Program Name	: **Diploma in Textile Manufacturers**
Program Code	: **TX**
Semester	: **Fourth**
Course Title	: **Principles of Weaving**
Course Code	: **22462**

1.   RATIONALE

Weaving is heart of the textile manufacturing process. Textile manufacturing students should therefore have thorough knowledge of basic principles of weaving, and different mechanisms of weaving machinery. This course aims to help student understand the concepts required for fabric formation and various mechanisms on weaving machines. After studying this course students will be able to identify causes and remedies of various fabric faults. Knowledge of weaving process is also must to develop a fabric having required properties. This course thus builds a foundation for the further courses related to weaving technology and other allied courses to be studied in higher semesters.

2.   COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:
  * **Weave different types of fabrics using different types of yarns and equipment.**

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. Prepare pirn (weft bobbin) on pirn winding machines.
  b. Draw warp threads through heald shafts by constructing drafts of fabric designs.
  c. Adjust different settings of primary motions for various qualities of fabrics.
  d. Maintain the secondary motions for obtaining required picks per inch for fabrics.
  e. Maintain auxiliary motion for weaving defect free fabric.
  f. Maintain loom mechanisms and weaving accessories for producing defect free fabrics.

4.   TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
				Paper Hrs.	Theory						Practical					
L	T	P			ESE		PA		Total		ESE		PA		Total	
					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 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.

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.
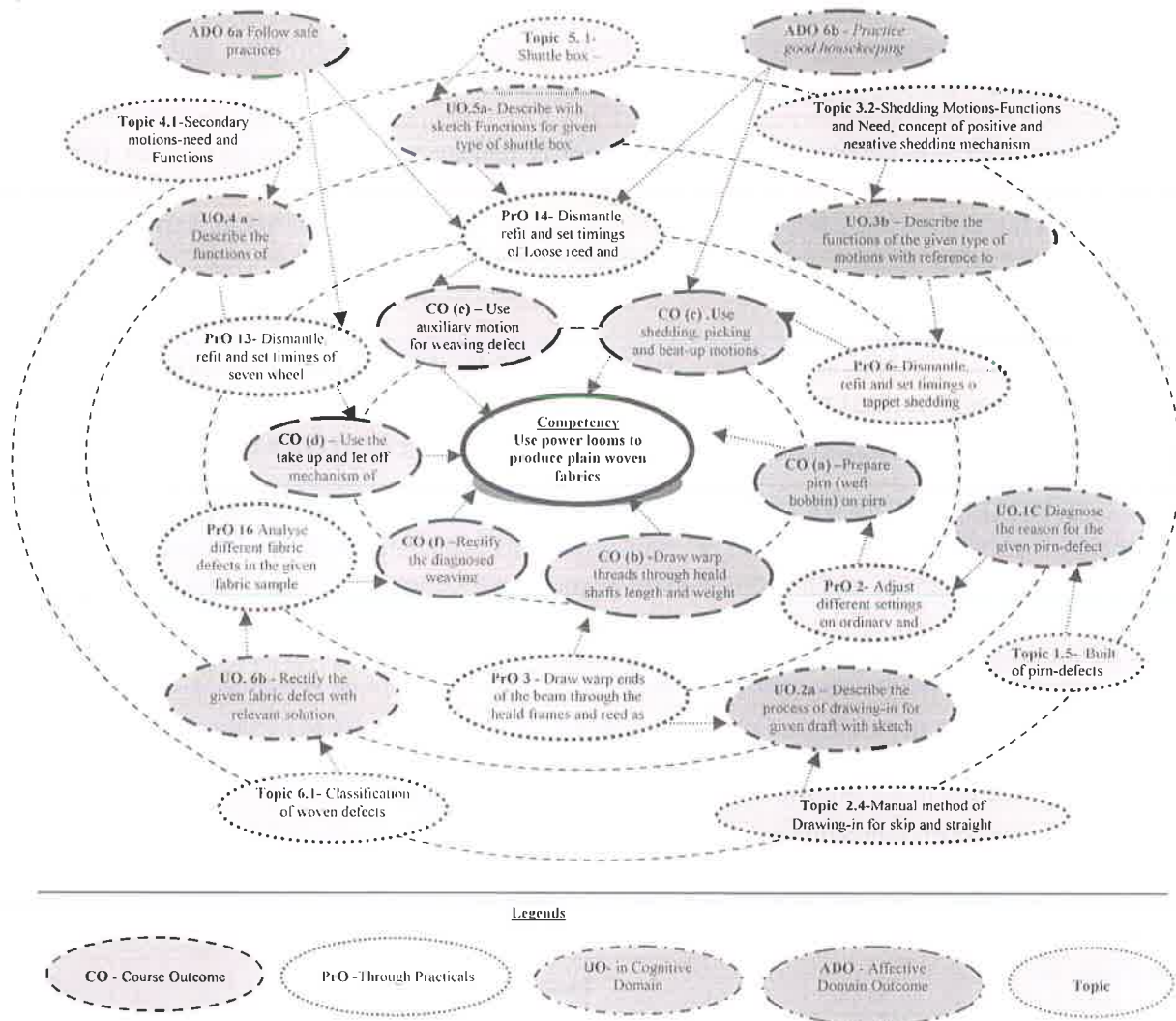

Figure 1 - Course Map

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1.	Identify various parts of an ordinary and automatic pirn winding machine and also the passage of yarn.	I	02
2.	Adjust different settings on ordinary and automatic Pirn winding machine for different quality of weft yarns along with production calculations.	I	02*
3.	Draw warp ends of the beam through the heald frames and reed	II	02*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	as per given draft and denting plan.		
4.	Identify various parts on power loom and sketch the passage of warp on loom.	III	02*
5.	Sketch loom timing diagram and identify loom timing for various primary motions. Sketch gearing diagram of drive to loom, determine speeds of crank shaft, bottom shaft and auxiliary shaft, determine productivity per day.	III	02*
6.	Dismantle, refit and set timings of tappet shedding mechanisms on a plain power loom	III	02*
7.	Dismantle, refit and set timings of over-pick mechanisms on a plain power loom	III	02*
8.	Dismantle, refit and set timings of side lever under-pick mechanisms on a plain power loom	III	02
9.	Dismantle, refit and set timings of cone under-pick mechanisms on a plain power loom	III	02*
10.	Dismantle, refit and set timings of beat-up mechanisms on a plain power loom	III	02*
11.	Dismantle, refit and set timings of negative let off mechanisms on a plain power loom	IV	02
12.	Dismantle, refit and set timings of Seven wheel intermittent take up mechanisms on a plain power loom and picks/inch calculations	IV	02*
13.	Dismantle, refit and set timings of seven wheel continuous take up mechanisms on a plain power loom and picks/inch calculations	IV	02*
14.	Dismantle, refit and set timings of Loose reed and Fast reed mechanisms on a plain power loom	V	02*
15.	Set different parts of shuttle box- front plate, side plate, spindle, picker, box swell, picking and checking mechanism.	VI	02
16.	Analyse different fabric defects in the given fabric sample and (a) Identify the defect (b) Categorize the defect (c) Find out causes of the defect and suggest remedies to avoid the defect.	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 judicial 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	Selection of relevant art material.	10
2	Use of relevant rendering technique.	20

S. No.	Performance Indicators	Weightage in %
3	Illustration/draping skills.	30
4	Variety in presentation of output.	30
5	Submit 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. Demonstrate working as a leader/a team member.
   d. Maintain tools and equipment.
   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
   • 'Organising Level' in 2nd year
   • '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.

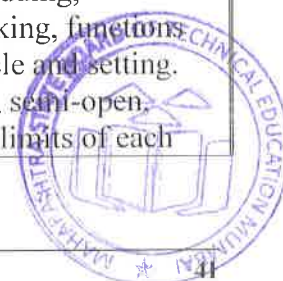| S. No.	Equipment/Instruments/Other resources name with Broad Specifications	Pro. No.
1	Ordinary pirn winding machine with 12 spindle	1, 2
2	Automatic pirn winding machine with 10 spindle	1, 2
3	Miniature Drawing in frame with heald frames and reed, weaver's beam	3
4	Plain Power looms with over pick mechanism 60 inch	4, 5, 6, 7, 10, 11, 15
5	Plain power looms with cone under-pick mechanism 60 inch	4, 5, 6, 8, 9, 10, 11, 15
6	Plain power looms with side under-pick mechanism 60 inch	4, 5, 6, 7, 10, 11, 15
7	Different fabric samples with various fabric defects, pick glass,	16

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.
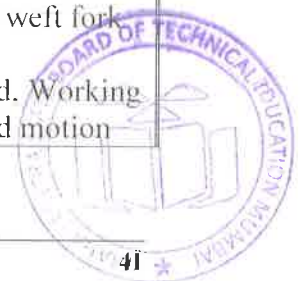
Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Pirn	1a. Describe with sketches the passage of yarn through	1.1 Functions and need of pirn winding machines

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Winding	different parts of the given type of pirn winding machine. 1b. Describe with sketches the functions of the given parts of pirn winding machine. 1c. Diagnose the reason for the given pirn-defect and the remedies therein. 1d. Estimate speeds, efficiency and production for the given situation.	1.2 Passage of yarn on pirn winding machine. 1.3 Functions of various parts of automatic pirn winding machine. 1.4 Requirements of pirns for automatic looms. 1.5 Built of pirn-defects and remedies for it 1.6 Calculation of pirn winding speed and production.
Unit –II Drawing-in	2a. Describe with sketches the the process of drawing-in for given draft. 2b. Describe with sketches the the drawing-in plan for the given type of draft. 2c. Interpret the relation between design, draft and peg plan for given type of basic weave. 2d. Describe with sketch merits and limits of given type of heald wire. 2e. Find the weight of warp and weft for given fabric quality particulars. 2f. Determine the heald count for given quality particulars of the fabric. 2g. Determine the reed count for given for given quality particulars of the fabric.	2.1 Functions and need of Drawing-in. 2.2 Basic concept of design, draft and peg plan 2.3 Types of drafts-skip, straight. 2.4 Manual method of Drawing-in for skip and straight 2.5 Heald wire-types, Features ,merits and limits, Calculation of heald count 2.6 Reed-Types, Reed count, relation between fabric width, reed count and EPI. 2.7 Calculations of warp and weft weight, fabric weight. 2.8 Beam knotting-Need, Method of knotting
Unit – III Shedding, picking and beat-up of Power Loom	3a. Describe the material flow for given loom with sketch. 3b. Describe with sketches the functions of the given type of motions with reference to passage of warp on loom. 3c. Compare with sketches the limitations and merits of given type of cam shedding mechanism with justification. 3d. Compare with sketches the the merits and limitations of given types of sheds with	3.1 Plain power loom- Passage of warp, objectives of primary, secondary and auxiliary motions. 3.2 Shedding Motions-Functions and Need, concept of positive and negative shedding mechanism, 3.3 Cam shedding-Tappet, conjugate cam, grooved cam shedding, merits and limits of each cam shedding, 3.4 Tappet shedding- working, functions of all parts, timing cycle and setting. 3.5 Sheds-Bottom, closed, semi-open, open shed, merits and limits of each

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	justification. 3e. Describe the working of tappet shedding mechanism with sketch. 3f. Determine timing and settings of the tappet shedding mechanism for the given situation. 3g. Explain with sketches the working of given type of picking mechanism. 3h. Determine timing and settings for given picking mechanism. 3i. Explain with sketches the working of beat-up mechanism.	shed characteristics of good shed, shedding time cycle, Early and late shedding. 3.6 Construction of shedding tappet for plain weave. 3.7 Picking Motions: - Object, types of picking mechanisms –over-pick and under-pick mechanisms. Over Picking Mechanism – working of cone over picking mechanism, function of all parts, timing and settings. Under Picking Mechanism – working cone under picking mechanism, functions of all parts, timing and settings. 3.8 Beat-up motions – object, working of crank beat-up mechanism, functions of – sley, crank and crank arm, Sley eccentricity, importance and calculations. 3.9 Drive arrangement for bottom, crank shaft.
Unit –IV Take up and Let off mechanism of power loom	4a. Describe with sketches the functions of secondary motions. 4b. Describe the working of given take up mechanism with sketch. 4c. Calculate the dividend of seven wheel mechanism to decide required pick wheel for a given fabric. 4d. Describe with sketches the the working mechanism of given type of let off motion.	4.1 Secondary motions-need and Functions 4.2 Take-Up Motion – object, types, working of seven wheel take-up motion, settings and timings of the mechanism, calculation of dividend, cloth wind-up device. 4.3 Let-off Motion – Functions, types of Let off motions –Negative Let off motion, Positive Let off motion, Working of Negative Let-off motions, oscillating back rest
Unit –V Auxiliary motions	5a. Describe with sketch Functions for given type of shuttle box elements. 5b. Describe with sketches the functioning of given warp stop motion 5c. Explain with sketches the functioning of the given weft stop motion. 5d. Compare with sketches the features of the given types of warp protecting motions. 5e. Describe with sketches the	5.1 Shuttle box –functions of all parts, their settings and its effect on loom working (Box plates – front, back, bottom and end plate), box swell, box flap, check strap, shuttle guard buffer, picker, picking band etc.) 5.2 Warp stop motion – types – Mechanical warp stop motion 5.3 Weft Stop Motion – Types, working of Side weft fork motion. Center weft fork Their merits and demerits 5.4 Warp Protector Motion – Need. Working of Loose reed motion Fast reed motion

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	functioning of the given type of warp protecting motion. 5f. Explain with sketches the given type of temple motion and its relative merits and demerits with reference to other types. 5g. Estimate efficiency and production of loom for the given data.	and their comparison. 5.5 Temple Motion – Two roller, three roller full width, Temple bracket mounting, various types of temple rollers. 5.6 Calculations of loom speed, production and efficiency
Unit –VI Fabric Defects	6a. Describe the given fabric defect with sketch. 6b. Distinguish the given defect into relevant categories. 6c. Describe the procedure to rectify the given fabric defect with relevant solution. 6d. Describe with sketches the processes of setting of the given part of the shuttle box for proper functioning of picking mechanism.	6.1 Classification of woven fabric defects 6.2 Warp wise defect- description, demonstration, causes and remedies for Missing end, float, double end, broken end, size patches, wrong drawing-in, 6.3 Weft wise defect- description, demonstration, causes and remedies for double pick, miss pick, weft bars, lashing in, short pick, snarl. 6.4 Machine defect: Let off marks, starting mark, Thick place, Thin Place, Reedy fabric or fabric with poor cover, all types of bad selvedges, temple marks, emery roller marks, stains, gout.

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	Pirn winding	8	2	2	4	8
II	Drawing-in	12	2	4	6	12
III	Shedding, picking and beat-up of Power Loom	16	4	8	10	22
IV	Take up and Let off mechanism of power loom	10	2	2	6	10
V	Auxiliary motions	10	2	2	4	8
VI	Fabric defects	8	2	2	6	10
	Total	**64**	**14**	**20**	**36**	**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. Draw diagrams of bare pirns of different looms (power loom, auto loom with mechanical feeler, auto loom with electrical feeler and auto loom with photo electric feeler)
- b. Students should collect different fabric samples available in market and collect information about design, draft, peg-plan and denting plan. They should determine reed and heald count required for each sample.
- c. Students should make a loom timings circle of card board showing timings of shedding, picking and beat up on it.
- d. Draw diagram of various picking mechanisms on a card board. Draw diagrams of various parts, write function of each part, elaborate about how picking force can be changed in each mechanism.
- e. Draw diagram of beat up mechanism of power loom on a card board and label the part.
- f. Collect information about various take up and let off mechanisms used on power loom, auto loom and shuttle less looms on internet in the form of photographs, videos and prepare a Power point presentation.

11.   SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES

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. With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.

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. **Pirn winding** - Students will build five different pirns by using different traverse length and traverse ratio. They will observe the performance of the pirns during weaving and record the performance for submission. They will make a Power point presentation on this study and present at the end of semester.

b. **Drawing-in-** Develop various fabric samples of basic weaves such as plain, twill and sateen. They will draw ends of the warp sheet as per the selected draft, and peg-plan to obtain required basic weave on table loom. Prepare a sample folder along with the details of design, draft and peg-plan of various weaves.

c. **Primary motions on power Loom-** Construct the plain, 2 up 1 down twill weave tappet cam profile and picking nose on drawing in sheet by considering all shedding and picking parameters.

d. **Primary motions on power Loom** -Measure the length of crank arm, radius of crank and width of loom of various looms available in workshop and Prepare a table for the sley eccentricity. Interpret the result by establishing relationship between sley eccentricity and width of loom.

e. **Secondary motions**: Students will draw the seven wheel take up mechanism. They will produce fabric samples of different PPI by changing the combination of slandered and change wheel. They will prepare relevant chart indicating effect of changing wheels on fabric parameters (PPI) with sample.

f. **Auxiliary motions-** Students will collect schematic diagrams, photographs, videos, animation videos and prepare a booklet having description of about all auxiliary motions.

g. **Fabric defects** – Students will prepare chart by collecting various defective fabric swatches and write causes and remedies of the same.

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, Ahmedabad,1998, ISBN:81-85401-16-0
4	Fancy Weaving Mechanisms	K.T.Aswani	Mahajan Book Distributors, Ahmedabad , 1990,
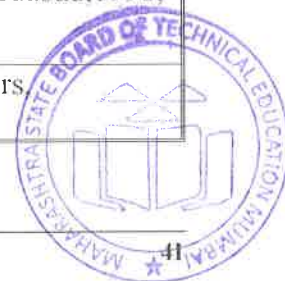
S. No.	Title of Book	Author	Publication
			ISBN 8185401012,
5	Fundamentals of yarn winding	Karanne,M.K.	A woodhead Publishing India Title, 2013,ISBN:9781782420682

14. SUGGESTED SOFTWARE/ LEARNING WEBSITES

a. http://nptel.ac.in/courses/116102005/10
b. http://nptel.ac.in/courses/116102005/29
c. http://nptel.ac.in/courses/116102005/53
d. http://nptel.ac.in/courses/116102005/32
e. http://nptel.ac.in/courses/116102005/37
f. http://nptel.ac.in/courses/116102005/42
g. http://nptel.ac.in/courses/116102005/47
h. http://nptel.ac.in/courses/116102005/51
i. http://nptel.ac.in/courses/116102005/52
j. https://www.rieter.com/en/rikipedia/articles/ringspinning/cop_buildup/the_winding_process/
k. https://en.wikipedia.org/wiki/Units_of_textile_measurement
l. https://www.uster.com/fileadmin/customer/Knowledge/Textile_Know_How/Yarn_clearing/UCQ_Analysis_of_yarns_be_a_sophisticated.pdf