GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

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

Course Title: **Quality and process control in textile**
(Course Code: 4362905)

Diploma programmes in which this course is offered	Semester in which offered
Textile Manufacturing Technology	Six

1.   RATIONALE

Quality and process control in textile is a crucial aspect of the textile industry, ensuring the production of high-quality products that meet customer expectations and regulatory standards. A well-structured syllabus for this subject should cover various aspects, including the definition of quality, process control techniques and the role of quality management systems. Quality is a significant factor that affects the success of textile businesses. It influences customer satisfaction, brand reputation and market competitiveness. Therefore, a course focusing on quality and process control in textiles is essential to ensure that students are well-equipped to handle the challenges in the industry. A well-designed quality and process control system can significantly reduce production costs and improve efficiency by minimizing waste, rework and errors. This course ensures students will learn how to optimize their production processes and improve overall productivity.

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 various quality control tools and techniques, understand the importance of quality management in textile production.**

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) Recognize the process variables in spinning and weaving that affect quality and cost in textile.
b) Analyze the factors affecting process and apply the remedial measures to control the spinning processes.
c) Analyze the factors affecting process and apply the remedial measures to control the weaving processes.
d) Describe the causes and remedies of faults occurring during spinning and weaving processes.

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	-	-	3	30*	70	0	0	100

(*): 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 approx. 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
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6.   MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

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

S. No.	Equipment Name with Broad Specifications	PrO. No.
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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 course competency.
   a) Work as a leader/a team member.
   b) Follow safe practices.
   c) Understanding of the role of continuous improvement in quality management.
   d) Development of problem solving skills in quality management.
   e) Practice environment 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:
   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 of quality and process control**	1a. Explain the role and scope for process control 1b. Identify the key variables of process control for spinning processes. 1c. Identify the key variables of process control for weaving processes. 1d. Identify different tools and techniques of process control 1e. Explain SPC(statistical process control) and improving processes	1.1 Role and scope for process control 1.2 Key variables of process control for spinning processes. 1.3 Key variables of process control for weaving processes. 1.4 Tools and techniques of process control 1.5 SPC and improving processes
Unit – II **Quality and process control in spinning**	2a. Explain the important parameters for control of mixing quality and cost 2b. Explain methods to control the yarn realization 2c. Describe the process to control the waste and cleaning in blow room and carding 2d. Explain the process to control the comber waste 2e. Explain the process to Control the yarn quality: count, strength and their variability 2f. Describe the process of online control in spinning operations	2.1. Instrumental evaluation of cotton, Control of mixing quality through fibre characteristics, Simultaneous control of mixing cost and quality 2.2. Records for estimation yarn realization and waste, Norms for yarn realization 2.3. Determination of trash content and cleaning efficiency, Cleaning and waste in blow room and cards, Norms for waste and cleaning in blow room, Norms for cleaning efficiency of individual machines in blow room, Optimising cleaning and waste at cards 2.4. Technological considerations, Optimum level of comber waste, The need for routine check of comber waste, Procedures for control of comber waste 2.5. Reducing within-bobbin count variation, Reducing between-bobbin count variation, Routine control of count, Control of variability in blow room and draw frames, control of variability of lea strength 2.6. Online control in spinning operations

Unit	Unit Outcomes (UOs) (4 to 6 UOs at different levels)	Topics and Sub-topics
Unit– III **Quality and process control in weaving**	3a. Explain the process control in winding	3.1 Scope and approach of process control in winding, Control of quality of knot, Control of efficiency of fault removal, process parameters: Slub catcher setting – condition of slub catchers – calibration of slub catchers with oscillating blades, approach to control productivity
	3b. Describe the process control in warping	3.2 Scope and approach of process control in warping, Minimizing end breaks in warping, performance in warping, Quality of warping beams, Productivity at warping
	3c. Describe the process control in sizing	3.3 Scope and approach of process control in sizing, Choice of size recipe and size pick-up, general considerations for size recipe and level of size pick-up, preparation of size pick-up, control of size pick-up, control of yarn stretch, control of moisture in sized yarn, Quality of sized beams
	3d. Describe the control of productivity in loom shed	3.4 Scope and approach of control of loom shed, Control of loom efficiency
	3e. Describe the process of online control in weaving operations	3.5 Online control in weaving operations
Unit– IV **Causes and remedies of faults**	4a. Explain the causes and remedies of fibre, yarn and package faults.	4.1 Measurement and assessment of imperfections, Fibre neps: assessment and control, Causes of thick and thin places, Control of yarn unevenness and imperfections, Yarn faults and package defects
	4b. Explain the causes and remedies of fabric faults	4.2 Specific fabric defects: Warp streaks, Reediness, Irregular reppiness, Small weft loops, Curled and folded selvedges, weft snarls, weft bar, broken picks, lashing-in; Some other common fabric defects: Missing ends(Chira), float(Jala), starting marks, shuttle smash, weft slough, Gout, Temple marks, hard size, stains

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	Introduction of quality and process control	4	3	3	0	06
II	Quality and process control in spinning	16	4	7	16	27
III	Quality and process control in weaving	16	4	7	16	27
IV	Causes and remedies of faults	6	4	3	3	10
Total		**42**	**15**	**20**	**35**	**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 to 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. They also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:
   a)   Prepare report on quality and process control practices in the industry.
   b)   Give seminar on quality and process control practices in the industry.
   c)   Prepare report on recent process control practices in spinning and weaving department.
   d)   Give seminar on recent process control practices in spinning and weaving department.

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)   Guide students on how to address issues on environment and sustainability.
   g)   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-projects 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 microproject 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) Raw material selection: Students can investigate the importance of raw material selection in determining the overall quality of textiles. They can analyze the properties of textile fibres, such as cotton, wool, silk and synthetic fibres, and their impact on the quality of final product.
   b) Students can explore the manufacturing process of yarn, from fibre selection to twisting and plying. They can study the importance of yarn specifications, including count, twist and uniformity, in determining the quality of final fabric.
   c) A preliminary study on various types of looms and knitting machines as well as the factors that affect the fabric quality, like tension, thread count and fabric weight.
   d) A preliminary study on various methods used in inspecting and controlling the quality of textiles like visual inspection, chemical analysis and instrumental testing. Also they can study the role of statistical process control in identifying and correcting quality issues in timely manner.

13.   SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Process control in cotton spinning	A.R.Garde and T.A.Subramanian	ATIRA, Ahmedabad, 1978
2	Process control in spinning	M.C.Paliwal and P. D. Kimothi	ATIRA, Ahmedabad, 1983
3	Process control in textile manufacturing	Abhijit Majumdar, Apurba Das, R. Alagiruswamy, V.K.Kothari	Woodhead Publishing, 1518 Walnut Street, Suite 1100, Philadelphia, PA 19102-3406, USA, ISBN 978-0-85709-027-0 (print) ISBN 978-0-85709-563-3 (online)
4	Quality control in spinning	T.V. Ratnam & K.N.Seshan	SITRA, Coimbtore, 1987

S. No.	Title of Book	Author	Publication with place, year and ISBN
5	Process control and yarn quality in spinning	G. Thilagavathi & T. Karthik	Woodhead Publishing India Pvt. Ltd., New Delhi, 2016 International Standard Book Number-13: 978-93-80308-18-0 (eBook - PDF)

14. SOFTWARE/LEARNING WEBSITES

a) https://archive.nptel.ac.in/courses/116/102/116102019/
b) https://textilelearner.net/principles-of-textile-quality-control/
c) https://www.textileblog.com/basic-concepts-of-quality-and-quality-control-in-textile/
d) https://study.com/academy/lesson/what-is-quality-control-in-textile.html
e) https://textilevaluechain.in/in-depth-analysis/articles/textile-articles/textile-testing-and-quality-control/
f) https://www.worldfashionexchange.com/blog/the-importance-of-quality-control-in-garment-manufacturing/

15. PO-COMPETENCY-CO MAPPING

Semester VI	Quality and process control in Textile (Course Code: 4362905)						
	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	Apply various quality control tools and techniques, understand the importance of quality management in textile production.						
Course Outcome CO a) Recognize the process variables in spinning and weaving that affect quality and cost in textile.	2	-	1	2	-	-	2
CO b) Analyze the factors affecting process and apply the remedial measures to control the spinning processes.	3	2	2	-	2	2	2
CO c) Analyze the factors affecting process and apply the remedial measures to control the weaving processes.	2	2	2	1	-	2	2

CO d)Describe the causes and remedies of faults occurring during spinning and weaving processes.	1	-	-	2	2	2	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

<u>GTU Resource Persons</u>

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