GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

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

Course Title: Quality Assessment & Analysis
(Course Code: 4345904)

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

1. RATIONALE

Textile designers have to fulfil the need for high-quality goods raised by customers in this competitive & open market. To ensure best quality as per the needs of the customer, it is essential for textile designers to appreciate the importance of testing and to develop skills to test the textiles as per standards using testing methods. Hence this course aims to gain basic knowledge & hands-on practice to test & analyse the textile materials at fibre, yarn, fabric & garment stages. As a result of taking this course, diploma holders will be able to ensure that quality is maintained during production and that general quality checks are performed prior to transit.

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 testing, inspection and quality checks on fiber, yarn, fabric, apparels to ensure designing quality product.**

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:

- Select appropriate quality standard and specification for textiles
- Apply requisite tests for ensuring fibre & yarn quality
- Apply basic knowledge of testing methods & procedures followed in an apparel industry for different fabrics performance and its evaluation
- Aware consumers about the different parameters to select fabrics

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	
2	0	2	3	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.	Measure Staple length of the fiber using an appropriate method	II	02
2.	Measure Fiber fineness using air flow method	II	02
3.	Measure Linear density of the yarn a. Using the micrometer for yarn diameter b. Yarn fineness (Yarn count measurement) in direct & indirect systems	III	02
4.	Measure yarn twist using an appropriate method	III	02
5.	Measure tensile strength of Fiber, single yarn & bundled Yarn (CSP value) using an appropriate method	III, IV	02
6.	Measure Fabric dimensions, weave identification, threads per unit length, Weight per unit area & yarn crimp %.	IV	02
7.	Measure grab strength, strip strength, seam strength using strength tester	IV, V	02
8.	Measure tearing strength using tearing strength tester	IV	02
9.	Measure Shrinkage in the fabric using an appropriate method	IV	02
10.	Measure fabric Drape using an appropriate method	IV	02
11.	Measure at least one fabric handle property (i.e. Stiffness, crease)	IV	02
12.	Measure fabric abrasion using an appropriate method	V	02
13.	Measure fabric colourfastness using at least two appropriate methods.	V	02
14.	Measure quality of at least two apparel accessories as per standards. (i.e. interlinings, zippers, elastic waistbands, buttons, snap fasteners, hook and loop fasteners, etc.	V	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.	Fibre Staple length measuring equipment i.e. Barer sorter, Fibrograph	1
2.	Fibre fineness measuring equipment i.e. Sheffield Micronair Tester	2
3.	Wrap reel, Electronic weighing balance	3
4.	Yarn Twist Tester	4
5.	Fibre strength tester i.e. Stelometer , Pressly fiber Strength Tester	5
6.	Measuring tape, Pointer, Pick glass, Thickness Tester, scissor	6
7.	Tensile strength tester i.e. Uster Single Thread Tester, Universal testing machine, etc.	5, 7
8.	Tearing strength tester	8
9.	Fabric drape tester	10
10	Fabric stiffness tester, Fabric crease recovery tester	11
11	Fabric abrasion tester	12
12	Fabric colour fastness grey scales i.e. grey scale for colour change, grey scale for staining, Chromatic colour transference scale	13
13	Colour fastness testers i.e. Light fastness tester, Washing fastness tester, sublimation fastness tester, rubbing fastness tester,	13
14	Dye pots and Glass-wares: Beaker, Pipette, Glass-rods, Measuring Cylinder	9, 13
15	Laboratory Oven / steamer, Electric iron, Hot blower	9, 13
16	Heating stove (Gas stoves, electric stoves and induction cook-tops)	9, 13
17	Apparel accessories testers i.e. peel / fusing bond tester, zipper life test, button pull tester	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 Importance of Quality & testing	1.a Define quality 1.b Derive important Factors for Quality in textile designing 1.c Describe Objectives & importance of testing 1.d Select appropriate standards and specifications for textile materials at various stages 1.e Select appropriate Sampling method for testing	1.1 Definitions of quality 1.2 Meaning of quality based on product, user, manufacturing and value 1.3 Eight dimensions of quality in textile designing 1.4 Quality control (QC), Quality assurance (QA), Quality management (QM) 1.5 Importance of textile testing 1.6 Objectives of textile testing 1.7 Standard atmospheric conditions 1.8 Sampling: aim of sampling 1.9 Types of sampling: random, bias, numerical and zoning
Unit – II Fibre testing	2.a Identify fibre length 2.b Describe Fibre Fineness & Maturity 2.c Describe Moisture content/	2.1 Fibre length Measurement 2.1.1 Principles 2.1.2 Testing methods 2.2 Fibre Fineness Measurement

	regain 2.d Measure Trash content 2.e Describe fibre strength measurement	2.2.1 Principles 2.2.2 Testing methods 2.3 Fibre Maturity Measurement 2.4 Trash content Measurement 2.5 fibre strength Measurement 2.5.1 Terms 2.5.2 Principles 2.5.3 Testing methods 2.6 Advanced testing methods & Equipment i.e. AFIS, HVI
Unit– III **Yarn testing**	3.a Describe Yarn diameter & Numbering systems. 3.b Describe Twist & its effect on fabric properties. 3.c Describe yarn evenness 3.d Describe Yarn strength testing: principles and methods	3.1 Yarn Numbering systems 3.1.1 Yarn count measurements 3.1.2 Count conversions from one system to another. 3.2 Describe Twist, twist factor, types of twist & fabric properties affected by twist, measurement of yarn twist 3.3 Yarn evenness 3.3.1 Terms 3.3.2 Principles 3.3.3 Testing methods 3.4 Yarn strength 3.4.1 Terms 3.4.2 Principles 3.4.3 Testing methods
Unit– IV **Fabrics testing**	4.a Measure fabric dimensions 4.b Measure Crimp of yarn in a fabric 4.c Describe Properties & terminologies of tensile testing. 4.d Describe Shrinkage behaviour of the fabric 4.e Describe fabric permeability 4.f Describe Fabric stiffness, handle & drape properties.	4.1 Fabric dimension measurement 4.1.1 Length, Width, Thickness 4.1.2 Identification of warp/ weft direction 4.1.3 Threads per unit length 4.2 Crimp of yarn in a fabric 4.3 Fabric Shrinkage behaviour 4.4 Measurement of permeability and repellency: air permeability test, water permeability & repellency, drop test, spray test 4.5 Parameters affecting handle of fabric - drape ability, fabric stiffness; Crease resistance and crease recovery tester
Unit– V **Apparel testing**	5.a Carry out Standard test methods for apparels	5.1 Standard test methods 5.1.1 Testing of apparels - bow

	5.b Carry out Fastness properties of the fabric 5.c Carry out Labelling of garments	and skewness, needle cutting/ yarn severance, sewability, pilling, snagging, abrasion resistance, fabric stretch properties, seam strength, seam puckering 5.1.2 Testing of other materials- Interlinings, zippers, elastic waistbands, buttons, snap fasteners, hook and loop fasteners, etc. 5.1.3 Product safety - Strangulation hazards, ingestion hazards, Skin irritation, Flammability, Laceration hazards 5.2 Colourfastness 5.2.1 Introduction to colourfastness 5.2.2 Scales for visual comparison of colours - Grey scale for colour change, Grey scale for staining, Chromatic colour transference scale 5.2.3 Evaluation of colourfastness to washing or laundering, light, dry cleaning, rubbing / abrasion (frosting), crocking, perspiration, heat, water, bleaching, chlorinated pool, sea water, water spotting, etc. 5.3 Labelling of garments 5.3.1 Care labelling 5.3.2 Care labelling regulations 5.3.3 ISO care symbols

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	**Importance of Quality & testing**	4	4	4	2	10
II	**Fibre testing**	4	2	4	4	10
III	**Yarn testing**	6	4	4	8	16
IV	**Fabric testing**	6	4	4	8	16
V	**Apparel testing**	8	4	6	8	18
Total		**28**	**16**	**24**	**30**	**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:

- Collect the fabric swatches and perform tests and record the findings.
- Explore library/internet for quality standards and specifications for textile materials at various stages and make a report.
- Visit to textile industry and preparing report with sketches.
- Prepare flow diagram of testing methods & procedures followed in an apparel industry.
- 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:

- **Select quality assessment processes**: Collect samples of different textile materials, perform various testing and prepare analytical report based on the standards. (**Duration: 6-8 hours**)
- **Testing Methods & specifications study:** Prepare a report on various Testing methods & their specifications. (**Duration: 8-10 hours**)
- **Apparel accessories testing study:** Prepare a report on various apparel accessories and their testing procedures. (**Duration: 8-10 hours**)

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Principles of Textile Testing – 3rd Edition.	Booth J. E.	New York: CBS Publishers & Distributors Pvt. Ltd.Sevak (1996).
2	Quality Management Handbook for the Apparel Industry.	Mehta, P. V.	New Delhi: New Age International Pvt. Ltd. (2012).
3	Physical Testing of Textiles.	Saville, B. P.	New York: CRC Press LLC. (2000).
4	Textile Testing.	Skinkle, J. H.	New York: Chemical Publishing Inc. (1949).
5	Physical Properties of Textile Fibers – 4th Edition.	Morton, W. E. & Hearle J. W. S.	New Delhi: Woodhead Publishing Ltd. (2008).
6	Testing and Quality Management.	Kothari, V. K.	New Delhi: IAFL Publications. (1999).
7	*Apparel Quality Lab Manual*	Bubonia, J. E.	Bloomsbury Publishing. London: (2014)
8	*Apparel Quality: A Guide to Evaluating Sewn Products.*	Bubonia, J. E.	(2014). London: Bloomsbury Publishing.

9	*Introduction to Clothing Manufacture*.	Cooklin, G.	(1991). Oxford: BSP Professional Books.
10	*Quality Characterization of Apparel.*	Das, S.	(2010). New Delhi: Woodhead Publishing India Pvt. Ltd.
11	*Textile Science: An Explanation to Fiber Properties*	Gohl, E., & Vilensky, L.	(1993).. Melbourne: Longman Cheshire
12	*Textiles – 10th Edition.*	Kadolph, S. J., & Langford, A. L.	(2006). New Jersey: Prentice Hall.
13	*Quality Assurance for Textiles and Apparel* – Second ed.	Kadolph, S. J.	(2007). London: Bloomsbury Publishing.
14	*Evaluating Quality Apparel.*	Stamper, A., Sharp, S., & Donnell, L.	(1991). New York: Fairchild Publications.

14. SOFTWARE/LEARNING WEBSITES

- http://nptel.ac.in/courses/116102029/
- https://ndl.iitkgp.ac.in
- http://www.sitra.org.in
- http://www.btraindia.com
- www.nitratextile.org/
- http://www.textileassociationindia.org/
- http://www.nitma.org/
- http://textilelearner.blogspot.in
- https://textilestudycenter.com/
- https://www.fibre2fashion.com/
- http://www.uster.com/en/instruments/fiber-testing/uster-hvi/
- http://www.ileusa.net/files/47258664.pdf
- https://atira.in/testing/
- http://www.fashion-era.com/

15. PO-COMPETENCY-CO MAPPING

Semester II	Quality Assessment & Analisys (Course Code: 4345904)								
	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 testing, inspection and quality checks on fibre, yarn, fabric, apparels to ensure quality designed product.***								
Course Outcomes CO a)	3	2	1	1	1	1	3	1	1
CO b)	3	2	2	3	2	1	3	2	1
CO c)	3	2	2	3	2	1	3	2	2
CO d)	3	2	2	3	2	1	3	2	2

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

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1	Pritesh P. Rana	GPG, Surat	8460371987	ggpshod.txt@gmail.com
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