

Program Name : Diploma in Textile Manufacturers
Program Code : TX
Semester : Fifth
Course Title : Fabric and Garment Testing
Course Code : 22582

1. RATIONALE

Quality of fabric depends on the fibre and yarn properties. The diploma engineer needs to have relevant knowledge and skills related to fabric testing. This subject intends to equip students with the concepts, principles and methods of testing of fabric and garment which are helpful in selection of fibre and yarn to produce desired fabric properties and to ensure fabric and garment quality as per required end use. The product development is also an important aspect, which requires lot of experimentation. Fabric and garment testing requires recording of number of observations, which are to be analyzed, interpreted. Therefore, knowledge of fabric and garment testing is essential for quality assurance.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Test the fabric and garment quality.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Select fabric sample for testing of fabric properties.
- Apply principles to determine fabric handle and crease recovery.
- Evaluate wear and serviceability properties of fabric.
- Evaluate water and air resistance properties of fabric.
- Test the tensile strength to predict fabric behavior in subsequent processes.
- Apply principles of fabric testing for inspection and development of garment quality.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
Max	Min	Max	Min		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min		
4	-	2	6	3	70	28	30*	00	100	40	25#	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment 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, ESE - End Semester Examination; PA - Progressive Assessment

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)



This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

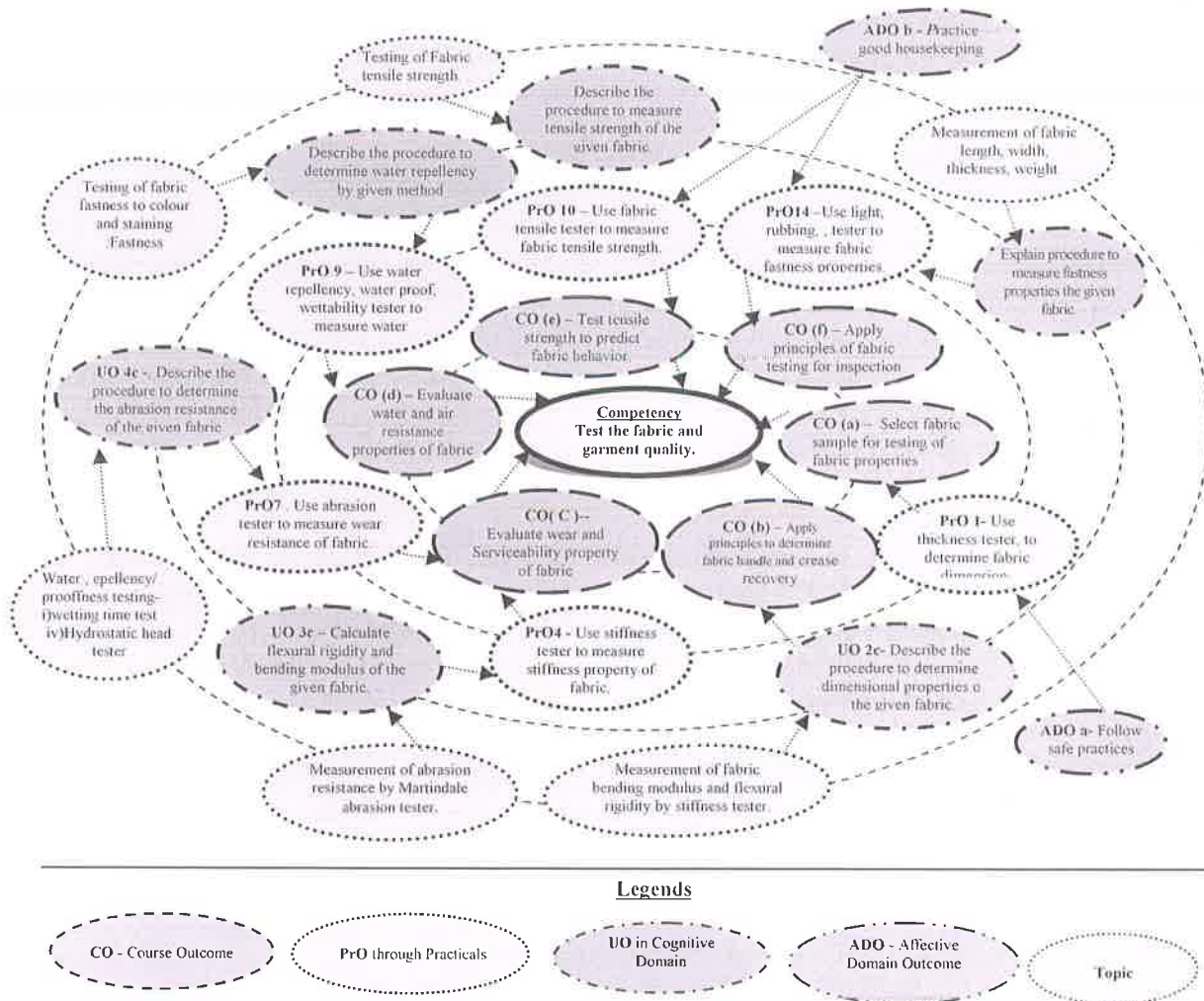


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency:

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Use thickness tester, scale, weighing balance to determine fabric dimensions-Length,width, thickness, weight of fabric.	I	02*
2	Use counting glass and weighing balance to determine warp and weft count, thread count, cover factor.	I	02*
3	Use crimp tester to measure and compare warp and weft crimp property.	I	02*
4	Use stiffness tester to measure stiffness property of fabric.	II	02*
5	Use drape meter to measure fabric drape.	II	02*
6	Use crease recovery tester to measure crease recovery of fabric.	II	02*
7	Use abrasion tester (Martindale) to measure Abrasion resistance of fabric.	III	02*
8	Use pilling tester to analyze pilling resistance of fabric.	III	02*



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
9	Use water repellency, water proof, wettability tester to measure water repellency, absorbency, and water proffness of fabric.	IV	02*
10	Use fabric tensile strength tester to measure fabric tensile strength.	V	02*
11	Use tear strength tester to measure fabric tear resistance.	V	02*
12	Use bursting strength tester to measurement of fabric bursting strength.	V	02
13	Use tensile strength tester to evaluate seam strength.	VI	02*
14	Use rubbing, sublimation, washing tester to measure fabric fastness properties.	VI	02
15	Use light, perspiration tester to measure fabric fastness properties.	VI	02
16	Use scale to measure shrinkage of fabric.	VI	02
17	Use of peel bond strength tester to evaluate fusing strength of cuffs and collars of garment.	VI	02
Total			34

Note

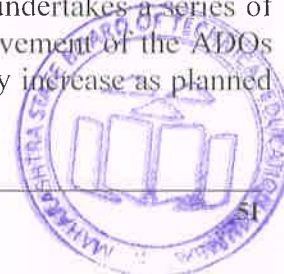
- i. A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- ii. The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S.No.	Performance Indicators	Weightage in %
a.	Preparation of experimental set up	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
Total		100

The above PrOs also comprise of the following social skills/ attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- a. Follow safety practices.
- b. Practice good housekeeping.
- c. Practice energy conservation.
- d. Work as a leader/a team member..
- a. Follow ethical Practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. 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
- 'Organisation Level' in 2nd year
- 'Characterisation Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Measuring table of 5 meter length ,scale of 0.1mm, 1inch counting glass.	1,2,15
2	Fabric thickness tester having 0.01mm LC.	1
3	Fabric GSM cutter and weighing balance having 0.01mm LC.	1
4	Crimp tester having 0.1mm LC.	3
5	Fabric stiffness tester having 45 ⁰ reference mark.	4
6	Fabric Drape tester.	5
7	Fabric crease recovery tester having 01kg.and 02kg.loading capacity.	6
8	Fabric abrasion tester (Martindale) having 200 and 400 gm. loading facility.	7
9	Fabric pilling tester.	8
10	Water repellency tester.	9
11	Wettability tester.	9
12	Water proof tester.	9
13	Fabric tensile tester having 230 kg capacity.	10,13,15,16
14	Fabric tear test having 6.4 kg capacity.	11
15	Fabric Bursting strength tester having 20 kg /cm ² capacity.	12
16	Colour fastness testers-light, rubbing, washing, perspiration,sublimation.	14,15
17	Peel bond tensile tester	17

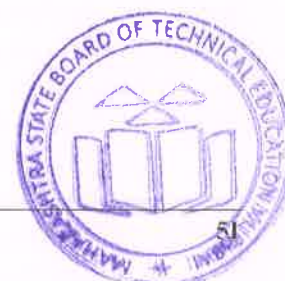
8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit– I Sampling and dimen- sional charac- teristics	1a. Select the relevant sampling for testing the given fabric. 1b. Describe the procedure to determine dimensional properties of the given fabric. 1c. Calculate cover factor for the given fabric data. 1d. Describe the procedure to determine crimp of warp and weft of the given fabric using crimp tester. 1e. Describe effect of crimp on the given type of fabric.	1.1 Sampling of fabric for testing fabric properties. 1.2 Measurement of fabric length, width, thickness, weight. 1.3 Warp Count , Weft Count ,EPI ,PPI, Cover Factor. 1.4 Crimp in warp and weft of fabric. 1.5 Effect of crimp on fabric properties. 1.6 Measurement of crimp by – crimp tester.



Unit– II handle and crease recovery	<p>2a. Calculate drape coefficient of the given fabric.</p> <p>2b. Relate the effect of epi,ppi,weave on drape of the given fabric.</p> <p>2c. Calculate flexural rigidity and bending modulus of the given fabric.</p> <p>2d. Describe the procedure to determine crease recovery of the given fabric.</p> <p>2e. Grade the given fabric based on crease recovery angle.</p>	<p>2.1 Fabric handle, drape , drape coefficient.</p> <p>2.2 Factors affecting fabric drape property.</p> <p>2.3 Measurement of fabric drape by drape meter.</p> <p>2.4 Stiffness, bending length, flexural rigidity.</p> <p>2.5 Measurement of fabric flexural rigidity by stiffness tester.</p> <p>2.6 Crease and Crease recovery.</p> <p>2.7 Measurement of fabric crease recovery by crease recovery tester.</p>
Unit-III Wear and Serviceability	<p>3a. Define the given terms.</p> <p>3b. Describe with sketches the procedure to determine the abrasion resistance of the given fabric.</p> <p>3c. Interpret the abrasion property of the given abrasion test parameters</p> <p>3d. Describe with sketches the procedure to determine the pilling resistance of the given fabric.</p> <p>3e. Grade the given fabric based on pilling result.</p>	<p>3.1 Fabric wear , abrasion and serviceability.</p> <p>3.2 Types of fabric abrasion - plain, flex and edge abrasion.</p> <p>3.3 Measurement of abrasion resistance by Martindale abrasion tester.</p> <p>3.4 Assessment of the abrasion test.</p> <p>3.5 Pilling, measurement of pilling by pilling tester.</p> <p>3.6 Factors affecting pill formation in fabric.</p>
Unit –IV Comfort properties	<p>4a. Describe with sketches the procedure to determine air permeability of given fabric.</p> <p>4b. List the factors affecting air permeability of the given fabric.</p> <p>4c. Explain basic concept of wettability of the given fabric.</p> <p>4d. Describe with sketches the procedure to determine water repellency by the given method.</p> <p>4e. Describe the procedure to determine Thermal Insulation Value of the given sample method.</p>	<p>4.1 Air permeability, air resistance and air porosity.</p> <p>4.2 Measurement of air permeability.</p> <p>4.3 Factors affecting air permeability of fabric.</p> <p>4.4 Water absorbency, water repellency, water- proof, shower-proof.</p> <p>4.5 Basic concept of wettability of fabric.</p> <p>4.6 Water repellency , Water proffness testing- i)wetting time test ii)Drop penetration test iii)Spray test iv)Hydrostatic head tester</p> <p>4.7 Thermal transfer process – conduction, convection and radiation</p> <p>4.8 Measurement of Thermal Insulation Value.</p>



Unit-V Tensile Properties	5a. Describe with sketches the procedure to measure tensile strength of the given fabric. 5b. Explain effect of fabric assistance on tensile strength of the given fabric. 5c. Describe with sketches the procedure for tear strength measurement of the given fabric. 5d. Describe with sketches the procedure to determine bursting strength of the given fabric.	5.1 Significance of fabric tensile strength. 5.2 Comparison -Cut strip ravelled, grab test. 5.3 Testing of Fabric tensile strength. 5.4 Fabric assistance and its effects on tensile strength of fabric. 5.5 Fabric tear strength and its testing by Elmendorf tear strength tester. 5.6 Measurement of fabric bursting strength by using bursting strength tester.
Unit-VI Testing of Garment and its accessories	6a. Describe the procedure to determine shrinkage of the given fabric. 6b. Describe with sketches the procedure to measure seam strength and seam efficiency of the given fabric 6c. Describe with sketches the procedure to measure the quality of the given garment accessories. 6d. Grade the given fabrics for color change and Staining using grey scale. 6e. List the fastness properties required to test for the given garment. 6f. Explain with sketches the procedure to measure fastness properties the given fabric.	6.1 Fabric shrinkage, shrinkage test. 6.2 Seam strength and seam Efficiency. 6.3 Testing of garment accessories: - Sewing threads, Button - Zipper, Fusible interlining - Elastic tape 6.4 Grey Scale for Colour Change and Staining. 6.5 Testing of fabric fastness to colour and staining : - Fastness to Washing, Fastness to rubbing, Dry-cleaning, Fastness to Light, Fastness to Perspiration

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'

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	Fabric Sampling and its dimensional characteristics	10	02	04	06	12
II	Fabric handle and crease recovery	12	02	04	06	12
III	Fabric Wear and Serviceability	10	02	04	06	12
IV	Comfort properties of fabrics	12	02	04	04	10
V	Fabric tensile testing	12	03	05	06	14
VI	Garment testing	08	02	04	04	10
Total		64	13	25	32	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary 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) Visit nearby one industry and collect test results of fabric manufactured by them
- b) Do internet survey and collect standard procedure for fabric testing.
- c) Library /Internet survey and collect norms – ATIRA,BTIRA,SITRA
- d) Prepare power point presentation or animation for understanding modern testing instruments like –HVI,AFIS
- e) Analyze the causes of defect in fabric

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) '*L*' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c) About *15-20% of the topics/sub-topics* which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d) With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
- e) Guide student(s) in undertaking micro-projects.
- f) Use different fabric samples to explain the importance of various fabric properties.
- g) Use proper equivalent analogy to explain different concepts.
- h) Use Flash/Animations to explain various principles for fabric testing.

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 are given here. Similar micro-projects could be added by the concerned faculty:

- a) **Fabric handle and crease recovery:** Collect different fabric sample and prepare comparative charts of crease recovery ,stiffness and drape properties of fabric.
- b) **Fabric Wear and Serviceability:** Abrade the fabric sample on different abrasion surface such as – emery paper, canvas fabric , leather surface and compare loss in weight and thickness strength after testing.
- c) **Comfort properties of fabrics:** apply wax finish manually on fabric surface and compare water repellency rating before and after waxing the fabric.



- d) **Fabric tensile testing:** Each batch will draw schematic diagrams of different principles and instruments based on them for fabric strength testing. Take three fabric sample of different thread count and calculate fabric assistance.
- e) **Garment testing:** stitch the fabric with 2-3 sewing threads of different manufacturers. Test and compare the seam strength.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Physical Properties of Textile Fibres'	Morton, W.E; Hearle, J.W.	Wood head publishing 2008, ISBN 978-1-84569-220-9.
2	Hand book of Textile Testing-part-1: Testing and grading of textile fibres.	--	SP 15-1:Published 1989 Bureau of Indian Standards(BIS)
3	Textile Testing Physical, Chemical and Microscopical	Skinkle, John H.	Chemical Publishing Co Inc (1940) ASIN: B001OMN6VS
4	Principles of Textile Testing	Booth, J. E.	CBS publishers and distributors private ltd. 1996.New Delhi India. ISBN 13:9788123905150
5	Testing & Quality Management	Kothari, V.K.	IAFL, New Delhi 1999 ISBN 819010330X, 9788190103305
6	Hand book of Textile Testing & Quality Control	Grover,E.B; Hamby, D.C .	Textile Book Publishers, 1960 - Technology and Engineering the University of Michigan.
7	Physical Testing of Textiles	Saville, B.P.	Wood head publishing limited -2002 Cambridge England. ISBN :1 85573 367 6
8	Methods of Tests, Fibre, Yarn & Fabric	--	CIRCOT, Mumbai
9	A Practical Guide to Textile Testing	Amutha,K.	Wood head Publishing New Delhi India.2016. ISBN:978-93-85059-07-0 .

14. SOFTWARE/LEARNING WEBSITES

- www.fibtex.lodz.pl/2012/5/41.pdf
- www.cdn.intechopen.com/pdfs/36900.pdf
- nptel.ac.in/courses/116102029/55
- nptel.ac.in/courses/116102029/56
- [www.fibtex.lodz.pl/file-Fibtex_\(00ybkcbys9nntazx\).pdf-FTEE_98_84.pdf](http://www.fibtex.lodz.pl/file-Fibtex_(00ybkcbys9nntazx).pdf-FTEE_98_84.pdf)
- https://www.researchgate.net/publication/283451342_Air_Permeability_of_Woven_Fabrics
- <http://nptel.ac.in/courses/116102029/58>
- <http://nptel.ac.in/courses/116102029/42>
- <http://nopr.niscair.res.in/bitstream/123456789/2611/1/IJFTR%2033%284%29%20377-382.pdf>
- <https://www.textilemates.com/fastness-property-fabrics/>
- <https://www.scribd.com/doc/201648794/SITRA-NORMS-SPINNING-MILLS-2010>

