

**Program Name** : Diploma in Textile Technology  
**Program Code** : TC  
**Semester** : Fifth  
**Course Title** : Process Control in Wet Processing  
**Course Code** : 22578

### 1. RATIONALE

In textile industry, the quality textile is manufactured through various processes such as pretreatment, dyeing, printing, and finishing. These major processes improve the aesthetic as well as the market value of the textile produced. Process control is an important parameter in textile substrate processing to maintain its quality as well as efficiency of the production machines. The knowledge and skills related to the process control are essential for the diploma engineer to produce quality textile. This course is developed in such a way that basic concepts and techno-commercial aspects of processes will help the diploma engineer to produce quality processed yarn and fabrics. This will further help them to solve broad based problems in the textile processing.

### 2. COMPETENCY

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

- **Ensure the quality process control in wet 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:

- Select relevant process control parameters for mechanical pretreatment.
- Select relevant process control parameters for chemical.
- Select relevant dyeing process control parameters on machines.
- Select relevant printing process control parameters on machines.
- Select relevant finishing process control parameters on machines.

### 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
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)





S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	exhaustion and fastness of reactive dyes on the given cotton fabric.		
6	Evaluate the effect of specified process control parameters on the exhaustion of vat dyes on the given cotton fabric.	III	02*
7	Assess depth of dyeing of acid dyes on the given wool by varying process control parameters.	III	02
8	Compare the effect of specified process control parameters on dyeing of the given polyester fabric with disperse dyes.	III	02*
9	Compare the effect of viscosity of print paste on fixation and fastness of reactive dyes on the given cotton fabric.	IV	02*
10	Evaluate the effect of specified process control parameters of ager on the fixation of vat dyes on the given cotton fabric.	IV	02
11	Assess depth of dye fixation of reactive dyes on the given cotton fabric by varying the number of squeeze strokes.	IV	02
12	Compare the effect of mesh size of printing screen on the given polyester fabric with disperse dyes.	IV	02
13	Compare the effect of speed of the given fabric on add-on and performance of finished cotton fabrics.	V	02*
14	Evaluate the effect of percentage expression of the given fabric on add-on and performance of finished cotton fabrics.	V	02
15	Assess the effect of curing temperature of the given fabric on the performance of finished fabric.	V	02
16	Compare the effect of number of dips of the given fabric on add-on and performance of finished cotton fabrics.	V	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.	Preparation of experimental set up	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of 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. 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 1<sup>st</sup> year
- 'Organisation Level' in 2<sup>nd</sup> year
- 'Characterisation 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.

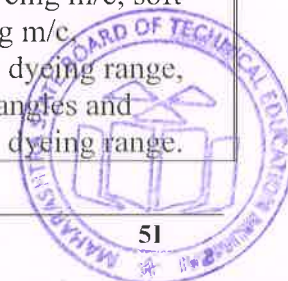
S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Open bath beaker dyeing machine (250 ml)	2, 5
2	Water bath (30 Liter) with 6/12 dye pots of 500 ml each	1,3-7
3	High Temperature High Pressure Beaker dyeing machine- 130 °C, Maximum working pressure: 2 kg/sq. cm, Electrical load: 4 Kw	8
4	Volumetric flask, measuring cylinder, pipette, weighing balance, beakers, thermometer (0-360°C).	2-16
5	Drying ovens- Temperature 0 to 120 °C	2-16
6	Two bowl horizontal padding mangle – 12 inches width, with adjustable nip pressure.	13 - 16
7	Relative dyes, chemicals and auxiliaries	2-16
8	Curing & Setting Chamber (Stenter), Working width: 450mm Max. Temperature -200°C	13 - 16
9	Electronic balance with 0.001gm accuracy, capacity 300 gm.	2-16
10	Laboratory steamer, Maximum temperature: 130 °C, Maximum working pressure: 4 kg/sq cm, Electrical load: 4 Kw	9-12
11	Inspection table- 150 cm length, 100 cm width	2
12	Printing screen of variable sizes and screen printing kit	9-12

### 8. UNDERPINNING THEORY COMPONENTS

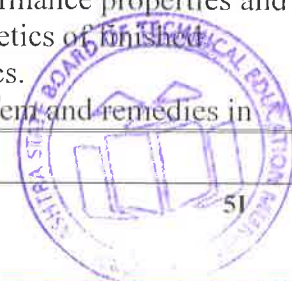
The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
<b>Unit– I Process and quality control in mechanical pre-treatment</b>	1a. Describe the importance of process and quality control in wet processing of the given fabric. 1b. Describe with flowchart the procedure to evaluate the effect of controlled and un-controlled processing parameters on singeing of the given fabric. 1c. Describe with flowchart the procedure to use 4 point system to decide the acceptability of the given finished fabric. 1d. Explain the importance of process control in grey inspection of the given fabric with justification. 1e. Describe process control parameters for the given mechanical pre-treatment.	1.1 Process and quality control- Concept, necessity, process control parameters, methods, Importance of quality assurance, techno-commercial aspects of processes. 1.2 Quality assurance department- Structure and functions 1.3 Effect of controlled and un-controlled processing parameters on singeing 1.4 Grey inspection- Importance in subsequent process control, 4 point system 1.5 Process control parameters for mechanical pre-treatment –shearing and cropping, brushing, sueding and gas singeing.
<b>Unit– II Process Control in chemical pre-treatment</b>	2a. Explain the importance of relevant process control parameters on the performance of product with justification. 2b. Describe with flowchart the process of assessing the effect of process control parameters on the efficiency of enzyme desizing of the given grey cotton fabric. 2c. Describe using flowchart the relevant bleaching method with time temperature profile for the given fabric. 2d. Suggest the process control rectification for the given scoured fabric. 2e. Describe relevant process control parameters for specified mercerising method for the given cotton variety. 2f. Suggest the norms and check points for the relevant pre-treatment process for the given fabric.	2.1 Process control parameters- In desizing, scouring, mercerization, bleaching and continuous bleaching range, norms and check points 2.2 Scouring efficiency- Effect of process control parameters on the efficiency of scouring of cotton fabrics and its assessment 2.3 Bleaching efficiency- Effect of process control parameters on efficiency of bleaching of cotton fabrics using H <sub>2</sub> O <sub>2</sub> 2.4 Enzyme desizing efficiency assessment of fabric 2.5 Problem and remedies in chemical pretreatments.
<b>Unit-III Process Control in Dyeing</b>	3a Explain the parameters affecting the dyeing quality of given dyes on the relevant dyeing machine for the given fabric with justification. 3b Describe with flowchart the procedure to evaluate the effect of specified process control parameters on the exhaustion of	3.1 Process control parameters- for jiggers, jet dyeing m/c, package dyeing m/c, soft flow dyeing m/c, continuous dyeing range, padding mangles and continuous dyeing range.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	<p>dyes on the given fabric.</p> <p>3c Describe with flowchart the procedure to assess depth of dyeing of given dyes on the given fabric.</p> <p>3d Describe with flowchart the procedure to compare the effect of specified process control parameters on dyeing of the given polyester fabric with disperse dyes.</p> <p>3e Suggest the rectification for the stated dyeing defects in the given fabric with relevant process control parameters / solutions.</p>	<p>3.2 Importance of Lab to bulk recipe formulation, examples</p> <p>3.3 Right First Time dyeing-Measures to achieve, importance, examples.</p> <p>3.4 Effect of various process control parameters on the quality, dyeability and fastness properties of various dyes.</p> <p>3.5 Problem and remedies in dyeing.</p>
<b>Unit –IV Process Control in Printing</b>	<p>4a. Explain the parameters affecting the printing quality of given dyes on the relevant printing machine for the given fabric with justification.</p> <p>4b. Explain the relation between lab and bulk recipe formulation in printing of the given fabric with justification.</p> <p>4c. Describe with flowchart the process to compare the effect of viscosity of print paste on fixation and fastness of dyes on the given cotton fabric.</p> <p>4d. Explain the importance of process control parameters of ager and washer to get desired quality of the given printed fabric.</p> <p>4e. Explain the parameters affecting the printing quality of given pigments on the relevant printing machine and stenter for the given fabric with justification</p> <p>4f. Suggest the rectification for the stated printing defects in the given fabric with relevant solutions.</p>	<p>4.1 Process control parameters- for flat bed screen printing m/c, rotary screen printing m/c.</p> <p>4.2 Process control parameters- for ager m/c, washer m/c.</p> <p>4.3 Importance of Lab to bulk recipe formulation in printing.</p> <p>4.4 Effect of process control parameters- on the quality, printability and fastness properties of various dyes.</p> <p>4.5 Problem and remedies in printing.</p>
<b>Unit-V Process Control in Finishing</b>	<p>5a. Explain the parameters affecting the finishing quality on the relevant finishing machine for the given fabric with justification.</p> <p>5b. Describe the procedure to evaluate the effect of percentage expression of the given fabric on add-on and performance of finished fabric.</p> <p>5c. Describe the procedure to assess the effect of curing temperature of the given fabric on the performance of finished fabric.</p> <p>5d. Describe the procedure to apply optimum process control parameters for</p>	<p>5.1. Process control parameter - for Stenter, Sanforiser, Calenders, drying ranges.</p> <p>5.2. Process control parameter – for chemical finishes.</p> <p>5.3. Importance of Lab to bulk recipe formulation in finishing.</p> <p>5.4. Process control parameters- Effect on the quality, performance properties and aesthetics of finished fabrics.</p> <p>5.5. Problem and remedies in</p>



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	the given machine to achieve desired performance effects. 5e. Suggest the rectification for the stated finishing defects in the given fabric with relevant process control parameters and solutions.	finishing.

*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	Process and quality control in mechanical pre-treatment	05	02	02	04	08
II	Process Control in chemical pre-treatment	06	02	02	04	08
III	Process Control in Dyeing	15	04	06	10	20
IV	Process Control in Printing	12	04	06	08	18
V	Process Control in Finishing	10	04	04	08	16
<b>Total</b>		<b>48</b>	<b>16</b>	<b>20</b>	<b>34</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:

- Visit process house nearby your institute and with the help of processing in-charge, collect information about various process control parameters of different machines available.
- Visit process houses nearby your institute and compare the existing process conditions for a given process on a specified machine.
- Collect information on safety precautions related to various chemicals and machinery used in process house.
- Survey on internet and prepare chart of various machines available in the market along with their technical features/ specifications.
- Survey the library/ internet and collect information about the recent developments in textile processing machineries and technologies.



- f) Prepare computer based presentation explaining processing conditions of various fabrics on different machines.
- g) Visit process houses nearby your institute and collect information about faults occurred in processing due to process control parameters and relevant remedies adopted.

### 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:

- 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.

### 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 is given here. Similar micro-projects could be added by the concerned faculty:

- a) Collect the different pretreated sample whose pretreatment temperature is varied and observe its effect on dye uptake for given textile fabric.
- b) Collect the different pretreated sample whose pretreatment time is varied and observe its effect on dye uptake for given textile fabric.
- c) Collect the different pretreated sample whose chemical concentration of pretreatment is varied and observe its effect on dye uptake and fabric quality for given textile fabric.
- d) Collect the different pretreated sample whose pretreatment method is varied and observe its effect on dye uptake and fabric quality for given textile fabric.
- e) Collect the different dyed sample whose process control parameter is varied and observe its effect on dye uptake and fabric quality for given textile fabric.





- f) Collect the different printed sample whose process control parameter is varied and observe its effect on dye uptake and fabric quality for given textile fabric.
- g) Collect the different finished sample whose process control parameter is varied and observe its effect on fabric quality for given textile fabric.
- h) Visit to local processing industry and prepare a chart on process control parameter for different process and machinery

### 13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	Textile processing & properties	Vigo, T. L.	Elsevier Science B.V. Amsterdam, 1994 ISBN: 9780444882240
2.	Dyeing and Chemical Technology of Textile Fibres	Trotman, E. R.	John Wiley & Sons Inc., New Delhi, 1985, ISBN: 9780471809104
3.	Handbook of Textile and Industrial Dyeing	Clarke, M.	Woodhead Publishing, UK, 2011 ISBN: 9781845696962
4.	Chemical processing of synthetic and its blends	Datya, K.V; Vaidya, A.A	A Wiley Inter Science Publication, New York, 1984 ISBN-9780471876540
5.	Dyeing and Chemical Technology of Textile Fibres	Trotman, E. R.	John Wiley & Sons Inc., New Delhi, 1985, ISBN: 9780471809104
6.	Dyeing and Screen Printing on Textiles	Joanna Kinnersly Taylor	A & C Black Publishers Ltd., London, UK. 1 Jan 2012 ISBN: 9781408124758
7.	Textile Printing	Miles, L.W.C.	Society of Dyers and Colourists, UK, 1981, ISBN: 9780901956330
8.	Textile Spinning, Weaving, Finishing and Printing	NIIR Board Of consultants and Engineers	Asia Pacific Business Press Inc. Delhi, 2016, ISBN: 9788178331638
9.	Chemical after treatments of textiles	Marks, Atlas; Wooding	A Wiley inter science publication, New York, 1971 ISBN-9781563675164
10.	Chemical finishing of textile	Schindler, W. D.; Hauser, P. J.	Wood Head Publishing, New Delhi, 2004, ISBN- 185573 9054
11.	Textile Finishing	Derek Heywood	SDC Publications, Hampshire, UK, 2003 ISBN-9780901950811

### 14. LEARNING WEBSITES

- a) [www.study.com/academy/lesson/what-is-dyeing-in-textiles.html](http://www.study.com/academy/lesson/what-is-dyeing-in-textiles.html)
- b) [www.fibre2fashion.com/industry-article/3871/dyeing?page=1](http://www.fibre2fashion.com/industry-article/3871/dyeing?page=1)
- c) [www.dyes-pigments.standardcon.com/batch-dyeing-process.html](http://www.dyes-pigments.standardcon.com/batch-dyeing-process.html)
- d) [www.dyes-pigments.standardcon.com/continuous-dyeing-process.html](http://www.dyes-pigments.standardcon.com/continuous-dyeing-process.html)[www.en.wikipedia.org/wiki/Dyeing](http://www.en.wikipedia.org/wiki/Dyeing)
- e) [www.utsavfashion.com/saree/brasso-work](http://www.utsavfashion.com/saree/brasso-work)
- f) [textilefashionstudy.com/what-is-pigment-printing](http://textilefashionstudy.com/what-is-pigment-printing)
- g) [textileapex.blogspot.in/2014/03/pigment-printing-advantages-disadvantages.html?m=1](http://textileapex.blogspot.in/2014/03/pigment-printing-advantages-disadvantages.html?m=1)



- h) [nptel.ac.in/courses/116102010/36](https://nptel.ac.in/courses/116102010/36)
- i) [textilelearner.blogspot.in/2012/03/what-is-heat-setting-working-process-of.html](https://textilelearner.blogspot.in/2012/03/what-is-heat-setting-working-process-of.html)
- j) [textilelearner.blogspot.in/2011/03/description-of-textile-finishing\\_1796.html](https://textilelearner.blogspot.in/2011/03/description-of-textile-finishing_1796.html)
- k) [indiantextilejournal.com/articles/FAdetails.asp?id=3729](https://indiantextilejournal.com/articles/FAdetails.asp?id=3729)
- l) [www.textileglossary.com/terms/soil-release.html](https://www.textileglossary.com/terms/soil-release.html)
- m) [textilelearner.blogspot.in/2013/03/soil-release-finish-mechanism-of-soil.html](https://textilelearner.blogspot.in/2013/03/soil-release-finish-mechanism-of-soil.html)
- n) [www.suitestyles.com/what-is-soil-release-finish/](https://www.suitestyles.com/what-is-soil-release-finish/)

