**Program Name** : **Diploma in Textile Technology**

**Program Code** : **TC**

**Semester** : **Sixth**

**Course Title** : **Quality Control in Textiles**

**Course Code** : **22674**

## 1. RATIONALE

In textile chemical processing fibre, yarn, and fabric are treated with chemicals at various stages to achieve the desired properties. A shop floor process control becomes very crucial during the textile processing. The product of every department needs to be checked using relevant tests for maintaining the quality. These tests provide assurance of quality to both the customer and the manufacturer. Indirectly it helps to maintain efficiency of the current and subsequent processes. Therefore testing of raw material, intermediate products and the final product becomes important aspect of the process. This course is developed in such a way that basic concepts and principles of textile and chemical testing will help the diploma engineer to get quality production by proper testing of textile and chemical. 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:

- **Evaluate various auxiliaries and textile substrate for quality production in textile 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 test for testing of dyes.
b) Use relevant test for testing of chemical.
c) Use relevant test for testing of auxiliary.
d) Use relevant test for quality control in pretreatment.
e) Use relevant test for quality control in dyeing and printing.
f) Use relevant test for quality control in finishing.

## 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 | -- | 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)

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.

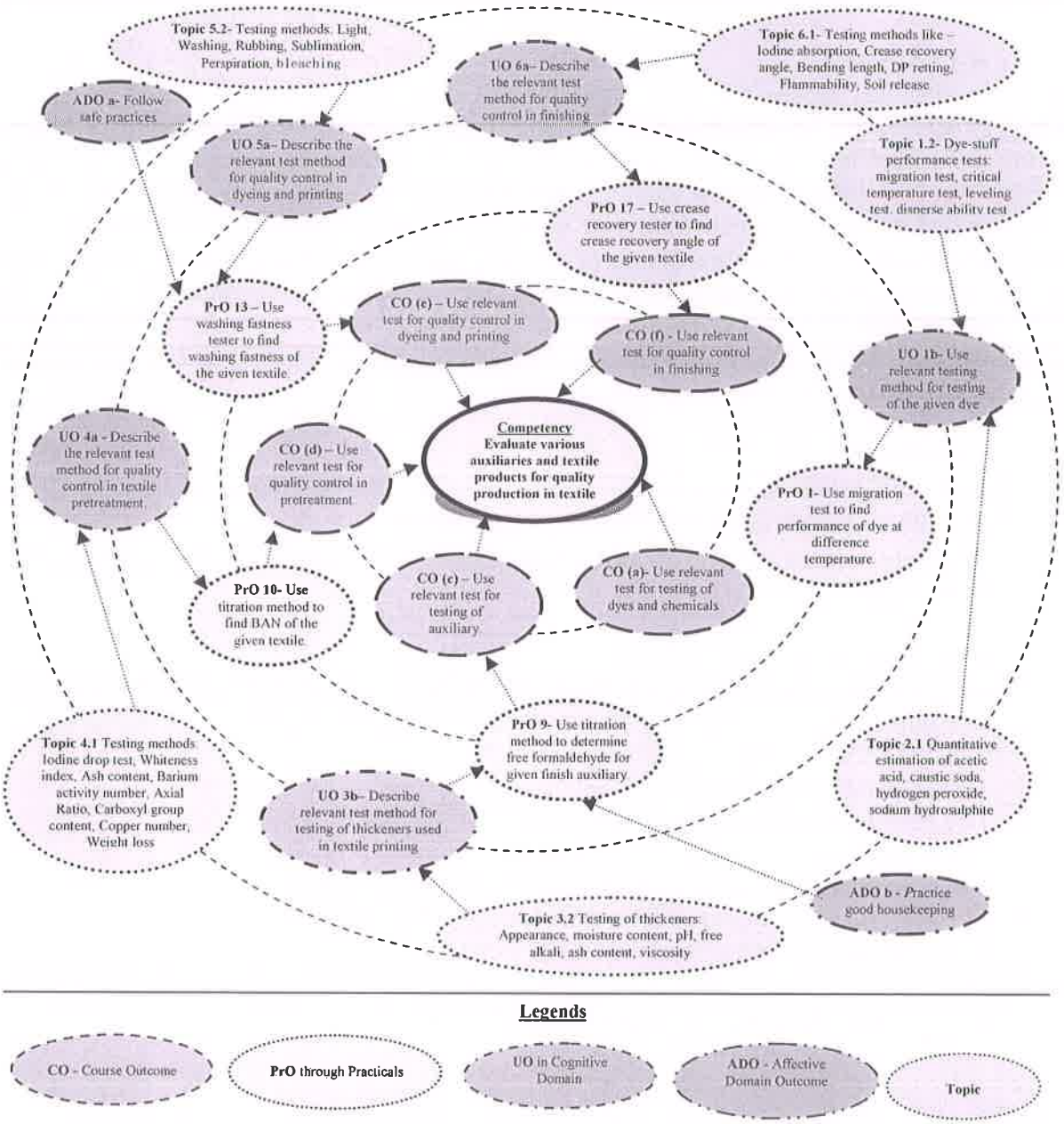


**Figure 1 - Course Map**

## 6. SUGGESTED PRACTICALS

The practical's 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 migration test to find performance of dye at difference | 1 | 2 |

| S. No. | Practical Outcomes (PrOs) | Unit No. | Approx. Hrs. Required |
|---|---|---|---|
| | temperature. | | |
| 2 | Use filtration method to test disperse ability of disperse dye | I | 2* |
| 3 | Use leveling determination test to find leveling property for given direct dye. | I | 2 |
| 4 | Use chemical method to find striping property for the given vat dyes. | I | 2* |
| 5 | Use titration method to find purity of sodium hydrosulphide. | II | 2* |
| 6 | Use titration method to find chelating power of Sodium Hexa-meta Phosphate. | II | 2 |
| 7 | Use titration method to find percentage purity of acetic acid. | II | 2* |
| 8 | Use Drave's test method to determine wetting property for the given wetting agent. | III | 2* |
| 9 | Use titration method to determine free formaldehyde for the given finish auxiliary. | III | 2 |
| 10 | Use titration method to find BAN of the given textile. | IV | 2* |
| 11 | Use titration method to find carboxylic group contain of the given textile. | IV | 2 |
| 12 | Use microscopic test method to find axial ratio of the given textile. | IV | 2 |
| 13 | Use washing fastness tester to find washing fastness of the given textile. | V | 2* |
| 14 | Use rubbing fastness tester to find rubbing fastness of the given textile. | V | 2* |
| 15 | Use sublimation fastness tester to find sublimation fastness of the given textile. | V | 2* |
| 16 | Use perspiration fastness tester to find perspiration fastness of the given textile. | V | 2 |
| 17 | Use crease recovery tester to find crease recovery angle of the given textile. | VI | 2* |
| 18 | Use bending length tester to find bending length of the given textile. | VI | 2* |
| | **Total** | | **36** |

***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 | Preparation of experimental set up | 20 |
| 2 | Setting and operation | 20 |
| 3 | Safety measures | 10 |
| 4 | Observations and Recording | 10 |

| S. No. | Performance Indicators | Weightage in % |
|---|---|---|
| 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..
a) 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
- 'Organization Level' in 2nd year
- 'Characterisation Level' in 3rd year.

## 7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will be useful in uniformity in conduct of practicals, as well as aid to procure equipment by authorities concerned.

| S. No. | Equipment Name with Broad Specifications | PrO. No. |
|---|---|---|
| | **Laboratory Glass Ware** | |
| 1 | Dryer- Temperature range 0 to100 degree Celsius, lab sample drying | 13-16 |
| 2 | Beakers (glass)-100 ml, 500ml, 1 liter, glass rod—20 cm in length | 1-11 |
| 3 | Weighing balance- 3 digit weighing balance | 10-11 |
| 4 | Measuring Cylinder- capacity-10 ml, 100 ml, 1000 ml. | 1-9 |
| 5 | Laboratory glass wears. | 1-11 |
| 6 | Microscope- 10X | 12 |
| 9 | Laundrometer- Capacity 8 Pot each of 500 ml | 13 |
| 10 | Rubbing fatness tester | 14 |
| 11 | Perspiration fastness set up | 16 |
| 12 | Sublimation fastness tester | 15 |
| 13 | Crease recovery angle tester | 17 |
| 14 | Bending length tester | 18 |

## 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 Testing of dyes and chemicals** | 1a. Describe the need of testing the given type of dye.<br>1b. Use relevant testing method for testing of the given type of dye.<br>1c. Describe stripping method for the specified dye from the fabric.<br>1d. Describe testing method for the specified chemical used in textile processing. | 1.1 Importance of testing of dyes.<br>1.2 Dye-stuff performance tests: migration test, critical temperature test, leveling test, disperse ability test,<br>1.3 Stripping of dyes: Acid dye, Vat dye, direct dye.<br>1.4 Quantitative estimation of acetic acid, caustic soda, hydrogen peroxide, sodium hydrosulphite |
| **Unit-II Testing of Auxiliary** | 2a. Describe relevant test method for testing of the specified auxiliary used in textile finishing processing.<br>2b. Describe relevant test method for testing of the specified type of thickeners used in the specified textile printing.<br>2c. Explain relevant test method for testing given type of dyeing auxiliaries.<br>2d. Describe the testing procedure of the specified synthetic stiffeners.<br>2e. Explain relevant test method for testing of the give type of binders. | 2.1 Testing of auxiliaries: finishing auxiliaries – softeners, nature of softeners, solid content, Active content.<br>Performance test: Evaluation of synthetic stiffeners.<br>Evaluation of binder: determination of stability & pH Resin- free formaldehyde, total formaldehyde content.<br>2.2 Testing of printing auxiliaries thickeners: Appearance, moisture content, pH, free alkali, ash content, viscosity.<br>2.3 Testing of dyeing auxiliaries Wetting agents, leveling agent, retarding agent, carriers, dye fixing agents, dispersing agents by performance test. |
| **Unit –III Quality Control in Pretreatment** | 3a. Describe the procedure of the specified test method for quality control in the specified textile pretreatment.<br>3b. State the norms of the specified test methods used in quality control of the specified textile pretreatment. | 3.1 Testing methods: Iodine drop test, Whiteness index, Ash content, Barium activity number, Axial Ratio, Carboxyl group content, Copper number, Weight loss.<br>3.2 Norms for the above test. |

| Unit | Unit Outcomes (UOs) (in cognitive domain) | Topics and Sub-topics |
|---|---|---|
| **Unit-IV Quality Control in Dyeing and Printing** | 4a. Describe the relevant test method for quality control in the specified dyeing and printing.<br>4b. State the norms of test methods used in quality control of the specified dyeing and printing. | 4.1 Principle of colour fastness testing.<br>4.2 Testing methods : Light, Washing, Rubbing, Sublimation, Perspiration, bleaching<br>4.3 Norms for the above test. |
| **Unit-V Quality Control in Finishing** | 5a. Describe the relevant test method for quality control in the specified finishing.<br>5b. State the norms of test methods used in quality control of the specified finishing. | 5.1 Testing methods like – Iodine absorption, Crease recovery angle, Bending length, DP retting, Flammability, Soil release.<br>5.2 Norms for the above test |

***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 | Testing of dyes and chemicals | 12 | 4 | 4 | 8 | 16 |
| II | Testing of Auxiliary | 08 | 2 | 4 | 6 | 12 |
| III | Quality Control in Pretreatment | 12 | 4 | 6 | 8 | 18 |
| IV | Quality Control in Dyeing and Printing | 08 | 2 | 4 | 6 | 12 |
| V | Quality Control in Finishing | 08 | 2 | 4 | 6 | 12 |
| **Total** | | **48** | **14** | **22** | **34** | **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) Visit a local Industry. Collect the samples of various dyes. Write their testing procedure.
b) Collect the various chemical used in textile processing. Write their use in textile processing. Classify them in various processes.

c) Visit local industry and prepare the process flow for various finished fabrics.
d) Market survey for various chemical as par there cost.
e) Collect fabric sample dyed with various dyes, compare their washing fastness and make a report with justification.
f) Collect fabric sample dyed with various dyes, compare their rubbing fastness and make a report with justification.

## 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 are 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 is 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. The concerned faculty could add similar micro-projects:

a) Visit a local Industry. List the dyes used in textile processing. Find out the information about the dyes such as manufacturing process, and role of dyes, market cost, etc. Present the report.
b) Visit a local Industry. List the chemical used in textile processing. Find out the information about the chemical such as strength, manufacturing process, and role of chemical, market cost, etc. Present the report.
c) Collect the sample dyed with various dyes and find their washing fastness. Compare the result and present the data.
d) Collect the sample dyed with various dyes and find their rubbing fastness. Compare the result and present the data.

e) Visit to local industry and collect the sample having various finishes. Carryout relevant testing and present data.

## 13. SUGGESTED LEARNING RESOURCES

| S. No. | Title of Book | Author | Publication |
|---|---|---|---|
| 1 | A Practical Guide to Textile Testing | Amutha, K. | Woodhead Publishing, New Delhi, 2016, ISBN: 9789385059070 |
| 2 | Chemical after treatments of textiles | Marks, Atlas; Wooding | A Wiley Inter Science Publication, New York,1971, ISBN: 9781563675164 |
| 3 | Chemical test method of analysis | Zolotov, Ivanov | Elsevier science, 2015, ISBN: 9780444502612 |
| 4 | Chemical texting of textile | Q Fan | Woodhead Publishing, New Delhi, 2005, ISBN: 9781855739178 |
| 5 | Chemistry: Inorganic Qualitative analysis in the laboratory | Clyde Metz and Mary E. Castellion | Academic Press, 1980, ISBN: 9780125033541 |
| 6 | Handbook of textile and industrial dyeing. | M. Clark | Woodhead Publishing, 2011 ISBN: 9781845696955 |

## 14. SOFTWARE/LEARNING WEBSITES

a) www.aatcc.org/wp-content/themes/twentythirteen-child/image/banners/banner17.jpg
b) pdfs.semanticscholar.org/0783/7cb48a73edc09fd267adedbe82c207a9d6c8.pdf
c) www.blcchemicaltesting.com/chemical-testing/disperse-dyes-testing/
d) www.intertek.com/chemicals/hydrogen-peroxide-testing/
e) www.powellfab.com/technical_information/preview/bleach_strength_test.aspx
f) citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.384.9799&rep=rep1&type=pdf
g) citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.384.9799&rep=rep1&type=pdf
h) www.intertek.com/polymers/testlopedia/ash-content-analysis/
i) www.cotton.org/journal/2008-12/1/upload/JCS12-33.pdf
j) textilelearner.blogspot.com/2011/07/washing-fastness-wash-fastness_2980.html
k) textileapex.blogspot.com/2015/03/colorfastness-to-washing.html
l) textilelearner.blogspot.com/2011/08/color-fastness-to-rubbing-rubbing_1201.html
m) www.testextextile.com/detection-color-fastness-rubbing-color-fastness-perspiration/
n) www.testextextile.com/sublimation-fastness-lightfastness-really-mean-test-color-fastness-light-color-fastness-sublimation/
o) www.tib.eu/en/search/id/tema%3ATEMA20060501388/The-sublimation-fastness-of-disperse-dye/
p) nptel.ac.in/courses/116102029/62
q) textilelearner.blogspot.com/2012/02/determination-of-fabric-crease-recovery.html
r) nptel.ac.in/courses/116102029/51
s) textilelearner.blogspot.com/2012/02/fabric-stiffness-testing-determination.html