

Program Name : Diploma in Textile Technology
Program Code : TC
Semester : Fourth
Course Title : Finishing of Natural Substrates
Course Code : 22460

1. RATIONALE

To educate the students regarding the basic terms and calculations involved in finishing of textiles. Finishing technology regards the principle of working of machines and various chemicals to enhance the value added properties of the fabric depending upon the end use of the product. The terms finishing and functional finishing are therefore similar and both play a fundamental role for the commercial Excellency of the results of textiles, strictly depending on market requirements that are becoming increasingly stringent and unpredictable and permit very short response times.

2. COMPETENCY

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

- Undertake finishing processes for cotton, silk, wool and all natural fibre textile materials for end use.

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:

- Use relevant finishing methods on the given natural fabric.
- Select suitable softening/ stiffening agents for the given natural fabric.
- Select suitable wrinkle free finish for the given natural fabric.
- Use the optical brightening agents on the given textile fabric.
- Use the flame retardant for the given natural fabric.
- Select suitable antimicrobial finish on the given natural fabric.

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		
3	-	2	5	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.

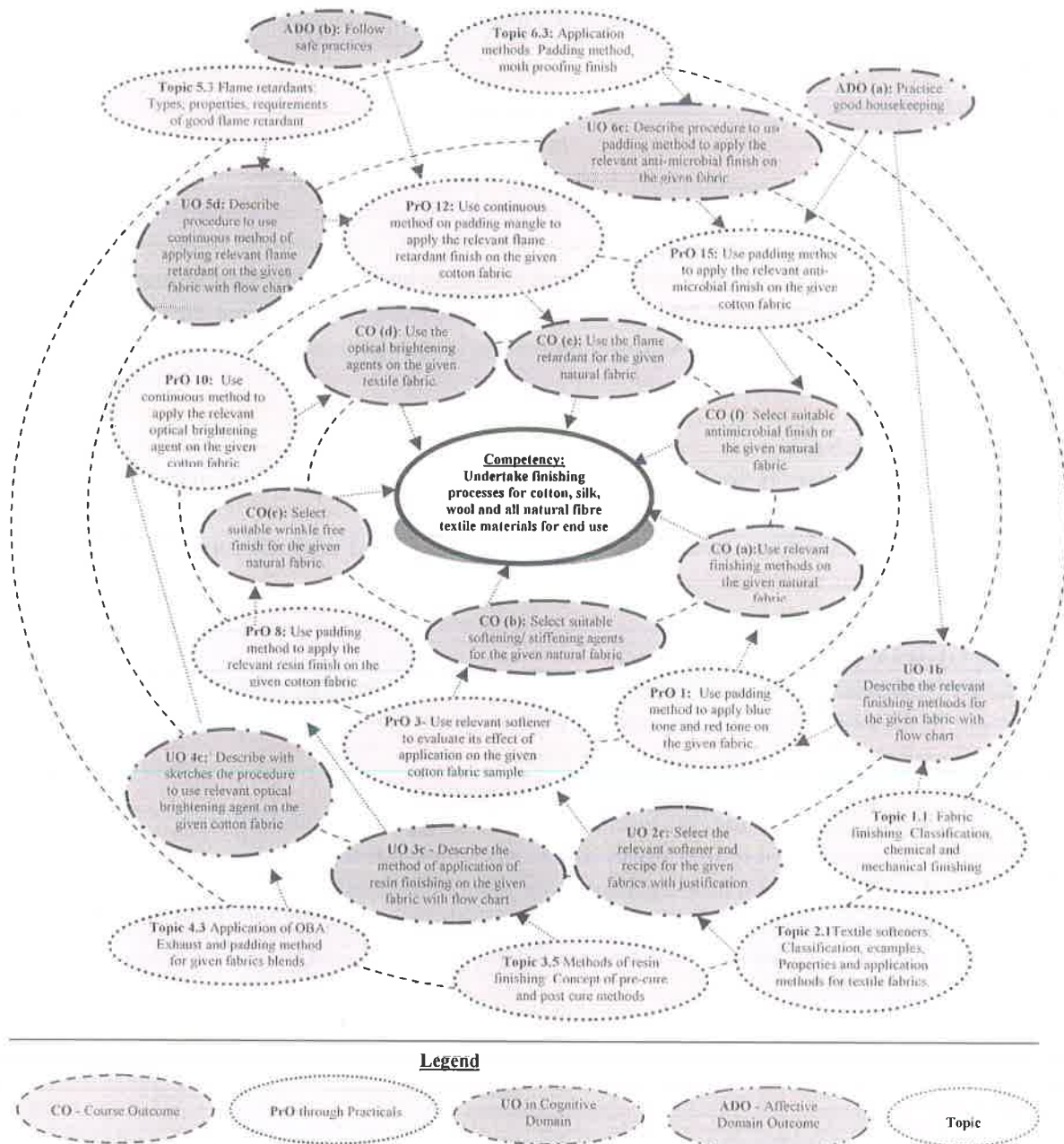
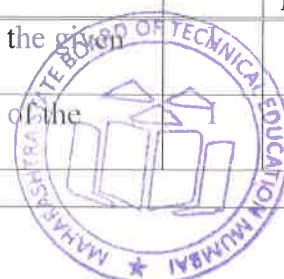


Figure 1 - Course Map

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 padding method to apply blue tone and red tone on the given fabric.		02*
2	Determine percentage expression and total finish liquor of the padding mangle for the given fabric samples.		02*

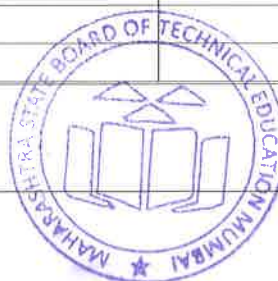


S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
3	Use relevant softener to evaluate its effect of application on the given cotton fabric sample.	II	02*
4	Use relevant softener to evaluate its effect of application on the given blend fabric sample.	II	02*
5	Use relevant softener to evaluate its effect of application on the given wool and silk fabric sample.	II	02*
6	Use padding method to apply the soft medium and stiff finish on the given cotton fabric.	II	02*
7	Use padding method to apply the stiff finish on the given blend fabric.	II	02
8	Use padding method to apply the relevant resin finish on the given cotton fabric.	III	02*
9	Apply scroopy finish on the given silk fabric.	III	02*
10	Use continuous method to apply the relevant optical brightening agent on the given cotton fabric.	IV	02*
11	Use exhaust method to apply the relevant optical brightening agent on the given cotton fabric.	IV	02*
12	Use continuous method on padding mangle to apply the relevant flame retardant finish on the given cotton fabric.	V	02*
13	Use continuous method to apply and evaluate the relevant flame retardant finish on the given blend fabric sample.	V	02
14	Use flame retardant finish to evaluate its efficiency on the given cotton fabric.	V	02*
15	Use padding method to apply the relevant anti-microbial finish on the given cotton fabric.	VI	02*
16	Apply moth proofing finish on the given wool fabric.	VI	02
Total			32

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 24 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 %
1	Selection of suitable component, apparatus/instrument	20
2	Preparation of experimental set up	10
3	Setting and operation	10
4	Safety measures	10
5	Observations and Recording	10
6	Interpretation of result and Conclusion	20
7	Answer to sample questions	10
8	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:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- 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
- 'Organising Level' in 2nd year and
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

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.

S. No.	Equipment Name with Broad Specifications	PrO. No.
1.	Laboratory Padding mangle machine-two bowl vertical or horizontal machine with safety measures. Automatic or manual machine, able to fabric sample piece finishing	All
2.	Lab Curing chamber-Temperature up to 200 deg, able to cure lab sample, continuous machine	
3.	Dryer-temperature range upto-300 deg, lab sample drying	
4.	Beakers (glass)-100 ml, 500 ml, 1 liter, glass rod-20 cm length	
5.	Weighing balance- 2 or 3 digit weighing balance	
6.	Water bath –capacity of 10 pot to 20 pots	
7.	Iron—for ironing of treated fabrics sample, ironing table with cloth	
8.	Measuring cylinder. capacity-10 ml,100ml,1000ml.	

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 Fabric finishing Techniques	1a. Explain the importance of finishing of the given textile fabrics. 1b. Describe with sketches the relevant finishing methods for the given fabric with flow chart. 1c. Calculate percentage expression, and weight pickup, total finish liquor for the given fabric. 1d. Identify different parts in the given finishing machine figure.	1.1 Fabric finishing: Classification. chemical and mechanical finishing 1.2 Chemical finishing: Exhaust and padding methods, Percentage expression and weight pickup 1.3 Mechanical Finishing: Construction and working of finishing machines

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	1e. Explain the application of finishing machine for the given fabric. 1f. Compare the salient feature of the given two finishing machines.	calendaring, sueding, stenter and sanforizing. 1.4 Finishing machines: Advantages and limitations of.
Unit-II Fabric Softening and Stiffening.	2a. Explain the importance of softening for the given textile fabrics 2b. Describe with sketches the specified application methods of softener for the given fabric. 2c. Select the relevant softener and recipe for the given fabric with justification. 2d. Explain the importance of stiffening for the given fabric. 2e. Select the relevant stiffener and suitable recipe for the given fabric with justification.	2.1 Textile softeners: Classification, (cationic, anionic, non-ionic, silicon emulsion, and reactive softeners), examples, Properties and application methods for textile fabrics. 2.2 Softener formulations: For various fabrics and their blends 2.3 Softener applications: For various fabrics 2.4 Textile stiffeners: Classification, examples, properties and application on various fabrics.
Unit- III Resin Finishing.	3a. Explain the importance and mechanism of resin finishing for the given textile fabric with sketches. 3b. Select the relevant resin formulation for the given fabric with justification. 3c. Describe with sketches the method of application of resin finishing on the given fabric with flow chart. 3d. Describe with sketches the evaluation method for the resin finishing for the given textile fabric.	3.1 Resins for textiles: types, characteristics, advantages, limitations 3.2 Resin finishing: Concept, crease formation and resin finishing Mechanism, Method of application 3.3 Catalyst: classification, role, mechanism 3.4 Formulations of resin finishing: For 100% Cotton garments, 100% cotton shirting, 100% cotton suiting, Concept of anti-crease, wash n wear, durable press. 3.5 Methods of resin finishing: Concept of pre-cure and post cure methods. 3.6 Limitations of resin finishing: Eco-friendly resin finishing for textile fabrics. 3.7 Evaluation-Crease recovery angle method.
Unit-IV Optical brightening	4a. Explain the importance and mechanism of optical brightening of the given fabric. 4b. Select the optical brightening agent for the given fabric with justification. 4c. Describe with sketches the procedure to use relevant optical	4.1 Optical brightening agent: Importance, Chemistry, mechanism 4.2 Optical brightening agent: Types, properties 4.3 Application of OBA: Exhaust and padding method for given fabrics.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	brightening agent on the given cotton fabric. 4d. Describe with sketches the process of evaluation of the given fabric.	4.4 Evaluation: OBA samples for the given fabrics, Stripping of OBA
Unit –V Flame Retardant finishing	5a. Explain the importance of flame retardant finishing for the given fabrics. 5b. Explain Limiting Oxygen Index with respect to flame retardant finishing of the given fabric. 5c. Select relevant flame retardant for the given fabrics with justification. 5d. Describe with sketches procedure to use continuous method of applying relevant flame retardant on the given fabric with flow chart. 5e. Describe with sketches the procedure to evaluate the efficiency of the given flame retardant finish on the given fabric/ blend.	5.1 Flame retardant Finishing: Concept, importance, Burning cycle and thermal behaviour of textile fibre, concept of flame proof and flame retardant 5.2 Flame retardancy: Concept, Mechanism, factors affecting flame retardancy, continuous method of applying flame retardant on different fabrics. 5.3 Flame retardants: Types, properties, requirements of good flame retardant. 5.4 Limiting Oxygen Index: Concept, significance in flame retardancy and combustion. 5.5 Evaluation methods: Angular method, vertical method.
Unit -6 Anti-microbial Finishing	6a. Explain the importance of antimicrobial finishing for the given textile fabrics. 6b. Select relevant anti-microbial finish based on its properties for the given fabrics with justification. 6c. Describe with sketches procedure to use padding method to apply the relevant anti-microbial finish on the given fabric. 6d. Describe relevant evaluation method for the given antimicrobial treated fabric.	6.1 Antimicrobial finishing: concept, desirable properties of good antimicrobial finish 6.2 Anti-microbial finishes: Types, properties, herbal antimicrobial finishes for fabrics. 6.3 Application methods: Padding method, moth proofing finish. 6.4 Evaluation methods for anti-microbial treated fabrics.

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 Finishing Techniques	09	02	04	06	12
II	Fabric Softening and Stiffening	07	02	04	04	10
III	Resin Finishing	12	04	06	06	16
IV	Optical Brightening	04	02	02	04	08
V	Flame Retardant Finishing	10	04	06	06	16
VI	Antimicrobial Finishing	06	02	02	04	08

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
Total		48	16	24	30	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:

- Survey market for different fabrics and compare them based on their properties, applications, and prices.
- Library/ internet survey regarding fabrics treated with various finishes used in different industries.
- Prepare table for different chemicals used in fabric finishing of cotton and various natural fabrics and their effects.
- Prepare presentation incorporating visuals, photographs, animations, video on process sequence of finishing natural fibres.
- Collect information from the natural fibre process house about the faults in finishing of natural fibres and relevant remedies.
- Collect information on safety precautions of various chemicals and machinery used in the process house.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- '**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.
- 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).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- Guide student(s) in undertaking micro-projects.
- Encourage students to refer different websites to have deeper understanding of the subject.
- Assign unit wise assignments to group of 4 to 5 students for solving unit wise questions.
- Use of video, animation films to explain concepts, facts and applications related to finishing of natural fibres.

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:

- Chart preparation:** Visit to local industry and prepare a chart of various machine part and write their working principles.
- Ready cloth sample:-** Visit industries, market shops to collect at least 20 fabric samples of various dimensions. Find the current price and end use of these collected samples, present the results.
- Unfinished and finished samples:** Collect different unfinished and finished samples and check the difference with respect to finishing, faults. Present the results.
- Softeners and stiffener samples:** Visit nearby industries and collect various softener and stiffener samples, test them in the lab and present their results.
- Resin samples:** collect samples of resins from industries and make the comparative chart of their properties and applications
- Optical brightening agents and their effect:** Collect OBA samples from the industries, evaluate the effect of these OBA samples under ultra violet light on various fabrics. Write report.
- Fabric Handle:** Evaluate the effect of every stage of chemical finishing such as softening, stiffening, and resin finishing on fabric samples. Present the findings.
- Herbal finishes:** Collect herbal finishes from the industries and see their effects on cotton fabric

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	Chemical processing of synthetic and its blends	Datya .K.V.; Vaidya .A.A	A Wiley Inter Science Publication, 1984; ISBN-0901956740
2.	Technology of finishing Vol. 10	Shenai V.A.	Sevak Publication, Mumbai, 1990
3.	Introduction to textile finishing	Marsh J.T.	Springer US, 1966, ISBN- 9781504127936
4.	Chemical after treatments of textiles	Marks, Atlas; Wooding	A Wiley Inter Science Publication, 1971, ISBN-9781563675164
5.	Silk Dyeing, Printing and Finishing	Gulrajani M. L.	Department of Textile Technology, IIT Delhi-1998
6.	Hand book of Textile Testing and Quality Control	Grover, E. B; Hamby, D. S.	Wiley India Pvt. Ltd, New Delhi, 2011, ISBN: 9788126531752
7.	Silk Dyeing, Printing and Finishing	Hurst, George; Henry	Rarebooksclub.com, 2012 ISBN-9781130986525

S. No.	Title of Book	Author	Publication
8.	A Practical Guide to Textile Testing	Amutha K.	Wood Head Publishing, New Delhi, 2016, ISBN: 9789385059070
9.	Environmental Studies	Basak Anindita	Pearson Education India, 2010 ISBN: 9788131785683
10.	Textile Finishing	Heywood D.	Society of Dyers and Colourists Publications, 2003 ISBN- 9780901956811

14. SUGGESTED SOFTWARE/ LEARNING WEBSITES

- a. textilelearner.blogspot.in/2011/03/description-of-textile-finishing_1796.html
- b. textilelearner.blogspot.in/2012/03/textile-softening-fabric-softening.html
- c. www.onlineclothingstudy.com/2015/11/mechanical-finishes-textiles.html
- d. textileapex.blogspot.in/2015/03/resin-finishing-importance.html
- e. textilelearner.blogspot.in/2011/05/description-of-optical-brightening_4142.html
- f. www.teonline.com/knowledge-centre/flame-retardants.html
- g. www.technicaltextile.net/articles/protective-clothing/detail.aspx?article_id=2686
- h. www.technicaltextile.net/articles/raw-material/detail.aspx?article_id=2600
- i. www.fibre2fashion.com/industry-article/1240/antimicrobial-finishes



