GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

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

Course Title: Quality Control in Textile Processing
(Course Code: 4352803)

Diploma Program in which this course is offered	Semester in which offered
Textile Processing Technology	5th Semester

1. RATIONALE

The polytechnic graduates are required to check and manage quality of finished products in industry. They should have basic knowledge and skills to check/test the quality of bleaching, dyeing, printing and finishing processes with their process parameters. The course on Quality and Process Control in Wet Processing has been designed to provide basic knowledge and skills as well as recent technological developments in the area of Quality and Process control parameters and testing methods of processed goods in textile wet processing.

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:

- **Check quality of pretreated, dyed, printed and finished textiles by performing various tests to control the process parameters.**

3. COURSE OUTCOMES (COs)

The theory should be taught and practical should be carried out in such a manner that students are able to acquire different learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

a. Describe the planning and implementation of quality and process control.
b. Perform the quality analysis of pretreated textile materials for implementing process control.
c. Analyse quality of dyed textile materials for controlling the process parameters of dyeing.
d. Check the quality parameters of printed textile materials for controlling the process parameters of printing.
e. Perform the quality analysis of finished textile materials for implementing process control.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CA	ESE	CA	ESE	150
3	0	4	5	30 *	70	25	25	

(*): 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. required
1	Evaluate the efficiency of desizing process	2	2
2	Study the efficiency of scouring process	2	2
3	Study the efficiency of mercerizing process (in terms of dyeing)	5	2
4	Evaluate the efficiency of mercerized fabric by barium activity Number	5	2
5	Evaluate the efficiency of pre shrinking process (%age shrinkage test)	5	2
6	Evaluate the efficiency of crease resistance finish (crease recovery angle test)	5	2
7	Evaluate the efficiency of water repellant finish (Spray test)	5	2
8	Perform flame test on flame retardant finished fabric	5	2
9	Evaluate the efficiency of heat setting (in terms of dyeing)	5	2
10	Perform washing fastness test for various dyes	3	4
11	Perform light fastness test for various dyes	3	4
12	Perform rubbing fastness test for various dyes	3	4
13	Perform sublimation fastness test for various dyes	3	4
14	Perform bleach fastness test for various dyes	3	4
15	Perform perspiration test for various dyes	3	4
16	Study the different types of stains on grey fabric	2	2
17	Study fixation methods for printed fabric	4	2
18	Evaluate efficiency of bleached fabric by cuprammonium fluidity test	5	2
19	Evaluate the efficiency of bleached fabric by copper number Test	5	2
20	Study the pilling behavior of synthetic fabric	5	2
21	Compare various thickening agent in terms of stability	4	2
22	Evaluate the efficiency of heat setting by iodine adsorption test.	5	2
23	Compare various thickening agent in terms of flow property.	4	2
	Total Hours		56

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 the administrators to user 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	All
3	Beaker: 100 ml, 250 ml, 500 ml	All
4	Measuring Cylinder of capacity 10 ml, 25 ml, 100 ml	All
5	Laboratory Padding Mangle: Horizontal	5-12
6	Digital weighing balance: 0.02 gm accuracy (100 gm)	2-12
7	Laundr-o-meter	10
8	Fed-o-meter	11
9	Crock meter	12
10	Sublimation fastness tester	13
11	Viscometer	

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 Introduction	1a. Differentiate Quality, Quality control and Process control. 1b. Distinguish between TQC and TQM system 1c. Different standards and certifications for quality control 1d. Types and purposes of Audit 1e. Concept of six sigma and kaizen	1.1 Terminologies: Quality, Quality Assurance, Quality Control, Process Control, Total quality control TQC and Total Quality Management TQM 1.2 Elements of quality control process and total quality management 1.3 Concept of statistical process control 1.4 ISO 9001 Quality Certification series 1.5 Different standards for quality control 1.6 Basic concept of Six Sigma
Unit– II Quality and Process Control in Pretreatment Operations	2a. Explain process control for various pretreatment processes 2b. Describe quality control parameters for pretreatment process	2.1 Process Control in Pretreatments like Shearing/cropping, Singeing, Desizing, Scouring and Bleaching 2.2 Quality Control in Pretreatments (Absorbency Test, TEGAWA test, Cupra ammonium fluidity, Copper Number, Whiteness Index)
Unit– III Quality and Process Control in Dyeing Operations	3a. Explain process control for various dyeing methods and machines 3b. Explain precautions for dyeing processes 3c. Describe quality control parameters for Dyeing	3.1 Process control in dyeing of various textile material for various dyeing methods and machines 3.2 Precautions required in dyeing ofvarious textile materials 3.3 Quality Control in dyeing (various colour fastness testing methods like washing, rubbing, light, perspiration, sublimation, hot pressing, dry cleaning, different water and bleach with instruments)
Unit– IV Quality and Process Control in Printing Operations	4a. Explain process control for various printing methods and machines 4b. Describe the precautionsfor printing processes 4c. Explain process control for Fixation machines 4d. Describe the precautions for Fixation and after treatments	4.1 Process control in Printing methods and machines 4.2 Precautions required in Printing of various textile materials 4.3 Process control of various fixation machines 4.4 Precautions required in fixation and after treatments
Unit – V Quality and	5a. Explain process control for Finishing	5.1 Process control in finishing like calendaring, drying, mercerization,

Process Control in finishing Operations	5b. Describe quality control in Textile finishing	heat setting, stentering(Heat setting) etc. 5.2 Quality control in finishing like crease recoverytest, Pilling, luster, Barium activity number test, shrinkage, Iodine adsorption test.

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
1.	Introduction	06	3	3	4	10
2.	Quality and Process Control in pretreatment Operations	08	3	3	6	12
3.	Quality and Process Control in Dyeing Operations	10	4	4	10	18
4.	Quality and Process Control in Printing Operations	10	4	4	10	18
6.	Quality and Process Control in finishing Operations	08	3	3	6	12
	Total	**42**	**17**	**17**	**36**	**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:

a) Survey in Industries for TQC and TQM.
b) Collect information about novel process and quality controls.
c) Prepare table for various fastness test results for different dyes and compare.
d) Prepare table for various methods for pretreatment and finishing and compare.
e) Survey market for different certification in 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) **Process control:** Visit textile industries and collect details regarding process control of various wet processes. Arranged them in proper manner and prepare report.
b) **Quality control:** Visit textile industries and collect details regarding quality control of various wet processes. Arranged them in proper manner and prepare report.
c) **Sample collection:** Collect different dyed and printed samples and prepare their fastness result charts as per fastness results.
d) **Certification:** Visit textile industries and collect details regarding different standards and certification applicable in textile industries.

13. SUGGESTED LEARNING RESOURCES

S.No.	Title of Book	Author	Publication with place, year and ISBN
1	Process and Quality Control in Chemical Processing	S.V. Gokhale and J.R. Modi	ATIRA, Ahmedabad
2	Orientation Programme in Wet Processing (Quality and Process Control)	---	BTRA
3	Six Sigma – Short term training manual	---	NITTTR, Bhopal

14. SOFTWARE/LEARNING WEBSITES

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a) www.nptel.iitm.ac.in
b) https://ndl.iitkgp.ac.in
c) www.textileschool.com
d) www.textileassociationindia.org
e) www.textilelearner.blogspot.com
f) en.wikipedia.org/wiki/Textile printing
g) http://textilefashionstudy.com
h) http://en.wikipedia.org/wiki/Quality_control

15. PO-COMPETENCY-CO MAPPING

Semester V	QCTP - 4352803						
	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	Check quality of pretreated, coloured, and finished textiles by performing various tests to control the process parameters						
Course Outcomes CO a) Describe the planning and implementation of quality and process control	3	2	-	2	3	2	3
CO b) Perform the quality analysis of pretreated textile materials for implementing process control	3	2	2	3	2	2	3
CO c) Analyse quality of dyed textile materials for controlling the process parameters of dyeing	3	2	2	3	2	2	3
CO d) Check the quality parameters of printed textile materials for controlling the process parameters of printing	3	2	2	3	2	2	3
CO e) Perform the quality analysis of finished textile materials for	3	2	2	3	2	2	3

implementing process control							

*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

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