
- Explore library/internet for processing technologies being used for colouration & finishing 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 printing processes**: Collect samples of differently printed fabrics and prepare analytical report based on the processes involved for manufacturing. (**Duration: 6-8 hours**)
- **Printing Methods & Styles study:** Prepare a report on various Printing methods & styles. (**Duration: 8-10 hours**)
- **Fabric finishes study:** Prepare a report on various Fabric finishes. (**Duration: 8-10 hours**)

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Technology of Printing Vol – IV	Dr. V. A. Shenai	Sevak Publication, Mumbai 1990
2	Textile Printing	L.W.C. Miles	Society of Dyers and Colourists, 1981, ISBN: 9780901956330
3	Introduction to Textile Printing	W. Clarke	Wood-head Publishing Ltd., Cambridge, ISBN: 9781855739949
4	Technology of Printing	R. S. Prayag	Shree J. Printers, Pune
5	Principles of Cotton Printing	D. G. Kale	Mahajan Brothers
6	Silk Dyeing, Printing and Finishing	George Henry Hurst	Bell, London Rarebooks Club.com (e-copy) 2012, ISBN: 9781130986525
7	Digital Printing of Textiles	Hitoshi Ujiie	Woodhead Publishing Ltd.
8	Colourage, ITB International bulletin on dyeing printing and finishing.	Colourage	Colour Publication PVT. LTD., Mumbai
9	Textile finishing	R. S. Prayag	Shree J. Printers, Pune
10	Technology of Textile Finishing (Vol-X)	Dr. V. A. Shenai	Sevak Publications, Mumbai
11	An introduction to Textile Finishing	J. T. Marsh	B. I. Publication Pvt. Ltd.
12	Handbook of Textile Processing Machinery	R. S. Bhagwat	Colour Publication PVT. LTD., Mumbai ISBN - 8175250771, 9788175250772
13	HANDBOOK of Textile Fibers, Dyes & Finishes	Howard L. Needles	Garland STPM press (November 1, 1980), ISBN-10 : 0824070461 ISBN-13 : 978-0824070465

14. SOFTWARE/LEARNING WEBSITES

- https://nptel.ac.in/courses/
- https://ndl.iitkgp.ac.in
- http://www.nios.ac.in/media/documents/SecHmscicour/english/Home%20Science%20(Eng)%20Ch-11.pdf
- 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.ittaindia.org/
- http://www.textileworld.com/
- http://www.teonline.com/knowledge-centre/
- http://textilelearner.blogspot.in
- http://www.elearning-textiles.co.uk/CatalogueofModules/
- https://textilestudycenter.com/
- https://www.fibre2fashion.com/
- www.textileguide.chemsec.com
- www.zimmer-usa.com
- www.textileschool.com
- http://karlmayer.com
- http://en.wikipedia.org/wiki/Finishing_(textiles)
- http://www.textileschool.com/articles/418/textile-fabric-finishing
- http://textilefashionstudy.com
- Textile Industry - Niir Project Consultancy Services

15. PO-COMPETENCY-CO MAPPING

Semester II	**Fundamentals of Fabric Technology (Course Code: 434590)**								
	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 printing and finishing to design & develop textile materials.***								
Course Outcomes CO a)	3	2	1	1	1	1	3	1	1
CO b)	3	2	1	1	2	1	3	2	1
CO c)	3	1	2	1	2	1	3	2	2
CO d)	3	1	1	1	3	1	3	-	-

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

S. No.	Name and Designation	Institute	Contact No.	Email
1	Pritesh P. Rana	GPG, Surat	8460371987	ggpshod.txt@gmail.com
2	Dr. S. B. Goswami	GPG, Surat	9377568889	ggpshod.txt@gmail.com