Program Name : **Diploma in Textile Technology**

Program Code : **TC**

Semester : **Fifth**

Course Title : **Garment Processing**

Course Code : **22579**

1. RATIONALE

In textile industry, varieties of garment undergo various chemical processes. The chemical processing of garments is a value addition process by way of increasing aesthetic properties through relevant processes. To achieve the high quality of garments, the diploma engineers must have adequate knowledge and skills related to garment processing machines, relevant finishing methods, garment printing techniques, fabric care treatments, etc. This course deals with the processing of denims and other ready-made garments which will facilitate the diploma engineers to apply the knowledge and skills related to garment processing to process garments and reproduce desired effects and finishes. It will also help the diploma engineers to analyze and rectify broad based problems in the garment processing industry.

2. COMPETENCY

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

- **Apply principles of wet processing in garment processing.**

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:

a) Use relevant production process sequence for garments.
b) Create different washing effects on denims and non-denims.
c) Use relevant methods and machines for dyeing garments.
d) Use relevant methods and machines for printing garments.
e) Use relevant type/s of finishes for finishing garments.
f) Select relevant stain removing and dry-cleaning treatment for garments.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
				Theory							Practical					
L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	4	7	3	70	28	30*	00	100	40	50@	20	50	20	100	40

(*): 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.

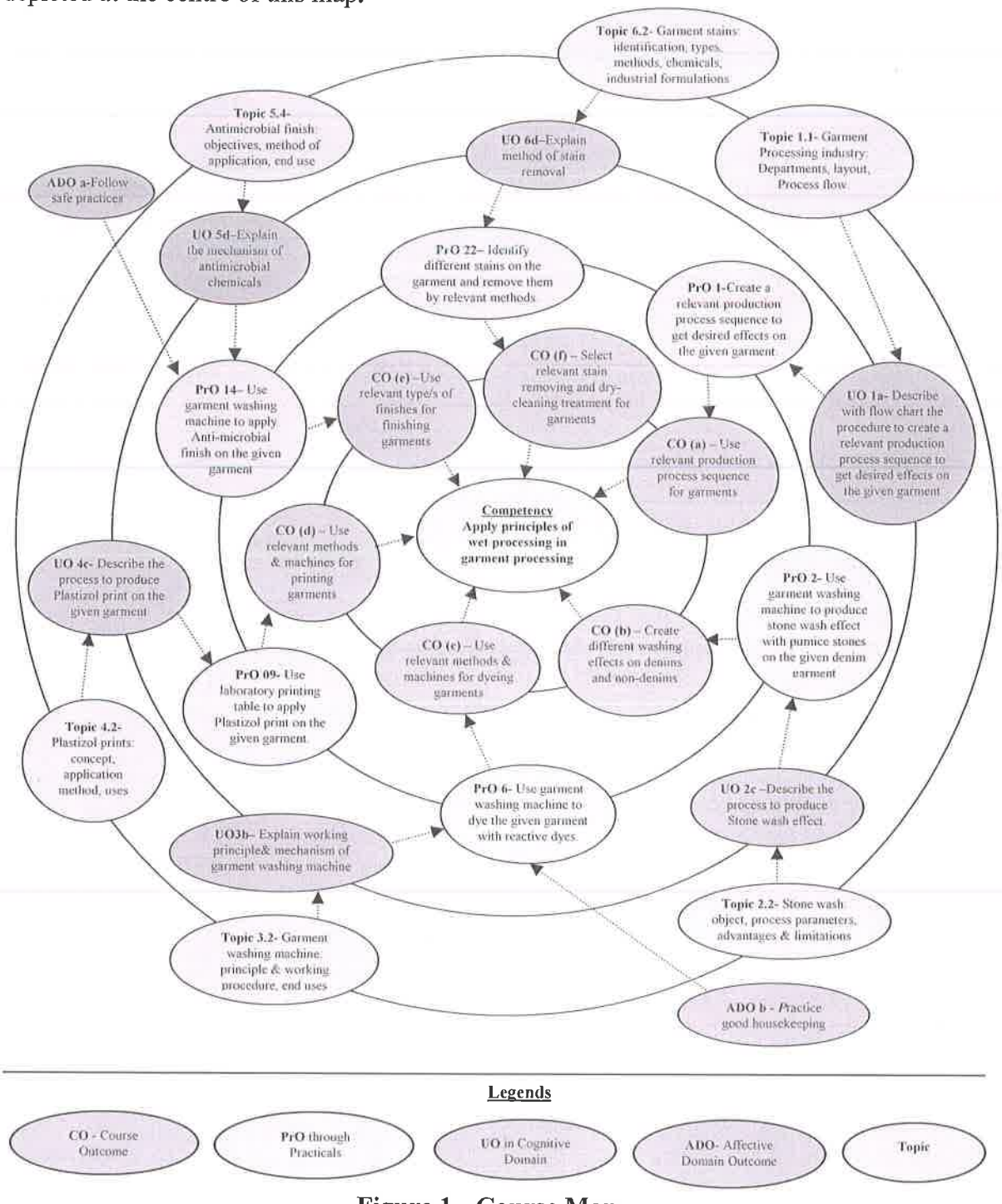

Figure 1 - Course Map

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	Create a relevant production process sequence to get desired effects on the given garment.	I	02*
2	Use garment washing machine to produce stone wash effect with pumice stones on the given denim garment.	II	02*
3	Use spray technique to produce acid wash effect on the given denim garment.	II	02
4	Use garment washing machine to produce enzyme wash effect on the given garment.	II	02*
5	Use sand papers to produce whiskering effect on the given denim garment.	II	02*
6	Use garment washing machine to dye the given garment with reactive dyes.	III	02*
7	Use garment washing machine to dye the given garment with pigment.	III	02*
8	Use laboratory printing table to apply Pigment print on the given garment.	IV	02*
9	Use laboratory printing table to apply Plastizol print on the given garment.	IV	02*
10	Use laboratory printing table to apply Flock print on the given garment.	IV	02*
11	Use laboratory printing table to apply Transfer print on the given garment.	IV	02*
12	Use laboratory printing table to apply Metallic print on the given garment.	IV	02*
13	Use table screen printing to apply puff print on the given garment	IV	02
14	Use garment washing machine to apply Anti-microbial finish on the given garment.	V	04*
15	Use garment washing machine to apply Water repellant finish on the given garment.	V	02*
16	Use garment washing machine to apply Bio polishing treatment on the given garment.	V	02*
17	Use garment washing machine to apply Soft finish on the given garment-Part I	V	02*
18	Use garment washing machine to apply Soft finish on the given garment-Part II	V	02*
19	Use garment washing machine to apply Soil release finish on the given garment.	V	04
20	Evaluate the shrinkage of the given garment after bio polishing.	V	02
21	Evaluate the color difference of the given garment after bio polishing.	V	02*
22	Use laboratory curing chamber to create wash n wear finish on the given garment. Part -1	V	02*
23	Use laboratory curing chamber to create wash n wear finish on the given garment. Part -II	V	02*
24	Use laboratory padding mangle to apply UV protective finish on the given garment sample. Part-1	V	02*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
25	Use laboratory padding mangle to apply UV protective finish on the given garment sample. Part-1I	V	02
26	Use curing range to produce durable press finish on the given garment sample	V	04*
27	Identify different stains on the garment and remove them by relevant methods.	VI	02*
28	Select relevant care labels for the given garment.	VI	02*
	Total		62

Note

A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial 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.*

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.	Preparation of experimental set up	20
2.	Setting and operation	20
3.	Safety measures	10
4.	Observations and Recording	10
5.	Interpretation of result and Conclusion	20
6.	Answer to sample questions	10
7.	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.
e) 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	Dye Pots: 250 ml, 500 ml	6,7
2	Glass rod: 15cm, Diameter 0.5 cm	All
3	Beaker: 50 ml, 100 ml, 150 ml, 200 ml, 500 ml, 1000 ml	All
4	Measuring cylinder of capacity 10 ml, 25 ml, 100 ml and 1 lit	All
5	Bunsen burner: 12x5x8 cm	all
6	Pipette: 1 ml, 10 ml, 25 ml	all
7	Electric drier: 230V, 200W	2,3,4,5,6,7
8	Electric Iron: 230 V, 1000W	11
9	Wooden Screen 10"x10"	8to 12,27
10	Rubber Squeeze: 8" width, 0.5 - 1cm thick,	8to 12,27
11	Laboratory Printing table: 90 x 60 cm and 75 cm Height	8to 12,27
12	Laboratory Stirrer: High Speed Mechanical Stirrer- 300 to 500 rpm	8to 12,27
13	Laboratory Drying, Curing and setting Chamber: temperature up to 220^0C, working width- 450 mm, length 1.7-meter, heater capacity- 8/16/24 kilo-watt.	13 to 20, 23to 25,28
14	Laboratory Padding Mangle: Horizontal (60-80% Expression)	13 to 18,23 to 25,28
15	Plastic Mug: 0.5, 1 and 2 lit capacity	all
16	Digital Weighing balance: 0.02 gm accuracy (300 gm)	all
17	Laboratory laundrometer: 5kg capacity	13 to 18
18	Laboratory garment dyeing machine (capacity-2kg load)	2,3,4,5,6,7
19	Sand papers (grain size-14mm)	5
20	Pumice stones	2
21	Computer colour matching system	20
22	Spray bottle (250 ml)	3
23	Plastic and metal tray	23,24

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 Introduction to Garment Processing	1a. Describe with flowchart the procedure to create a relevant production process sequence to get desired effects on the given garment. 1b. Select garment processing plan for the given garment according to its properties and end use with justification. 1c. Formulate relevant	1.1 Garment Processing industry: Departments lay out, Process flow. 1.2 Importance of Garment processing: Concepts of garment stage and pre-garment stage processing, difference between fabric and garment processing, advantages and limitations. 1.3 Fiber properties: suitability for garment construction, seam strength, shrinkage. 1.4 Major issues related to garment processing: reproducibility, batch to batch variations, processing faults, ecological

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	processing method for reproducibility of the desired effect on the given garment with minimum faults. 1d. Explain relevant ecological issues related to the processing of the given garment with justification.	factors, skilled labor.
Unit– II Denims and non-Denim Washes and its machineries	2a. Describe with sketches process sequences of the given denim fabric. 2b. Describe with sketches the process to produce the specified effect. 2c. Classify the washes on the basis of the given parameters 2d. State the objectives of the given type of was.	2.1 Denim washes: process sequence, Advantages and limitations of all washing treatments 2.2 Stone wash: objectives, process parameters, advantages and limitations 2.3 Acid wash: objectives, process parameters, applications 2.4 Sand blasting: objectives, process parameters, applications 2.5 Laser fading: Sand blasting: objectives, process parameters, applications 2.6 Stone less stone washes: objectives, process parameters, applications – Mud wash, Chalk wash, Enzyme wash, ion wash.
Unit-III Garment Dyeing and its machineries	3a. Explain with sketches the working principle and mechanism of the specified garment washing machine. 3b. List uses of given type of dryer. 3c. Explain with sketches the working of the given type of machine. 3d. Compare the features of the given two types of machines	3.1 Garment Dyeing machine: principle and working mechanism, types. 3.2 Garment washing machine: principle and working procedure, end uses 3.3 Tumble dryer: principle and working procedure, end uses 3.4 spray booth systems: principle working procedure and end uses 3.5 Hydro extractor: principle and working procedure, application 3.6 Tumble dryer: principle and working procedure, application. 3.7 RF drier: principle and working procedure, application. 3.8 Pressing and fusing machines: objectives, working principle and end uses
Unit –IV Garment Printing and its machineries	4a. Identify the given types of garment prints. 4b. Describe with sketches the process to produce the specified type of print on the given type of garment 4c. Describe the method of	4.1 Flock Printing: concept, application method, uses 4.2 Plastizol prints: concept, application method, uses 4.3 Metallic prints: concept, application method, uses 4.4 Foil prints: concept, application method, uses

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	puff printing on the given type of garment. 4d. Explain the concept of the specified digital print and its features.	4.5 Pearl prints: concept, application method, uses 4.6 High Density prints: concept, application method, uses 4.7 Khadi prints: concept, application method, uses 4.8 Photochromic prints: concept, application method, uses 4.9 Puff printing: concept, application method, uses 4.10 Digital printing: concept, application method, uses
Unit-V Garment Finishing	5a. Choose relevant machine used for the specified finishing process with justification 5b. Explain with sketches the mechanism of given type of antimicrobial chemicals. 5c. Compare the features of the given two types of garment finshes. 5d. Explain with sketches the given method of garment finishing.	5.1 Garment finishing methods: exhaustion, padding, spraying 5.2 Wash n Wear finish: objectives, method of application, end uses 5.3 water repellent finish: objectives, method of application, end uses 5.4 Antimicrobial finish: objectives, method of application, end use. 5.5 UV protection finish: objectives, method of application end uses 5.6 Fragrance finish: objectives, method of application end uses 5.7 Moisture management finish: objectives, method of application end uses
Unit-VI Garment care treatments	6a. Identify given types of labels and their application 6b. Identify the given type of stains and their removal method with justification 6c. Explain the given method of stain removal 6d. List the properties of the given chemicals used in dry cleaning	6.1 Garment labels: objects, importance, types of labels and symbols used advantages. 6.2 Garment stains: identification, types, methods, chemicals, industrial formulations 6.3 Dry cleaning: Object Chemicals and solvents.

***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'*

8. 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 to Garment Processing	06	04	04	02	10
II	Denims and non-Denim Washes and its machineries	10	03	05	07	15

III	Garment Dyeing and its machineries	08	03	04	06	13
IV	Garment Printing and its machineries	08	02	04	06	12
V	Garment Finishing	08	02	02	06	10
VI	Garment care treatments	08	02	03	05	10
Total		**48**	**16**	**22**	**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.*

9. 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 any garment processing unit nearby and take the help of in-charge to know the activities going on.
b) Write report of the visit, prepare lay out of the garment processing unit.
c) Do internet survey to find out new developments in garment processing.
d) Guide student(s) in undertaking micro-projects.
e) Prepare power point presentation on different garment printing techniques.
f) Analyze the colour fastness of various dyed garment samples.
g) Prepare process flow charts for garment finishing.
h) Collect samples of different garment printing techniques.

10. 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) Demonstrate students thoroughly before they start doing the practice.
g) Encourage students to refer different websites to have deeper understanding of the subject.
h) Observe continuously and monitor the performance of students in Lab

11. 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.

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

a) **Scope and future of Garment Industry:** Collect information/ data from various sources for the last 15 years and analyse the fashion trends in the garment Industry in domestic as well as international market. Present your observations, findings and thus project the future of the Industry.

b) **Classify various Denim washes:** Visit denim/ garment washing units and collect at least 50 samples of various types of denim washes. Classify them according to types and present the results.

c) **Comparison of conventional and digital printing of garments:** Collect information from various sources to prepare a comparative chart related to type of machine, machine cost, operational cost, dyes and chemicals needed for garment printing. Present the results.

d) **Short film on working of machine:** Visit different garment processing industries. Observe the working operations of machines at various stages and capture video clips. Edit the video clips as per specified process sequence and make a short film. Present the short film.

e) **Collection of care label samples:** Visit garment processing/ manufacturing units and collect at least 30 samples of various care labels. Classify them according to types and present the results.

12. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	Fabric care	Noemia, Dsouza	New Age International Publishers, New Delhi,1998, ISBN: 9788122411430
2.	Denim: manufacture, finishing and applications	Paul, R	Wood-Head Publishing, Swaston, Cambridge, 2015; ISBN: 9780857098436
3.	Textile printing	Miles, L.W.C	Society of Dyers and Colorists, UK, 1981 ISBN: 9780901956330
4.	Introduction to textile finishing	Marsh, J. T.	Chapman and Hall publications, U. K1966 ISBN: 9781114790087
5.	Chemical finishing of textiles	Schindler, W D; Hauser, P J	Wood-Head Publishing, Swaston, U.K. Cambridge, 2004, ISBN: 9781855739055
6.	Functional finishes for textiles	Paul, R	Wood-Head Publishing, Swaston, U.K Cambridge, 2014 ISBN: 9780857098399
7.	Encyclopedia of garment printing	Freshner, Scott	US Screen print industries, 1986 ISBN: 9780933493001

13. SOFTWARE/LEARNING WEBSITES

a) www.fibre2fashion.com/industry-article/1265/garment-processing?page=1
b) www.slideshare.net/sunnyvikasmalhotra/types-of-denim-washing
c) www.slideshare.net/prabukrishnaa/garment-dyeing-techniques
d) www.slideshare.net/sivajagadish/garment-printing
e) textilelearner.blogspot.in/2011/03/description-of-textile-finishing_1796.html
f) nptel.ac.in/courses/116102014/12
g) www.ni.com/multisim
h) www.onlineclothingstudy.com/2015/11/mechanical-finishes-textiles.html
i) www.slideshare.net/Tesfaywasee/chemical-finishing-of-textiles
j) www.researchgate.net/publication/259912687_Chemical_Finishing_of_Textile
k) www.fibre2fashion.com/industry-article/6939/care-labeling-in-apparels-and-textiles