

# **SYLLABUS**

**Uttar Pradesh Textile Technology Institute, Kanpur**

**Affiliated to**

**DR. A.P.J ABDUL KALAM TECHNICAL UNIVERSITY, LUCKNOW**



**PROPOSED STUDY & EVALUATION SCHEME**

**FOR**

**B. TECH.**

**(TEXTILE CHEMISTRY)**

**Based on**

**AICTE B. Tech Model Curriculum Structure (MCS)**

**(Effective from the Session: 2020-21)**

**Study & Evaluation Scheme (MCS)**  
**3<sup>rd</sup> Year B. Tech TEXTILE CHEMISTRY**  
**Uttar Pradesh Textile Technology Institute Kanpur**  
**Affiliated to**

**DR. APJ ABDUL KALAM TECHNICAL UNIVERSITY, LUCKNOW**

**3<sup>rd</sup> Year V-Semester**

**Effective from Session-2020-21**

Sl. No.	Subject Codes	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit	
			L	T	P	CT	TA	Total	PS	TE	PE			
1	KTT505	Technology of Dyeing-II	3	1	0	30	20	50		100		150	4	
2	KTT506	Technology of Printing-I	3	1	0	30	20	50		100		150	4	
3	KTT507	Technology of Finishing-I	3	1	0	30	20	50		100		150	4	
4	KTT055/ KTT056	<b>DEPTT. Elective I</b> Polymer Chemistry/Fabric Structure and Analysis	3	0	0	30	20	50		100		150	3	
5	KTT057/ KTT058	<b>DEPTT. Elective II</b> Chemistry of Dyes and Colour Chemistry/ Industrial Chemistry	3	0	0	30	20	50		100		150	3	
6	KTT555	Technology of Dyeing- II Lab	0	0	2					25		25	50	1
7	KTT556	Technology of Printing-I Lab	0	0	2					25		25	50	1
8	KTT557	Technology of Finishing-I Lab	0	0	2					25		25	50	1
9	KTT554	Mini Project or Internship Assessment*	0	0	2			50				50	1	
10	NC	Essence of Indian Traditional Knowledge/Constitution of India	2	0	0	15	10	25		50				
11		MOOCs (Essential for HonsDegree)												
		<b>Total</b>	<b>17</b>	<b>3</b>	<b>8</b>							<b>950</b>	<b>22</b>	

\*The Mini Project or internship (3-4 weeks) conducted during summer break after IV<sup>th</sup> semester and will be assessed during V<sup>th</sup> semester.

The non credit (NC) courses **Essence of Indian Traditional Knowledge/ Constitution of India**, to be done through NPTEL@MOOCS

**Study & Evaluation Scheme (MCS)**  
**3<sup>rd</sup> Year B. Tech TEXTILE CHEMISTRY**  
**Uttar Pradesh Textile Technology Institute Kanpur**  
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**3<sup>rd</sup> Year VI-Semester**

**Effective from Session-2020-21**

Sl. No.	Subject Codes	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	KTT604	Physical Testing of Textiles	3	1	0	30	20	50		100		150	4
2	KTT605	Technology of Printing-II	3	1	0	30	20	50		100		150	4
3	KTT606	Technology of Finishing-II	3	1	0	30	20	50		100		150	4
4	KTT063/ KTT064	<b>DEPTT. Elective III</b> Theory of Dyeing and Colour Measurement / Garment Production and Processing	3	0	0	30	20	50		100		150	3
5		Open Elective-I	3	0	0	30	20	50		100		150	3
6	KTT654	Physical Testing of Textiles Lab	0	0	2				25		25	50	1
7	KTT655	Technology of Printing-II Lab	0	0	2				25		25	50	1
8	KTT656	Technology of Finishing-II Lab	0	0	2				25		25	50	1
9	NC	Essence of Indian Traditional Knowledge/Constitution of India	2	0	0	15	10	25		50			
10		MOOCs (Essential for Hons. Degree)											
		<b>Total</b>	<b>17</b>	<b>3</b>	<b>6</b>							<b>900</b>	<b>21</b>

Essence of Indian Traditional Knowledge/Constitution of India shall be conducted through NPTEL (MOOCs)

**Open Elective-I:**

1. Industrial Automation & Control
2. RAC Product Design
3. Pollution Prevention
4. Idea to Business Model
5. Introduction to Smart grid
6. Integrated Waste Mgt for Smart City

## **5<sup>th</sup> Semester B. Tech. Textile Chemistry**

### **1. Technology of Dyeing-II ( L T P 3-1-0 = 4)**

**Unit – 1:** Mass coloration of Man Made fibres viz, polyester, nylon, acrylics, viscose and various methods- colour additions in polymerization, chips coating, master batch addition systems, Advantages and limitations of the above processes.

**Total lectures required – 9**

**Unit – 2** Dyeing machinery- Jet dyeing m/cs, Beam dyeing, Soft flow m/cs, Infra colour dyeing m/cs, closed jiggers and continuous dyeing ranges.

**Total lectures required – 7**

**Unit – 3:** Polyester dyeing -Preparation of fabric for dyeing, Carrier dyeing of Polyester, Advantages and limitations of carrier dyeing. High temperature dyeing process, Effects of different auxiliaries, typical dyeing cycle, Control and rectification of various problems in High temperature dyeing, Oligomers problem. Thermo fixation Process –Pad liquor preparation, Industrial practice and Thermofixation equipment for dyeing. Dyeing of microdenier and texturised polyester

**Total lectures required – 8**

**Unit – 4 :** Nylon and Acrylic Dyeing - Dyeing theory of Nylon, Dyeing with acid and metal complex dyes, leveling agents, swelling agents, High and low temperature dyeing, dyeing with disperse and reactive dyes. Faults and remedies in Nylon Dyeing. Preparation of acrylic for dyeing, mechanism of dyeing with cationic dyes, Effect of different parameters on dyeing. Effect of different auxiliaries in dyeing. Defitherm process. Dyeing of acrylic with disperse dyes

**Total lectures required – 9**

**Unit 5:** Dyeing of Other Synthetic Fibres and Blends -Dyeing of cellulose acetate and tri acetate, dyeing of modified and unmodified polypropylene, Dyeing of PVA, PVC and polyurethane Fabrics. Batch and continuous dyeing process of poly / cellulose blends, Dyeing of poly / wool, polyester / Acrylic, Polyamide / Wool, Acrylic /Wool, Acrylic / Silk, Dyeing of polyester / modified polyester blend, polyester / Lycra, Acrylic / cellulosic blend

**Total lectures required - 9**

**Grand total of lecture required – 42**

**Reference & text Books:**

1. Technology of Dyeing Vol 6 by V.A. Shenai
2. Dyeing & Chemical technology of Textile Fibres by E.R. Trotman
3. Textile Chemistry Vol II by R.H. Petters
4. Chemical Processing of Synthetic Fibres & Blends by Datye & Vaidhya

**2. Technology of Printing-I (L T P 3-1-0 = 4)**

**Unit (1):** Introduction to printing, methods and styles of printing, classification of printing thickeners and methods of thickeners paste preparation, emulsion thickeners, synthetic thickeners, and mechanism of viscosity build up in emulsion and synthetic thickeners, Rheological behavior of thickeners.

**Total Lectures Required = 9**

**Unit (2):** Preparation of cloth for print paste preparation, wetting agents, hygroscopic chemicals dispersing agents, oxidative and reducing agents etc., precautions.

**Total Lectures Required = 6**

**Unit (3):** Methods of printing - block printing, block preparation, roller printing, roller engraving and chroming, Screen printing- preparation of screens, Manual and automatic flat bed screen printing, rotary screen printing, rotary screen preparation-manual and photosensitive, its method of application, merits and demerits. Faults and prevention in printing methods.

**Total Lectures Required = 10**

**Unit (4):** General methods of print fixation, and machines used for after treatment of printing goods- steaming, ageing, curing etc

Pigment printing of cotton, binder emulsion, print paste recipe and steps involved.

**Total Lectures Required = 9**

**Unit (5):** Various styles of printing- direct, resist & discharge style of printing of cotton using direct, reactive, vat and indigosol colours.

**Total Lectures Required = 10**

**Grand Total of lectures required = 44**

**Text Books/Reference Books:-**

1. Technology of Printing - V.A. Shenai
2. Printing - D.G. Kale
3. Technology of textile printing – R.S. Prayag
4. Textile Printing- L W C Miles ( Dyers Company Publication Trust, Bradford, England)

**3. Technology Finishing-I (L T P 3-1-0 = 4)**

**Unit – 1** Objective of Textile Finishing, Principle of finishing of cotton, wool, silk and linen. Classification of finishing – (a) Mechanical, Chemical, Temporary and durable/ permanent finishes. Finishing machines – Mangle & their function, drying machines, Methods of application- padding, exhaustion, coating, lamination

Mechanical finishes- Stentering, Calendaring, Sanforising, Decatising, embossing, seuding, compacting, raising. **Total lectures-10**

**Unit – 2:** Beetling of linen, Crimping of Silk & rayon. Finishing of woollen fabrics- Dry Wet decatising, Crabbing, Felting, Milling, Permanent Setting, Shrink Proofing, and special finishing of silk. **Total lecture required – 9**

**Unit – 3:**, Heat setting -Objects, types of setting, Mechanism of temporary set and permanent set, Structural changes brought about by heat setting. Concept of grey intermediate and post heat setting. Heat Setting conditions of various yarns and fabrics. Industrial practices of heat setting of polyester and its blends. Various methods to determine the degree of heat setting.

**Total lecture required – 7**

**Unit-4:** Softeners and hand builders-Desirable properties and various classes of softeners, Properties, mode of action and application of cationic, anionic, Non-ionic, reactive and emulsion type softeners. Softeners for cotton, wool, silk, jute, polyester and acrylic. Comparison of various softeners, Classification of stiffeners, examples and their application.

**Total lecture required= 8**

**Unit – 5:** Energy efficient technology-low liquor application, spraying, powder coating and foam technology, blow ratio, foam generator, stabilizer, applicator.

**Total lecture required – 8**

**Total no. of lectures =42**

**Reference & Text Books:**

1. Textile Finishing by V A Shenai
2. Introduction to Textile finishing by J.T. Marsh
3. Chemical Processing of Synthetic Fibres & Blends by Datye & Vaidhya
4. Functional finishes for textiles by Paul, Roshan
5. Principles of textile finishing by Choudhory, Asim kumar Roy

#### **4. Departmental Elective 1 (L T P 3-0-0 = 3) Polymer Chemistry/ Fabric Structure & Analysis**

##### **a) Polymer Chemistry (3-0-0=3)**

**Unit (1)** Scope of Polymer Chemistry, (a) definition of monomers, homo-polymers and copolymers (b) Chemistry of important monomers (c) Thermo sets (d) Thermoplastic (e) Elastomers (f) Tg, Tm, and solution properties of polymers. **Total Lectures Required = 9**

**Unit (2)** Condensation polymerization (b) Mechanism, kinetic and molecular weight build up, (c) Bulk, Solution, Emulsion and suspension polymerization (d) comparison of condensation and addition polymerization. **Total Lectures Required = 8**

**Unit (3):** Addition polymerization , (b) Type of addition polymerization , (c) Radical, cationic and anionic polymerization (d) Mechanism and kinetics of polymerization (e) Copolymerization, Stereo-Regular polymerization, Block and Graft polymerization. **Total Lectures Required = 9**

**Unit (4):** Characterization of molecular weight of polymers, End-Group analysis method, Viscosity of measurement method, gel permeable chromatography. Techniques for measurement Polydispersity **Total Lectures Required = 8**

**Unit (5):** Application of polymer to textiles, Fiber forming synthetic polymer, Properties of fiber forming synthetic polymer. **Total Lectures Required = 8**

**Grand Total Lectures required = 42**

**Text Books & Reference Books:**

1. Text Book of Polymer science by **F.W. Bill Meyer**
2. Text book of Polymer, Vol.I, II, III by **M.S.Bhatnagar**
3. Polymer science by **Gawaskar, Vishwanathan, sreedhar and Jaydev**
4. Polymer chemistry by **B.K.Sharma**

**b) Fabric Structure & Analysis (L T P 3-0-0=3)**

**Unit (1):** Classification of various fabrics, construction of plain weave and its derivatives (rib and mat weave), ordinary twill, right hand twill, warp faced, weft faced & balanced twills, **Total Lectures required = 8**

**Unit (2):** Satin regular, irregular and their extension. Combined twills, end to end and pick- to-pick combination, elongated twills, steep twills, broken twill, curved twill, Fancy twills- large diagonal shaded twills, Wave/ zig-zag, herringbone twill. **Total Lectures Required = 8**

**Unit (3):** Regular and irregular satin, sateen base diagonals and brained twills, Diamond, mock leno, ordinary honeycomb, brighten honeycomb , Huck-a-back and crepe weave. **Total Lectures Required = 9**

**Unit (4):** derivatives of hopsack, barley corn stitched hopsack and twilled hopsack, Ripstop weave, Simple and wadded bed ford cords (1), weft and piques (1), principle of figuring with extra material extra warp figuring, extra weft, limitation of extra thread.

**Total Lectures Required = 9**

**Grand Total Lectures Required = 34**

**Reference Book: -**

1. W. Watson Textile Design & colour Longmans Greens Co. London.
2. Z.J Grosicki Watson's Textile design and colour Newnes Buter Worth, London.
3. Z.J. Grosicki, Advance Textile Design Newnes Butter Worth, London.
4. "Nishant" A Grammar of textile.

## 5. Departmental Elective II (L T P 3-0-0 = 3) Chemistry of Dyes & Colour Chemistry / Industrial Chemistry

### a) Chemistry of Dyes & Colour Chemistry

**Unit 1:** Colour and chemical constitution, Red and blue shift, Orbital theory of valency, Classification of dyes based on constitution, Different types of chromophores

**Total lectures required = 8**

**Unit 2:** (4) Unit organic process/operation- sulphonation, nitration, amination and halogenation. Synthesis of major dye intermediates

**Total lectures required = 8**

**Unit 3:** Azo dyes: Diazotisation and coupling reactions, azoic colours, acid dyes, mono azo dye; diasazo, nitro, diphenylamine and anthraquinone dyes; acid mordant dyes, azo metal complex dyes, direct dyes

**Total lectures required = 10**

**Unit 4:** Vat dyes: Indigoid, anthraquinonoid and polycyclic quinonoid dyes; solubilised vat dyes. Sulphur dyes and sulphurised vat dyes. Reactive dyes: Chlorotriazine and other halo heterocyclic compounds, vinyl sulphone based dyes, high fixation, highly substantive dyes, neutral fixing reactive colours.

**Total Lectures required = 9**

**Unit 5:** Pigments- Phthalocyanine pigments, other organic and inorganic pigments. Optical Brightening Agents- Fluorescence and phosphorescence, Fluorescent brighteners for different fibres.

**Total Lectures required = 7**

**Grand total lectures required = 42**

#### Reference Books:

Colour Chemistry - R L M Allen

Chemistry of dyes and principles of dyeing - V A Shenai

Synthetic dyestuff - Cain & Thrope

Chemistry of Synthetic Dyes - K Venkatraman

Industrial Dyes - Klaus Hunger

Colour Chemistry – Synthesis, Properties and Applications of Dyes and Pigments, Zollinger H

### b) Industrial Chemistry

**Unit (1):** Clausius- Claparyon equation and its applications, General Phase theory-Phase rule, phase equilibrium and P.T. diagram for one component system, Equilibrium in two and three component system. **Total Lectures required = 09**

**Unit (2):** General introduction about Acids- (a)Hydrochloric Acid, Sulphuric Acid (b)Acetic Acid, Formic Acid;(3) Alcohols, Aldehydes, and Ketones and their application in textiles.

**Total Lectures required = 08**



**Unit (3):** General methods of preparation and properties of – Monohydric alcohols, polyhydric alcohols e.g. Glycol and glycerol, Aldehydes-formaldehyde and Ketones-acetone, Dicarboxylic acids- oxalic acid, DMF and their application in textiles. **Total Lectures required = 08**

**Unit (4):** Introduction of Solution- saturated and unsaturated, ideal and non ideal solution Different type of concentration units, Effect of temperature on concentration. **Total Lectures required = 08**

**Unit (5):** Determination of strength of hypochlorite, hydrogen peroxide, hydrosulphite, Estimation of strength of NaOH containing sodium carbonate volumetrically and by Tw meter

**Total Lectures required = 09**

**Grand Total Lectures required = 34**

**Reference books:**

1. Industrial Chemistry by **B.K.Sharma**
2. Synthetic Organic Chemistry by **Chatwal and Gurdeep**
3. Physical Chemistry of Surfaces by **A.W.Adamson**
4. Chemical Principles of Synthetic Fibre Dyeing by **S.M.Burkinshaw**

#### **6. Technology of Dyeing –II Lab (L-T-P 0-0-2) Credit 1**

Carrier dyeing of polyester, HTHP dyeing of polyester in glycerine bath and mini soft-flow machine, their comparative study. Dyeing of nylon with different classes of dyes, acrylic dyeing with cationic dyes. Dyeing of various Blended fabrics.

#### **7. Technology of Printing –I Lab (L-T-P 0-0-2) Credit 1**

Print paste preparation, viscosity measurement, Pigment printing, Direct, discharge and resist style printing of cotton fabric using different dyes such as direct, reactive, vat and solubilized vats.

#### **8. Technology of Finishing –I Lab (L-T-P 0-0-2) Credit 1**

Heat setting of synthetic fabrics and study of its impact on their dyeing behavior, Application of stiffeners. Softener finish using cationic, anionic and non-ionic softeners. Treatment with silicone emulsions. Comparative study of various softener finishes. Coating and lamination

## **6<sup>th</sup> Semester B. Tech. Textile Chemistry**

### **1. Physical Testing of Textiles (L T P 3-1-0= 4)**

#### **Unit I (10 Hours)**

Introduction to Textile testing: Importance of testing, Quality, Relative humidity and standard condition for testing. Moisture content moisture regains, Selection of sample for testing. Different technique for fibre, yarn and fabric sampling. Fibre Testing: Measurement of fibre length and its distribution, fineness, Trash% and strength etc using different methods and instruments. Brief idea about advanced & high volume

fibre testing instruments

**Unit II (08 Hours)**

Procedure for measurement of yarn linear density, measurement of yarn twist, Doubling effect on count and uniformity. stress-strain curve, various methods for finding of yield point, methods for finding of various modulus, estimation of tenacity Single yarn strength and Lea count strength product (CSP) and Corrected Count (CCSP).. Tensile properties and - various type of measuring instruments based on CRT, CRL and CRE and their working principles.

**Unit III (08Hours):**

Nature and causes of irregularities, principles of evenness testing: optical and capacitance methods, evaluations and interpretation of evenness results, concept of index of irregularity. Variance - length curves and spectrogram analysis, yarn imperfections, yarn faults classification, Uster Classimat and Classifault. Yarn hairiness: Importance and assessment techniques.

**Unit IV (10 Hours)**

Testing of fabric Dimensional Properties: Thickness, Area density (GSM),Warp and Weft crimp, Cover factor calculations.

Testing of fabric mechanical Properties: Tensile, Tear, compression and shear, Fabric Abrasion, Pilling, Bursting, flexural rigidity; Drape-ability, Crease recovery.

Transmission behavior of fabrics: Measurement of Air, water, heat and static charge transmission.

**Unit V (06 Hours)**

Garment Testing: Sewability: Seam strength, Seam slippage, Seam pucker, Needle Cutting Index, Low stress Mechanical Properties of Fabric, Primary and total hand value.

**Grand total Lectures required= 42**

Books Recommended:

1. J.E. Booth, Principle of Textile Testing
2. V K Kothari, Testing and quality management Vol-1
3. GAV Leaf, Practical Statistics For The Textile Industry: Part I, The Textile Institute,1984.
4. Saville B P, Physical Testing of Textiles, Woodhead publishing -UK,2004.
5. Jinlian H U, Fabric Testing, Woodhead Publishing,2008.
6. Arindam Basu, Textile Testing (Fibre, Yarn and Fabric), SITRA, Coimbatore,2001.
7. Somasundar S, Application of Statistical Methods in Textile Industry, SITRA, Coimbatore,1998.

**2. Technology of Printing-II (L T P 3-1-0 = 4)**

**Unit-1:** Printing of wool and silk with different dye classes such as reactive, acid, metal complex dyes using the above styles.

**Total lecture required=6**

**Unit-2:** Printing of synthetic and blends- Printing in different styles on polyester, nylon, acrylic and their blends such as P/V, P/C, wool/acrylic, wool/nylon and different types of union fabrics- cotton/wool, cotton/silk etc with different dye classes.

**Total lecture required=10**

**Unit-3:** Other techniques of printing like raised, metal and flock printing, Poly chromatic dyeing, foam printing, bubble printing etc. Spray printing, Tie and dye, Batik printing, Brasso printing.

**Total lecture required=7**

**Unit-4:** Transfer printing- fundamental principles of transfer printing, Sublimation transfer printing of polyester, machines used.

Digital printing - Inkjet printing, concept and practice.

**Total lecture required=9**

**Unit-5:** Printing of non wovens -carpets, hosiery goods and bonded goods, camouflage printing, cost calculation for textile printing.

**Total lecture required=8**

**Grand Total of lecture required=40**

**Text Books/ Reference & text Books:**

1. Technology of Printing by V.A. Shenai
2. Technology of Printing by G.D. Kale
3. Chemical Processing of Synthetic Fibres & Blends by Datye & Vaidhya
4. Textile Printing –L W C Miles

### **3. Technology of Finishing-II (L T P 3-1-0=4)**

**Unit – 1:** Mechanism of creasing and theory of antcrease finish, wash-n-wear, low and no formaldehyde cross linking agents, application of BTCA and CA, Evaluation of wrinkle resistance.

**Total lecture required = 8**

**Unit – 2:** Concept and mechanism of Flame retardancy, Flammability of textile fibres. Concept of LOI. Flame retardant and flame proof finishes on natural fibres, synthetics and blends, temporary and durable finishes, phosphorylation and phosphonylation, use of halogen derivatives. Evaluation of flame retardancy.

**Total lecture required= 10**

**Unit – 3:** Soil release finish – mechanism of soiling, steps of soil release and theory, different soil release finishes, soil repellency, fluorocarbons and Teflon finish. Standard test methods for the finish effect

**Total lecture required=-7**

**Unit – 4:** Water proofing and water repelling, mechanism of water repellency, chemistry and application of silicones, testing of water repellency

Antimicrobial finishing, chemistry of various antimicrobial finishes, application and evaluation.

**Total lecture required=10**

**Unit - 5:** Nano Finishes:- Concept of nano phase materials, Various types of nano finishes, Characterization and their application in textiles: e.g. self cleaning, anti bacterial, UV protection nano finishes.

**Total lecture required =7**

**Grand total of lectures required: 42**

**Reference Books:**

1. Chemical Processing of Synthetic Fibres & Blends by Datye & Vaidya
2. Chemical finishing of textiles by W D Schindler and P J Hauser- Woodhead Publishing Ltd
3. Textile Finishing by V.A. Shenai
4. Textile fibres, dyes, finish and process by Howard L. Needles
5. Textile Finishing: Recent developments and future trends by K.L.Mittal, Thomas Bhaners

#### **4. Departmental Elective II (L T P 3-0-0 = 0) Theory of Dyeing & Colour Measurement / Industrial Chemistry**

##### **a) Theory of Dyeing and Colour measurement (L T P 3-0-0 = 3)**

**Unit – 1:** Evolution of theories of dyeing. Fundamentals of kinetics and thermodynamics of dyeing. Diffusion of dyes. Methods for measurement of diffusion coefficient. Effect of fibre structure on dyeability and diffusion of dyes.

**Total lecture required =10**

**Unit – 2:** Thermodynamic parameters like affinity and heat of dyeing. Thermodynamics of dyeing cotton with direct dye. Glass transition temperature and its influence on dyeing.

**Total lecture required =10**

**Unit – 3:** Source of natural light, sources of artificial light, CIE illuminants, Absorption & scattering of light. Beer-Lambert law, Kubelka-Munk's Equation. Spectrophotometric curves and their relationship to pre-received colour. Instruments for the measurement of the colour of transparent and opaque objects. Principles of spectrophotometry. Colorimeters.

**Unit – 4:** Munsell's system of colour specification. Relationship of hue, value and

chroma. The 1931 CIE system. CMC. Additive and subtractive mixing. Standard observer colour matching functions. Tristimulus values. Chromaticity coordinates. Metamerism. Whiteness & Yellowness Index, Computer aided Colour matching and recipe prediction.

**Total lecture required =10**

**Grand Total no. of lectures =40**

**Reference & Text Books:**

1. Theory of Coloration of Textiles by C L Bird
2. Instrumental Colour measurement and Computer Colour Matching for Textiles by Shah & Gandhi
3. The Theory of Coloration of Textiles- Edited by Alan Johnson
4. Computer Colour Analysis: Textile Applications by A D Sule
5. Cellulose Dyeing by John Shore

**b) Garment Production and Processing (L T P 3-0-0 = 3)**

**UNIT – I**

Automation in Garment Industry-Information Technology in Garment Industry, Microprocessor based machinery in design, pattern making, marker making, cutting, sewing, embroidery, programmable machines.

**Total lecture required =10**

**UNIT – II**

Garment Processing: Dyeing of denim using Indigo Dye, Ring dyeing techniques, factors affecting dyes build-up on cellulosic material, continuous Indigo dyeing range, new Indigo vating & dyeing techniques, finishing of denim fabric, types of denim fabrics and garment printing techniques.

**Total lecture required =10**

**UNIT – III**

Garment Dyeing Machinery, Dyeing and processing of cotton garments, polyester, woollen, acrylic and blended garments, Garment wash technique, Stone-wash, Enzymatic stone wash, stain removal.

**Total lecture required =10**

**UNIT – IV**

Inspection systems – raw material inspection, in process inspection, final inspection, Comparability checks.

Quality Control, Tools of Quality Control; Production planning in garment manufacturing; Cost structure in garment manufacturing; Production technology – manual and mechanical systems.

**Total lecture required =10**

**Grand Total no. of lectures =40**

**Reference Books:**

1. An Introduction to Quality Control for Apparel Industry - PV Mehta
2. Denim- a fabric for all - Parmar MS & Others
3. Managing Quality for Apparel Industry PV Mehta & SK Bhardwaj

**5. Physical Testing of Textiles Lab ( L T P 0-0- 2) Credit 1**

**At least 10 of the following**

**Fibre & Yarn Testing**

1. To determine the fundle strength of cotton fibre
2. To determine the fibre fineness by air-flow method
3. To determine the span length of fibre & analyse it.
4. To determine the Hank and Hank C.V% of the given sliver / Determination of the within bobbin and between bobbin hank C.V % of the given roving.
5. To determine the count of a yarn by using physical/electronic balance.
6. To measure the Single yarn and Ply yarn twist of the given yarn sample using Twist Tester.
7. To determine the Yarn count, Lea Strength and CSP of the given yarn sample.
8. To determine the single yarn strength.
9. To Study evenness and imperfection in the given yarn and compare the results with Uster statistics.
10. To Study the spectrogram and irregularity trace to determine type of irregularity.
11. To prepare yarns Appearance Boards and compare with ASTM standards.

**Fabric & garment Testing**

12. To characterize a woven fabric with respect to its dimensional properties: thread density, yarn number, crimp, weave, cover factor, weight, skewness, thickness
13. To determine the tensile strength of a woven fabric by strip test method. Draw load-elongation curve of a woven fabric.
14. To determine the tear strength of a fabric using Elmendorf tear tester or ballistic tester.
15. To determine the bursting strength of a fabric using hydraulic bursting tester.
16. To determine the abrasion resistance of a fabric.
17. To determine the bending length and flexural rigidity of a woven fabric using the Shirley tester.

18. To determine the crease recovery of fabric and observe the effect of loading time and recovery time on crease recovery.
19. To determine the drape coefficient of woven and knitted fabric using the drape meter.
20. To measure the Air permeability and Fabric Impact Strength of the given fabric.
21. To measure the water permeability of the given fabric.

#### **6. Technology of Printing Lab-II (L T P 0-0-2) Credit -1**

Printing of wool and silk with different classes of dyes, Printing of polyester and selected blends such as P/C, P/V, terry wools, acrylic/wool etc. Nylon and acrylic printing. Mechanical resist print by tie and dye, Batik. Burnt out style printing of polyester/cotton. Sublimation transfer printing, printing of non-wovens.

#### **7. Technology of Finishing Lab-II (L T P 0-0-2) Credit -1**

Resin finishing using glyoxal based cross-linkers, citric acid treatment and evaluation of anti-crease finishes. Fire retardant finish of cotton and synthetic textiles, water repellent finish, soil release finish of polyester and its blends, their evaluation. Anti-microbial finish using select compounds.

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