

**Program Name** : Diploma in Textile Manufacturers  
**Program Code** : TX  
**Semester** : Third  
**Course Title** : Elements of Wet Processing  
**Course Code** : 22367

### 1. RATIONALE

Diploma engineers have to work at various levels in textile industry as shift supervisor to marketing head. To solve the textile manufacturing related problems, they should have a basic knowledge of each stage of textile production starting from fibre production up to garment manufacturing. This course develops necessary skills in using the chemicals which are used during pretreatment process for improving absorbency and whiteness of fabrics. This course also gives the basic knowledge about dyeing, printing and finishing processes of textile which improves the aesthetic value of textile substrate.

### 2. COMPETENCY

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

- Use principles of chemical wet processing in textile manufacturing.

### 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 principles of pretreatment of fabrics in textile manufacturing
- Use relevant method for desizing, scouring and bleaching of fabrics.
- Use relevant dyes and dyeing methods for given cellulosic and protein fabrics.
- Use relevant dyes and dyeing methods for given synthetic fabrics.
- Select relevant ingredients for formulation of print paste for printing cellulosic and synthetic textiles.
- Choose relevant finishing process according to the end uses.

### 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
4	-	2	6	3	70	28	30*	00	100	40	25@	10	25	10	50	20

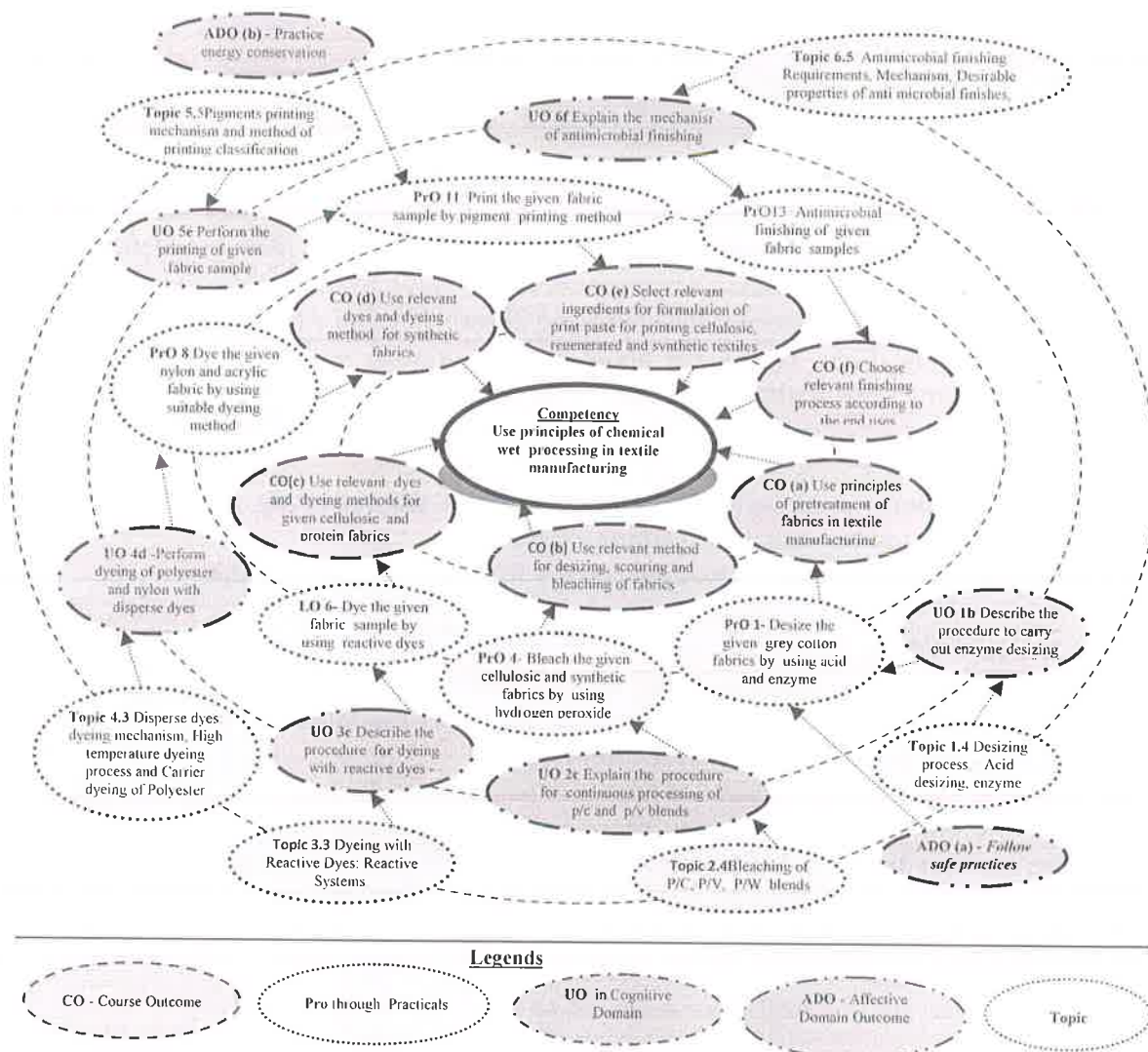
(\*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

**Legends:** L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Projective 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	Desize the given grey cotton fabrics by using acid /enzyme.	I	02*
2	Scour the given cellulosic and synthetic fabrics.	I	02
3	Bleach the given cotton fabric by using sodium hypochlorite.	I	02
4	Bleach the given cellulosic and synthetic fabrics by using hydrogen peroxide. Part - I	II	02*
5	Bleach the given cellulosic and synthetic fabrics by using hydrogen peroxide. Part - II	II	02*



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
6	Dye the given fabric sample by using direct dyes.	III	02*
7	Dye the given fabric sample by using reactive dyes.	III	02
8	Dye the given polyester/nylon fabric with disperse dyes by using H.T.H.P./ Carrier dyeing method.	IV	02*
9	Dye the given acrylic fabric by using cationic dyes.	IV	02
10	Print the given fabric sample by direct style of printing by using direct dyes.	V	02*
11	Print the given fabric sample by discharge styles of printing by using reactive dyes. Part - I	V	02
12	Print the given fabric sample by discharge styles of printing by using reactive dyes. Part - II	V	02
13	Print the given fabric sample by pigment printing method.	V	02
14	Resin finish the given fabric samples.	VI	02*
15	Perform finishing of Antimicrobial fabric samples.	VI	02
16	Carry out softening treatment of fabrics.	VI	02
<b>Total</b>			<b>32</b>

**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.	Correctness of Practical	40
b.	Reasoning ability	20
c.	Quality of presentation	10
d.	Answer to sample questions	20
e.	Submit report in time	10
<b>Total</b>		<b>100</b>

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. Monitor the level of achievement of the ADOs



according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1<sup>st</sup> year
- 'Organising Level' in 2<sup>nd</sup> year
- 'Characterising Level' in 3<sup>rd</sup> 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. S. No.
1	Laboratory Glass Ware (beaker, measuring cylinder)	1 to 14
2	Laboratory steamer (50 psi)	2,8,9
3	Dye pot (capacity 500 ml)	5,6,7,8
4	Dye bath (6 or 12 pots)	5,6,7,8
5	Laboratory Rota dyer (250ml 12 or 24 pots)	5,6,7,8
6	Laboratory HTHP beaker dyeing machine (250ml 12 or 24 pots)	7,8
7	Printing screen (12 x 12 inch), rubber squeeze	9,10,11
8	Stiffness tester	12
9	Curing chamber	11 to 14
10	Padding mangle	11 to 14

### 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
<b>Unit – I Basics of pretreatments</b>	1a. Describe with sketches the features of the given system 1b. Describe with sketches the procedure to carry out the given type of desizing. 1c. Determine the scouring loss% in the given situation. 1d. Describe with sketches the procedure to carry out given type of bleaching.	1.1 Grey inspection process: objective, Four point checking system. 1.2 Shearing and cropping process: Shearing cropping machine, Two cutter and four cutter system 1.3 Singeing process and gas singeing machine. 1.4 Desizing process: Acid desizing, enzyme desizing, Batch wise and continuous process of desizing. 1.5 Scouring process: vertical pressure kier and J-box system 1.6 Bleaching process. sodium hypochlorite and hydrogen peroxide bleaching. 1.7 Mercerization: factors affecting the process of mercerization, Machine used for mercerization



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
<b>Unit– II Bleaching of regenerate d and synthetic fibres</b>	2a. Explain with sketches the procedure for processing of the given type of fibre. 2b. Explain with sketches the procedure for continuous processing of the given type of blend 2c. Explain with sketches the pretreatment of given type of synthetic fibres. 2d. Describe with sketches the heat setting for setting up process sequence of the given type of synthetic fibres	2.1 Batch wise and continuous method of bleaching 2.2 Wet Process sequence for P/C, P/V, P/W and synthetic goods 2.3 Machines used for bleaching: Jiggers, winch, soft flow, continuous bleaching range. 2.4 Bleaching of P/C, P/V, P/W blend 2.5 Heat setting process 2.6 Details of preparatory processes for PET, Nylon, Acrylic and its blends
<b>Unit– III Dyeing of cellulosic fibres</b>	3a. Describe with sketches for processing of given type of cellulose fibre. 3b. Describe with sketches the procedure for using the given type of dye. 3c. Describe the features of the given type of vatting systems 3d. Describe with sketches the given type of dyeing method	3.1 Colouring matter: classification of dyes. 3.2 Direct dyes: method of application, after treatments on direct dyed goods. 3.3 Reactive Dyes: classification , method of dyeing 3.4 Dyeing with vat Dyes: Use wise classification, dyeing method. 3.5 Dyeing methods: dyeing of yarn and fabric with batch-wise and continuous processes
<b>Unit-IV Dyeing of protein and synthetic fibres</b>	4a. Describe with sketches the procedure for dyeing with the given type of dyes on wool 4b. Describe with sketches the procedure for dyeing with basic dye on the given synthetic fibre. 4c. Describe with sketches the given dyeing method.	4.1 Acid dyes: Classification of acid dyes application of acid dyes on wool and silk. 4.2 Basic dyes: Application of Basic dyes on wool and silk 4.3 Disperse dyes: dyeing mechanism, High temperature dyeing process and Carrier dyeing of Polyester 4.4 Nylon dyeing: Dyeing mechanism, dyeing with acid and metal complex dyes, dyeing with disperse and reactive dyes. 4.5 Acrylic Dyeing: Preparation of acrylic for dyeing. Dyeing of acrylic fibre with disperse dyes. 4.6 Dyeing methods: Batch and continuous dyeing process of poly / cellulose blends



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
<b>Unit –V</b> <b>Basic concepts of printing</b>	5a. Describe with sketches the procedure for of the given method of printing. 5b. Describe the features of the given style of printing. 5c. Describe with sketches the construction of given type of printing machine 5d. Describe with sketches the procedure for printing of the given type of fabric sample	5.1 Printing: objective, Methods and Styles of Printing Fixation of printed textiles 5.2 Screen printing: table screen printing, Flat bed screen printing m/c. and its various parts. Technical features of printing with flat bed printing m/c. . Rotary screen printing m/c. and its various parts. Squeeze system. Technical features of rotary printing machine. 5.3 Printing with direct dye :Print paste ingredients for direct and discharge style of printing 5.4 Printing with reactive dyes: Print paste ingredients for direct, discharge and resist style of printing. 5.5 Pigments printing: mechanism and method of printing
<b>Unit-VI</b> <b>Basic concepts of finishing</b>	6a. Describe the features of the given type of finishing machinery. 6b. Describe with sketches the mechanism of the given type of finishing 6c. Describe with sketches the given type of softening treatment 6d. Describe with sketches the mechanism of antimicrobial finishing for the given type of fabrics.	6.1 Finishing: objective of textile finishing, classification of finishing 6.2 Finishing machinery : Calendaring, Decatising , Raising, Sueding, felting, Sanforising, Stenter, 6.3 Resin finishing :Mechanism of creasing and resin finishing, Types of resin finishing, concept of Anticrease, wash-n-wear and Durable Press, 6.4 Flame retardant finishing: Concept of flame proof and flame retardancy. Limiting oxygen Index and its importance, Thermal behaviour of textile fibres. 6.4 Softening treatments: classification of softeners. Properties, mode of action and application of softeners 6.5 Antimicrobial finishing Requirements, Mechanism, Desirable properties of anti microbial finishes, and various antimicrobial finishes for cotton, wool, silk, polyester, nylon and acrylic.

*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	Basics of pretreatment processes	08	04	04	-	08
II	Bleaching of regenerated and synthetic fibres	08	-	03	04	07
III	Dyeing of cellulosic fibres	10	02	03	04	09
IV	Dyeing of protein and synthetic fibres	10	02	05	07	14
V	Basic concepts of printing	14	02	06	09	17
VI	Basic concepts of finishing	14	02	06	07	15
<b>Total</b>		<b>64</b>	<b>12</b>	<b>27</b>	<b>31</b>	<b>70</b>

**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:

- collection of fabric swatches (dyed/printed/finished)
- preparation of charts of various dye classes
- Visit textile process house and observe various activities.
- Collection of videos on chemical processing.

## 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:

- 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.
- Observe continuously and monitor the performance of students in Lab.



## 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. **Collection of samples:** Collect samples at each stages of pretreatment and check the absorbency
- b. **Effect on depth of shade:** Collect various fabric qualities carry out dyeing with direct dyes and check the depth of shade
- c. **Colour fastness:** Carry out dyeing with three selected dyes and check the washing fastness, rubbing fastness.
- d. **Preparation of charts:** Collect printed samples made by various printing methods and prepare chart of it.
- e. **Shade card preparation:** Select three reactive dyes carry out dyeing activity and prepare shade cards.
- f. **Collection of processing information:** Visit different chemical processing units and collect their process sequence.
- g. **Power point presentations:** Prepare presentation on relevant machineries used in chemical processing.

## 13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Dyeing and chemical Technology of Textile Fibres	Trotman, E. R. T.	John Willey and Sons Inc, 1985 ISBN: 978-0471809104
2	Silk Dyeing printing and finishing by	Gulrajani, M. L.	BPB Publications, New Delhi 2016, ISBN: 978-8183331630
3	Fundamental Principles of Textile Processing	Shenai, V.A.	Sevak Publications, Bombay, 1984 ISBN 13: 9783659686047.
4	Textile Printing	Miles, L.W.C.	Published by Society of Dyers and Colourists (1981) ISBN: 9780901956330
5	An Introduction to Textile Printing	Clarke, W.	CBS Publishers and Distributors Pvt. Ltd., New Delhi 2004; ISBN: 9781855739949
6	Technology of Printing	Shenai, V.A.	Sevak Publications, Bombay, 1984 ISBN 13: 9783659686047





**14. SUGGESTED SOFTWARE/LEARNING WEBSITES**

- a. [www.textilelearner.blogspot.in/2011/07/dyeing-process-different-types-of-dye](http://www.textilelearner.blogspot.in/2011/07/dyeing-process-different-types-of-dye)
- b. [www.teonline.com/knowledge-centre/dyeing-fiber-](http://www.teonline.com/knowledge-centre/dyeing-fiber-)
- c. [www.en.wikipedia.org/wiki/dyeing](http://www.en.wikipedia.org/wiki/dyeing)
- d. [www.en.wikipedia.org/wiki/Textile\\_printing](http://www.en.wikipedia.org/wiki/Textile_printing)
- e. [textilelearner.blogspot.com/printing-method-method-of-printing](http://textilelearner.blogspot.com/printing-method-method-of-printing)
- f. [www.tikp.co.uk/knowledge/technology/finishing/textile-finishing/](http://www.tikp.co.uk/knowledge/technology/finishing/textile-finishing/)
- g. [textilefashionstudy.com/finishing-of-textiles-definitions-objectives](http://textilefashionstudy.com/finishing-of-textiles-definitions-objectives)
- h. [www.sciencedirect.com/science/book/9781855739055](http://www.sciencedirect.com/science/book/9781855739055)

