

Program Name : Diploma in Textile Manufacturers
Program Code : TX
Semester : Fourth
Course Title : Fabric Structure Design
Course Code : 22464

1. RATIONALE

Diploma engineers are supposed to analyse and understand the fabric structure of different types of woven samples and then should be able to plan methods for production of desired fabric on loom using appropriate techniques. This course contains basic concepts and principles of fabric structure and hence study of this course is very important for students so that they can design and plan production of good quality fabric. It is therefore a key course for textile engineering students.

2. COMPETENCY

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

- Develop different fabric structure by applying principles of interlacement.

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:

- Develop different drafts and peg plans for given designs applying basic concepts of fabric structures.
- Develop relevant derivatives of plain weave.
- Construct relevant derivatives of twill weave.
- Create different designs by using principle of sateen weave.
- Compose different design by using colour and weave effect principle.
- Develop innovative fabric designs by using fancy structure.

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	
2	2	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 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.

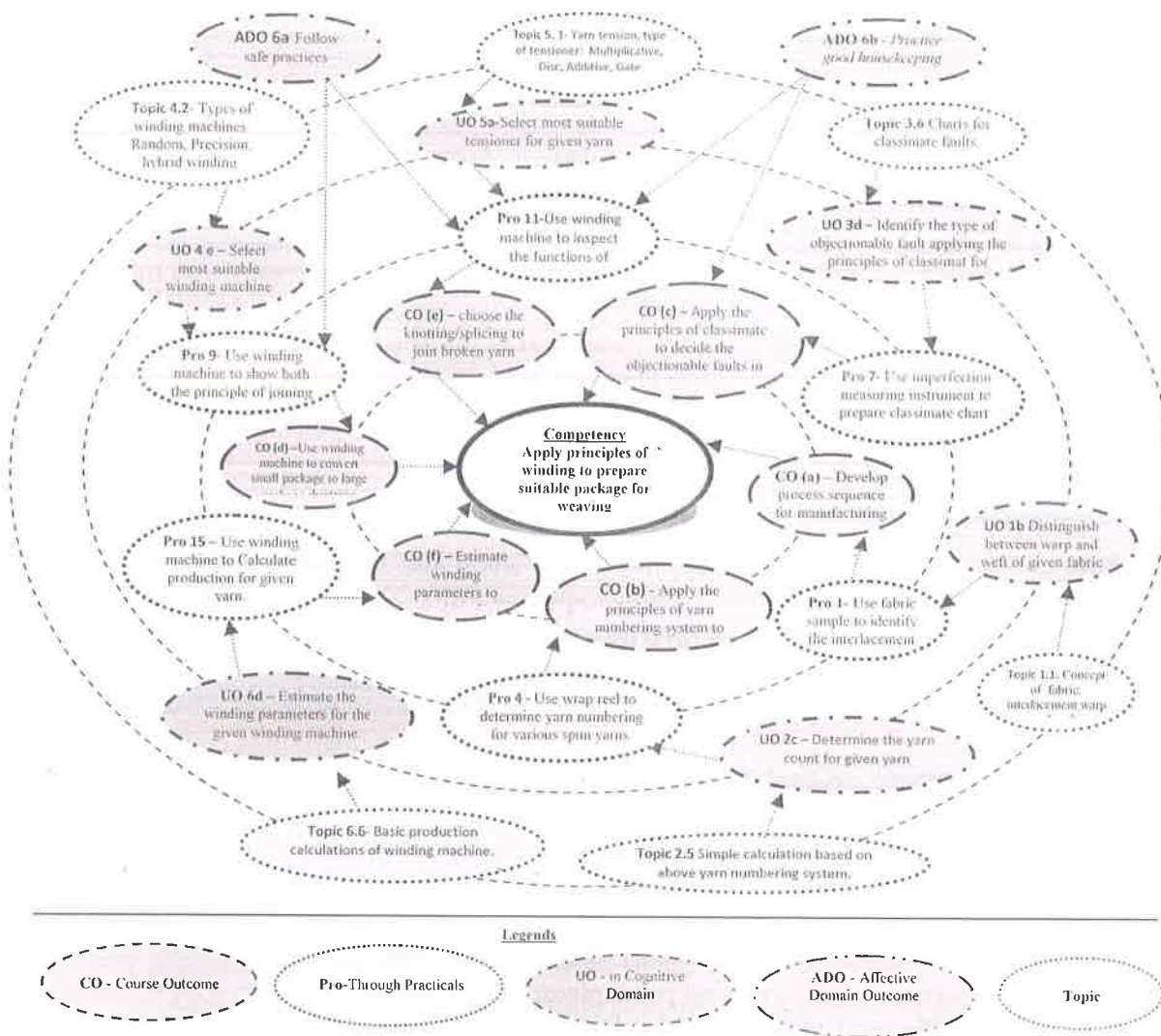


Figure 1 - Course Map

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 Counting glass to : (i) Identify the interlacement of warp and weft. (ii) Identify and Mark warp and weft direction. (iii) Find ends per Inch and Picks Per Inch	I	02*
2	Use analysis tool kit to analyze the plain weave :(Part I) (i) Estimate the EPI, PPI, warp/weft- count, colour pattern, twist direction of plain weave fabric. (ii) Calculate cover factor, reed count, weight per unit area	II	02*
3	Use counting glass to analyze the plain weave :(Part II) (i) Represent the design on point paper. (ii) Draw draft, peg plan and denting order		02



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
4	Use analysis tool kit to Analyze the warp/weft rib weave sample to: (i) Estimate the EPI, PPI, warp/weft- count, colour pattern, twist direction. (ii) Calculate cover factor, reed count, weight per unit area. (iii) Represent the design, draft, peg plan and denting order on point paper.	II	02*
5	Use analysis tool kit to Analyze the Matt Rib weave sample to: (i) Estimate the EPI, PPI, warp/weft- count, colour pattern, twist direction. (ii) Calculate cover factor, reed count, weight per unit area. (iii) Represent the design, draft, peg plan and denting order on point paper.	II	02*
6	Use analysis tool kit to Analyze the basic twill weave sample to: (i) Estimate the EPI, PPI, warp/weft- count, colour pattern, twist direction. (ii) Calculate cover factor, reed count, weight per unit area. (iii) Represent the design, draft, peg plan and denting order on point paper.	III	02*
7	Use analysis tool kit to Analyze the herring bone twill weave sample to: (i) Estimate the EPI, PPI, warp/weft- count, colour pattern, twist direction. (ii) Calculate cover factor, reed count, weight per unit area. (iii) Represent the design, draft, peg plan and denting order on point paper.	III	02*
8	Use analysis tool kit to Analyze the pointed twill weave sample to: (i) Estimate the EPI, PPI, warp/weft- count, colour pattern, twist direction. (ii) Calculate cover factor, reed count, weight per unit area. (iii) Represent the design, draft, peg plan and denting order on point paper	III	02
9	Use analysis tool kit to Analyze the satin and sateen weave sample to: (i) Estimate the EPI, PPI, warp/weft- count, colour pattern, twist direction. (ii) Calculate cover factor, reed count, weight per unit area. (iii) Represent the design, draft, peg plan and denting order on point paper.	IV	02*
10	Use sample loom to develop colour and weave effect sample by given ratio of warp/weft colour pattern.	V	02
11	Use analysis tool kit to analyze the crepe weave sample to: (i) Estimate the EPI, PPI, warp/weft- count, colour pattern twist direction. (ii) Calculate cover factor, reed count, weight per unit area. (iii) Represent the design, draft, peg plan and denting order on point paper.	VI	02*



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
12	Use analysis tool kit to Analyze the honey comb weave sample to (i) Estimate the EPI, PPI, warp/weft- count, colour pattern, twist direction. (ii) Calculate cover factor, reed count, weight per unit area. (iii) Represent the design, draft, peg plan and denting order on point paper	VI	02*
13	Use analysis tool kit to Analyze the Brighton honey comb weave sample to: (i) Estimate the EPI, PPI, warp/weft- count, colour pattern, twist direction. (ii) Calculate cover factor, reed count, weight per unit area. (iii) Represent the design, draft, peg plan and denting order on point paper	VI	02
14	Use analysis tool kit to Analyze the huck a back weave sample to: (i) Estimate the EPI, PPI, warp/weft- count, colour pattern, twist direction. (ii) Calculate cover factor, reed count, weight per unit area. (iii) Represent the design, draft, peg plan and denting order on point paper	VI	02
15	Use analysis tool kit to Analyze the mock leno weave sample to: (i) Estimate the EPI, PPI, warp/weft- count, colour pattern, twist direction. (ii) Calculate cover factor, reed count, weight per unit area. (iii) Represent the design, draft, peg plan and denting order on point paper	VI	02*
16	Use analysis tool kit to Analyze the combination weave sample to (i) Estimate the EPI, PPI, warp/weft- count, colour pattern, twist direction. (ii) Calculate cover factor, reed count, weight per unit area. (iii) Represent the design, draft, peg plan and denting order on point paper	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 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 %
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:

- 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 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	Reflex type 1 inch counting glass, Needle, 12 inch steel ruler, Beesley's balance,	All Exp
2	Plain weave fabric sample with 50 EPI X 20 PPI and 70 EPI X 50 PPI.	2,3
3	Warp/weft/matt rib samples with 60EPI X 52 PPI	4,5,6
4	Brighton /ordinary honey comb samples with 50 EPI X 50PPI	9,10,11, 15
5	Huck-A-Back Sample	7,8

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 Fundamentals of Fabric Structure	1a. Draw interlacement diagram of the given design. 1b. Represent the given fabric design by the relevant method. 1c. Define the design, draft, peg plan and weave repeat for the given fabric. 1d. Select relevant draft for the given design with	1.1 Interlacement of warp & weft, Method of fabric representation on point paper 1.2 Concept of weave/design, weave repeat, draft, denting order and lifting plan. 1.3 Type of drafts – Straight draft, Skip draft, pointed draft, sateen draft, transposed, curved & combing drafts. 1.4 Relation between design, draft &

Unit	Unit Outcomes (UOs) (in cognitive domain))	Topics and Sub-topics
	justification. 1e. Justify the relationship between draft and peg plan for the given design with sketches.	lifting plan.
Unit– II Plain Weave and derivatives	2a. Draw design, draft, and peg plan for the given weave. 2b. Classify the given weaves into different categories of plain weave. 2c. Describe the characteristics features of the given weave. 2d. Create the design by using given fabric weave repeat. 2e. Develop the rib effect by using the warp and weft rib weaves. 2f. Develop fabric samples of plain weave using different ornamentation techniques.	2.2 Interlacing Diagram, Design, draft, lifting plan and denting order of plain weave. 2.3 Characteristic feature of plain woven fabric. 2.4 Cross – sectional views of plain weave. 2.5 Rib & cord effects produced in plain weave 2.6 Derivatives -Warp Rib weaves, Weft Rib weaves, Hopsack, Mat or Basket weaves. 2.7 Ornamentation of Plain weave- by changing colour, count, twist direction, twist level, tension and finishing techniques.
Unit – III Twill weave and derivatives	3a. Draw the design of twill weave by using the given weave repeat. 3b. Classify the given weave into different categories of twill weave. 3c. Develop design of balanced/unbalanced twill weave using the given repeat. 3d. Develop designs, drafts, peg plans for the given derivatives of twill weave. 3e. Differentiate between weaves and fabrics for the given derivatives of twill weave.	3.1 Design of Basic Twills, Characteristic feature of twill woven fabric, Classification of basic twills. 3.2 Balanced twill-Design, draft, denting order & lifting plan 3.3 Unbalanced twill- Warp and weft faced twill, Design, draft, denting order & lifting plan with cross section. 3.4 Derivatives of Twill weave- Design, draft, denting order & lifting plan of following twills: Pointed twill, Waved twill, Broken twill, Herring bone, Transposed or Rearranged twill, Curved twill, Elongated twill, Combinations of twill weaves
Unit– IV Satin/Sateen weaves and derivatives	4a. Describe with features the given weaves 4b. Select the suitable move number for the given weave repeat to construct satin weave. 4c. Draw the design, draft, peg plan for the given satin weave.	4.1 Characteristic feature of satin & sateen woven fabrics, Interlacement diagram, Concept of move number. 4.2 Development of regular satin weave, Draft, denting order & lifting plan, interlacing diagram of regular satin. 4.3 Development of irregular satin weave, Draft, denting order & lifting plan, Interlacing diagram of regular satin irregular satin weave 4.4 Development of satin stripes and



Unit	Unit Outcomes (UOs) (in cognitive domain))	Topics and Sub-topics
		checks and combination.
Unit– V Simple Colour & Weave effect	5a. Describe the principle of colour and weave effect. 5b. Classify the colour and weave effect for given situation. 5c. Create the relevant colour and weave effect by using the given colour pattern.	5.1 Concept and classification of colour and weave effect 5.2 Representation of colour and weave effect on design paper. 5.3 Examples of simple colour and weave effect: Continuous line effect, Hound's tooth patterns. Bird's eye and spot effects, Hairlines, Step patterns. All over effects
Unit –VI Fancy Fabric Structures	6a. Describe the features of the given type of fancy weave. 6b. Draw the design, draft, peg plan for given type of fancy weave. 6c. Classify the given crepe weave based on construction factors. 6d. Distinguish between given types of honey comb structures. 6e. Develop the huck-a-back design by given weave repeat.	6.1 Crepe weaves- developments, Constructions of crepe weaves upon sateen bases, Combination of floating weave upon plain threads, Crepe weaves produced by reversing method, crepe weave produced by inserting one weave over another. 6.2 Development of Huck-a-Back structures- Huck-a-back structures, Huck-a-back structure on ten picks, Reversible Huck-a-Back structure, Huck-a-back structure on eighteen picks. 6.3 Development of Honey-comb structures- Ordinary Honey-comb structures, Honey-comb structure having equal warp & weft floats, Large Honey-comb structures, Brighton Honey-comb structures, comparison of ordinary honey-cob with Brighton honey-comb weave. 6.4 Development of Mock- Leno Structure- Concept, development of perforated fabrics, Simple Mock- Leno Structure development on 6x6, Mock- Leno Structure on 8x8,10x10, Concept of missing dents and application of special denting order for development of Mock- Leno 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	Unit Title	Teaching	Distribution of Theory Marks
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No.		Hours	R Level	U Level	A Level	Total Marks
I	Fundamental of Fabric Structure	02	04	04	-	08
II	Plain Weave and derivatives	04	03	03	04	10
III	Twill weave and derivatives	06	03	03	04	10
IV	Satin/Sateen weaves and derivatives	04	04	04	06	14
V	Simple Colour and Weave effect	08	04	04	06	14
VI	Fancy Fabric Structures	08	04	04	06	14
Total		32	22	22	26	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:

- Each batch will collect ten woven fabric samples and mark warp weft direction.
- Prepare journals based on practical performed in workshop.
- Measure yarn numbering for set of yarns.
- Give seminar on any relevant topic.
- Library survey regarding winding parameters used for different materials.
- Prepare power point presentation or animation for showing different sizes of yarns.
- Prepare question bank referring old MSBTE question papers

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.
- '**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.

S. No.	Tutorial Exercises in the class	Unit No.	Approx. Hrs. Required
1	Develop plain weave designs and create various directives of plain weave on point paper.	II	02
2	Develop twill weave designs and create various directives of twill	III	02

S. No.	Tutorial Exercises in the class	Unit No.	Approx. Hrs. Required
	weave (Part I)		
3	Develop twill weave designs and create various directives of twill weave (Part I)	III	02
4	Develop twill weave designs and create various directives of twill weave (Part I)	III	02
5	Develop twill weave designs and create various directives of twill weave (Part I)	III	02
6	Develop satin weave designs and create various directives of satin weave	IV	02
7	Develop colour and weave effects and Practice various innovative effects.(part I)	V	02
8	Develop colour and weave effects and Practice various innovative effects.(Part II)	V	02
9	Develop crepe weave designs and create various directives of crepe weaves.(Part I)	VI	02
10	Develop crepe weave designs and create various directives of crepe weaves.(Part II)	VI	02
11	Develop crepe weave designs and create various directives of crepe weaves.(Part III)	VI	02
12	Develop Huck-a-Back weave designs and create various directives of it. (Part I)	VI	02
13	Develop Huck-a-Back weave designs and create various directives of it. (Part II)	VI	02
14	Develop Honey comb designs and create various directives of it by using relevant weave repeat.(Part I)	VI	02
15	Develop Honey comb designs and create various directives of it by using relevant weave repeat. (Part II)	VI	02
16	Develop Mock Leno weave designs and create various designs by using relevant weave repeat	VI	02
	Total		32

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. Collect swatches of plain weave and its derivatives, analyse them and prepare a report about their structures.
- b. Develop swatches of plain weave and its derivatives sample using sample loom.
- c. Collect swatches of twill weave and its derivatives, analyse them and prepare a report about their structures.
- d. Develop swatches of twill weave and its derivatives sample using sample loom.
- e. Collect swatches of satin weave and its derivatives, analyse them and prepare a report about their structures.
- f. Develop swatches of satin weave and its derivatives sample using sample loom.
- g. Collect swatches with different colour and weave effect and discuss their features in report.
- h. Develop swatches of colour and weave effect samples using sample loom.
- i. Collect swatches of different fancy weave structure and discuss their features in report.
- j. Develop swatches of fancy weave structure using sample loom.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Weaving; Conversion of Yarns to Fabric	Lord. P.R; Mahamed. M.H.	Woodhead Publication,USA,1982 ISBN:9781855734838
2	Principle Of Weaving	Marks. R; Robbinson,A.T.S.	The Textile Institute. Manchester. 1976, ISBN: 0-900739258
3	Weaving: Machines, Mechanisms, Management	Talukdar. M.K.: Ajgaonkar, D.B.; Sriramulu, P.K.	Mahajan Publisher Private Limited,Ahmedabad,1998, ISBN:81-85401-16-0
4	Modern Preparation and Weaving Technology	Ormerod, A.	Butterworth, (Publishers) Limited. 1983, ISBN: 9780408012126
5	Fundamentals of yarn winding	Karanne,M.K.	A Woodhead Publication, India, 2013,ISBN:9781782420682

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

1. <http://nptel.ac.in/courses/116102005/48>
2. <http://nptel.ac.in/courses/116102005/49>
3. <http://www.textbooksonline.tn.nic.in/books/11/stdxi-voc-textiles-em.pdf>
4. https://en.wikipedia.org/wiki/Textile_manufacturing
5. https://www.rieter.com/en/rikipedia/articles/ringspinning/cop_buildup/the_winding_process/
6. <http://www.clothingstudy.com/yarn-numbering-system-yarn-count-direct-system-indirect-system/>
7. https://en.wikipedia.org/wiki/Units_of_textile_measurement
8. https://www.uster.com/fileadmin/customer/Knowledge/Textile_Know_How/Yarn_clearing/UCQ_Analysis_of_yarns_be_a_sophisticated.pdf

