

FACULTY OF SCIENCES

SYLLABUS

for

B. TECH (TEXTILE CHEMISTRY) (Under Credit Based Continuous Evaluation Grading System) (SEMESTER: V to VIII)

Examinations: 2014-15



GURU NANAK DEV UNIVERSITY AMRITSAR

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B. TECH. (TEXTILE CHEMISTRY) SEMESTER SYSTEM
(Under Credit Based Continuous Evaluation Grading System)

SEMESTER – V

Course Code	Subject	Course Type	Credits	L	T	P
TCL-301	Synthetic Dyeing Technology	C	4	3	1	0
TCL-302	Printing Technology – I	C	4	3	1	0
TCL-303	Finishing Technology – I	C	4	3	1	0
TCL-304	Textile Testing – II	C	4	3	1	0
TCL-305	Introduction to Fabric Manufacture	C	4	3	1	0
TCP-301	Synthetic Dyeing Lab	C	3	0	0	3
TCP-302	Printing Lab – I	C	2	0	0	2
TCP-303	CCM – Lab	C	3	0	0	3

SEMESTER – VI

Course Code	Subject	Course Type	Credits	L	T	P
TCL-306	Blends Dyeing Technology	C	3	3	0	0
TCL-307	Printing Technology – II	C	3	3	0	0
TCL-308	Finishing Technology – II	C	3	3	0	0
TCL-309	Quality and Process Control in Textile Wet Processing	C	3	3	0	0
<i>TCL-310 ♠</i>	<i>Hi-tech Application of Dyes</i>	<i>EL</i>	<i>3</i>	<i>3</i>	<i>0</i>	<i>0</i>
<i>TCL-311 ♠</i>	<i>Textile Testing Standards/Regulations</i>	<i>EL</i>	<i>3</i>	<i>3</i>	<i>0</i>	<i>0</i>
<i>TCL-312 ♠</i>	<i>Recent Trends in Printing & Garment Processing</i>	<i>EL</i>	<i>3</i>	<i>3</i>	<i>0</i>	<i>0</i>
<i>TCL-313 ♠</i>	<i>Bio-Processing of Textiles</i>	<i>EL</i>	<i>3</i>	<i>3</i>	<i>0</i>	<i>0</i>
<i>TCL-314 ♠</i>	<i>Technical Textiles</i>	<i>EL</i>	<i>3</i>	<i>3</i>	<i>0</i>	<i>0</i>
	Interdisciplinary Course – V	ID	3	3	0	0
	Interdisciplinary Course – VI	ID	3	3	0	0
TCP-304	Blends Dyeing Lab	C	3	0	0	3
TCP-305	Printing Lab – II	C	2	0	0	2
TCP-306	Finishing Lab	C	2	0	0	2
TCE-301	Industrial Training	C	6	0	0	6
TCD-301	Research Project*	C	2	0	0	2
♠ Elective Course: To select any one						
* Evaluation of Literature Survey.						

B. TECH. (TEXTILE CHEMISTRY) SEMESTER SYSTEM
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SCHEME

SEMESTER – VII

Course Code	Subject	Course Type	Credits	L	T	P
TCL-401	Business and Financial Management	C	4	3	1	0
TCL-402	Waste Management in Textile Industry	C	4	3	1	0
TCL-403	Garment Manufacturing & Processing Technology	C	4	3	1	0
	Interdisciplinary Course – VII	ID	3	3	0	0
	Interdisciplinary Course – VIII	ID	3	3	0	0
TCS-401	Seminar	C	4	0	0	0
TCD-401	Research Project	C	4	0	0	4

SEMESTER – VIII

Course Code	Subject	Course Type	Credits	L	T	P
TCD-402	Research Project	C	4	0	0	4
TCE-401	Industrial Training (4 Months)	C	16	0	0	16

TCL-301

SYNTHETIC DYEING TECHNOLOGY

Credits: 3-1-0

UNIT – I

1. Machines for Dyeing Synthetics:

The thermosol method. The pad-roll system. Pressure beam dyeing machines: Principle of pressure beam dyeing, precautions and method of beam making, beam loading, heating and cooling, main pump, liquor circulation, sequence of steps involved in beam dyeing and factors controlling dyeing. Jet dyeing and soft-flow machines: The Gaston county machine, advantages over winch dyeing machine, fully flooded jet machines, low liquor ration reel-jet dyeing machines. (15)

2. Technology of Acrylic Dyeing:

Introduction, use of cationic dyes, thermodynamics of dye-adsorption, kinetics of dye adsorption, effect of pH, electrolyte and temperature of dye adsorption, effect of water on PAN fibres, Carrier dyeing, Retarding agents in acrylic dyeing, dye-fibre characteristics, Migrating cationic dyes, Gel dyeing, Dyeing of acrylic using disperse dyes: thermodynamics, kinetics and general considerations. (15)

UNIT – II

3. Technology of Polyester Dyeing:

Introduction, Use of disperse dyes: effect of crystal form of the dye of dye adsorption, effect of particle size and distribution on dye adsorption, effect of dispersing agents on dye adsorption, effect of leveling agents on dye adsorption, effect of temperature on dye adsorption, isomorphism, oligomers, carrier dyeing, solvent assisted dyeing, solvent dyeing, high temperature dyeing, thermofixaion and after clearing. Use of Azoic and vat colorants on polyester. (15)

UNIT – III

4. Technology of Nylon Dyeing:

Introduction, Use of anionic dyes: Barre effects, Acid dyes, mordant dyes, direct dyes and reactive dyes. Use of cationic dyes. Use of non-ionic dyes viz. disperse dyes, disperse reactive dyes, azoic colorants and vat dyes. (15)

Text Books:

1. Engineering in Textile Coloration Edited by C. Duckworth (1983 Edition), Chapter–1 Pages 1-68. The Dyers Company Publication Trust, Distributed by The Society of Dyers and Colorists (SDC), UK.
2. Chemical Principles of Synthetic Fibre Dyeing by S.M. Burkinshaw (1995 Edition). Blackie Academic and Professional (Chapman and Hall), UK.

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TCL-302

PRINTING TECHNOLOGY-I

Credits: 3-1-0

UNIT – I

1. Traditional Methods:

Block printing, engraved copper printing, surface printing and engraved roller printing. (5)

2. Screen-printing:

Hand screen printing, semi-automatic and fully automatic screen printing, rotary screen printing. Design aspects: design selection, repeat sketch, colour separation, step and repeat. Screen production: the photochemical process, flat screens, rotary screens. half-tone and multi-tone printing, laser engraving.

(10)

UNIT – II

3. Transfer Printing:

Sublimation transfer, selection of paper, printing methods, dyes and inks, the mechanism of sublimation transfer, sublimation transfer on natural fibres. Melt transfer printing, film release transfer printing, wet transfer printing. The fundamental mechanism of screen printing. Carpet printing: the stalivart machine, flat screen printing machines, rotary screen printing machines, spray and jet printing machines, foam printing. (15)

UNIT – III

4. Direct Print Coloration:

Pigment Printing: Pigment dispersions, binder systems, thickening systems, pigment printing pastes, advantages and limitations of pigment printing. Pigment printing of polyester / cotton blend. Printing of Cellulosic fibres, printing of polyester/cotton blend with a mixture of dyes: Disperse and reactive dyes, disperse and vat dye, special brands of dyes. Printing of polyester fibres, cellulose acetate fibres, acrylic fibres, polyamide fibres, protein fibres. (20)

5. Azoic Colour Printing:

Introduction. Methods of printing: base printing method: Naphthol printing method: Naphthol Nitrite Padding Method: Naphthol Nitrite Printing Method: Fast Bases. (10)

Text Book:

Textile Printing Edited by Leslie W.C. Miles (1994 Edition). Chapters (1-8). Published by Society of Dyers and Colourists, Bradford.

TCL-303

FINISHING TECHNOLOGY-I

Credits: 3-1-0

UNIT – I

1. Introduction to Finishing:

Wet and dry or chemical or mechanical finishing, application of chemical finishes, drying wet textiles, curing chemical finishes, Calendaring, Emerising, Raising, crepe, linen beetling, compressive shrinkage. (10)

2. Application Methods:

Dip and nip padding, the padding mangle, low wet pick-up application methods, saturation removal methods, spray application systems, foam application methods, comparison of low wet pick up methods, wet on wet application. (5)

UNIT – II

3. Stenters:

Pin and clip stenters rails, fabric entry into stenter, drive system, fabric delivery, heating in stenters, hot flues, contact heating, perforated suction drums, continuous steamers for dye fixation. (5)

4. Hand Building Finishes:

Introduction, the hand building effect, examples of textiles with hand building finishes, typical hand builder chemistry, evaluation methods, trouble shooting (8)

5. Softening Finishes:

Mechanism of the softening effect, cationic softeners, amphoteric soft finishes, non-ionic soft finishes, anionic soft finishes, reactive soft finishes, silicones, typical softened textile articles, product types and their chemistry, compatibility and combinability, evaluation and testing. (8)

UNIT – III

6. Easy care and Durable Press Finishing of Cellulosics:

Introduction, easy care properties, easy care technology, mechanism of easy care and durable press finishing, chemistry of easy care and durable press finishes, application methods, formaldehyde free easy care finishes, compatibility with other finishes, evaluation methods. (9)

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-V
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7. Finishing of Woolen Textiles: Shrinkage Control and Mechanical Finishing:

Setting, Decatizing, Milling, fulling and fabric development, cropping/shearing, fabric conditioning, raising/teaseling, pressing, relaxing/sponging/shrinking, Felting and shrinkage – the dimensional stability problem, measurement of shrinkage- equipment and procedures, shrinkage prevention and control, processing – the issues and options, additional aspects, commercial process routes. (15)

Text Books:

1. Textile Finishing, (Ed.) Derek Heywood Society of Dyers and Colorists, 2003.
2. Chemical Finishing of Textiles, by W.D. Schindler and P.J. Hauser, Woodhead Publishing Ltd, Aug 2004.
3. Handbook of Fiber Science and Technology: Volume–II, Chemical Processing of Fibers and Fabrics Functional Finishes Part–A and Part–B, Edited by Menachem Lewin and Stephen B. Sello.

TCL-304

TEXTILE TESTING-II

Credits: 3-1-0

UNIT – I

1. Fabric Dimensions:

Measurement of fabric length, width, thickness, and fabric weight per unit area and per unit length. Threads per inch in woven fabric, crimp of yarn in fabric, definition, crimp and fabric properties, the measurement of crimp percentage. The W.I.R.A. crimp tester. Textile structure- yarn count, diameter and cloth cover, cover factor and its relation to fabric weight per unit area, crimp, count and cloth setting, crimp, crimp amplitude, cloth setting and cloth thickness. (6)

2. Fabric Properties:

Definition of air permeability, air resistance and air porosity, and measurement of air permeability, air permeability and fabric properties. Thermal properties of fabric, fabric stiffness, drape and handle. The 'Shirley' stiffness tester, bending length, flexural rigidity and bending modulus. The 'Heart loop' test, drape meter, crease resistance and crease recovery, measurement of crease recovery by 'Shirley Crease Recovery tester'. (8)

UNIT – II

3. Serviceability, Wear and Abrasion Resistance:

Purpose of serviceability testing-abrasion and wear, flat, edge and flex abrasion. Testing of abrasion resistance conditioning of specimen, choice of testing instrument, choice of abradant, abrasion motion and direction of abrasion, backing the specimen, end point of test and assessment of abrasion damage. The B.F.T. abrasion testing machine, the pilling of fabrics, I.C.I. pilling box test and Martindale abrasion tester. Flammability-definitions, factors affecting flame resistance. (8)

4. Water and Fabric Relationships:

Waterproof, Shower-proof and Water-repellent fabrics, wettability. Methods of testing – wetting time test, spray test, drop penetration test, Bundesmann test. The penetration of fabrics by water under pressure, the 'Shirley Hydrostatic Head' test, the water percolation test, sinking test, wetting by wicking test. Shrinkage test-relaxation and felting shrinkage, testing for shrinkage, percentage shrinkage. (8)

UNIT – III

5. The Tensile Testing of Textiles:

Definitions, load, breaking load, stress, mass stress, tenacity or specific stress, breaking length, strain, extension, breaking extension, the load-elongation curve, the stress-strain curve, initial Young's modulus, Yield point. 'Work of Rupture', Work factor, Elastic recovery, instantaneous and time dependent effects, loading the specimen beyond the yield point, some factors affecting the tensile properties of textiles and the results obtained from testing instruments. (10)

6. Application of Load and Elongation to Textile Specimen:

CRE, CRL, CRT and CR Stress methods of loading, the Pendulum lever principle with CRT, Stelometer, Balance principle, Pressley fibre bundle strength tester, the inclined plane principle, the Scott I.P. tester, the 'Uster' yarn strength tester, the Ballistic or impact tester. The Strain-gauge principle, advantages and disadvantages of strain-gauge instruments, the 'Instron' tensile testing instrument, yarn strength testing- lea test, C.S.P. skein breaking tenacity, single thread test. Fabric Strength testing- objectives, the hydraulic bursting strength tester, the strip and Grab test, tearing strength, methods of measuring tearing strength- tongue tear test, the tongue double rip tear test, the trapezoid test, the wing-rip tear test, the ballistic tear test, the Elmendorf tearing tester. (10)

7. Evenness Testing

Random and periodic variations, short, medium and long term variations, index of irregularity, limit irregularity, reduction of irregularity by doubling, electronic capacitance evenness testing- the 'Uster Evenness tester', material speed, chart speed and chart contraction, the choice of measuring capacitor, normal and inert testing, imperfection indicator, photoelectric tester, nep counting and nepping potential. (10)

Text Book:

Principles of Textile Testing by J.E. Booth Published by CBS Publishing Company, New Delhi.

TCL-305

INTRODUCTION TO FABRIC MANUFACTURE

Credits: 3-1-0

UNIT – I

1. Clearing, Doubling and Winding:

Objects of clearing, doubling and winding. Twist and twist direction effects, Z on Z Vs Z on S twists balanced and unbalanced yarns, ply, cord and cable yarns, resultant count calculation for ply & cord yarns. Fancy yarns- definition of Boucle, gimp and loop yarns, eccentric or slub gimp yarns, snarl yarn, knop yarn, spiral or corkscrew yarn, chenille yarn, slub yarn, cloud yarn and flock yarn. Introduction to mechanical & electronic yarn clearers, doubling machines (Ring Doubler and TFO) and their comparison. Introduction to autoconer. General introduction to various methods of fabric manufacturing (woven, knitted, braided, lace and net fabrics, felts and non-wovens). (10)

2. Weaving Preparatory:

Warping and sizing-their objects and machines for the same. (10)

UNIT – II

3. Weaving:

Primary, secondary and auxiliary motions of a loom, types of shuttle and shuttleless looms, definition of bottom closed, center closed, semi-open and open shed. (10)

4. Fabric Construction and Design:

Construction of cloth design, classification of weaves (plain weave, twill weave, satin and sateen weave and their derivatives-ribbed effects, mock rib, matt weave, waved twills, herringbone twill, elongated twill, diamond weave) crepe weave, stripe & check effects, lappet, swivel, gauze & leno weaves, pile fabrics-cut & uncut – terry, velvet and corduroy fabrics, combination of two weaves, types of selvages. (10)

UNIT – III

5. Knitting:

Introduction, advantages and disadvantages of knitted fabrics over woven fabrics. Knitting stitches (plain stitch, purl stitch, miss stitch and tuck stitch). Classification of knitted fabrics (weft knit, warp knits). Classification of weft knitted fabrics – plain, rib purl and interlock knit fabrics, Warp knitted fabrics. Defects in knitted fabrics, knits in use, advantages and disadvantages of specified knitted fabric types, weft insertion knits and their advantages. (10)

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6. Felts and Non-Woven:

Definition, dry and wet laid webs, spun and melt blown webs, parallel, cross and random laid webs, adhesive bonding, needle punched fabrics, stitch-bonded fabrics, thermally bonded fabrics, reinforced felts, nonwovens in use. Fabrics formed from non-fibrous materials. (10)

Text Books:

1. Textiles – Fibre to Fabric by Bernard P. Corbman (Latest Edition) Chapter 4, Published by McGraw Hill Book Company, New Delhi.
2. Textiles by A. Wyne–The Motivate Series, Published by Macmillan, Hongkong.

TCP-301**SYNTHETIC DYEING LAB****Credits: 0-0-3**

1. Application of different classes of dyes on synthetic fibres/fabrics/yarn. Preparation of dyeing using different hues and different depths on the following classes of dyes.
2. Basic dyes on acrylic.
3. Disperse dyes on Polyester.
4. Acid and metal complex dyes on nylon.
5. Effect of different parameters and auxiliaries on the above dyeing processes.
6. Stripping of dyed materials and re-dyeing.
7. Shade matching of above dye classes.
8. Determination of washing fastness of dyes of the above dye classes.

Text Book:

Giles Laboratory Course in Dyeing by David G. Duff and Roy S. Sinclair, Fourth Edition, 1989.
The Society of Dyers and Colorists, UK.

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TCP-302

PRINTING LAB-I

Credits: 0-0-2

1. Printing of cotton with Direct, Reactive, Vat, sulphur dyes & pigments.
2. Printing of wool with acid & metal complex dyes.
3. Printing of polyester with disperse dyes & pigments.
4. Printing of various blends e.g. polyester/cotton, polyester/wool and other available blends.
5. Printing of textile fabrics with different styles of printing i.e. Direct, discharge & resist.

Text Books:

1. Textile Printing edited by Leslie W. C. Miles (1994 edition).
2. An introduction to Textile Printing by W. Clarke, Newnes - Butterworths.

Reference:

The Thames & Hudson Manual of Textile printing by Joyee Storey. (1974 Edition).

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-V
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TCP-303

CCM LAB

Credits: 0-0-3

1. Calibration of spectrophotometer.
2. Measurement of colour using spectrophotometer.
3. Measurement of reflectance and its conversion into K/S values.
4. Colorimetric determination of single component and mixture (two components) of dyes in solution.
5. Validation of Lambert-Beer Law and determination of unknown concentrations.
6. Preparation of dye data bases and their recording/storing in CCM.
7. Determination of dye strength after dyeing.
8. Comparison of dye strength after dyeing.
9. Determination of whiteness index.
10. Determination yellowness index.
11. Recipe formulation of unknown shades.
12. Evaluation of color related properties such as metamerism, color constancy.
13. Evaluation of color difference.

Text Books:

1. Color Physics for Industry by Roderick McDonald, Second Edition, 1987, Society of Dyers and Colourists, UK
2. Instrumental Color Measurement and Computer Aided Color Matching for Textile by H.S. Shah and R.S. Gandhi (1990 Edition), Mahajan Book Distributors, Ahmedabad.

TCL-306

BLENDS DYEING TECHNOLOGY

Credits: 3-0-0

UNIT – I

1. Why blending is necessary?

Blending from dyer's viewpoint, composition of blend fabrics, relative importance of individual blends, reasons for development of fibre blends, color effects achieved by blending. (5)

2. Classification of fibre types and their blends:

Classification of fiber types in terms of dyeability, colour distribution attainable on binary blends. (3)

3. Dynamic competition between fiber types in the dyeing of blends:

Introduction, distribution of acid dyes on nylon/wool blends, nylon/polyurethane blends, cross-staining of wool by disperse dyes and basic dyes, the transfer of disperse dyes during thermofixation of polyester/cellulosics blends. (5)

4. Minimizing incompatibility between dyes from different classes:

Interaction between disperse dyes and reactive dyes, interaction between disperse dyes, vat dyes and basic dyes, interaction between anionic dyes and basic dyes. (5)

UNIT – II

5. Principles of design and coloring of differential dyeing methods:

Design of differential- dyeing variant synthetic-polymer yarns, Dyeing of acid-dyeable nylon variants, Dyeing of acid-dyeable/basic-dyeable nylon variants, design of differential-dyeing cellulosic fabrics, Design of differential-dyeing wool keratin derivatives. (2)

6. Nylon/wool and other AA blends:

Dyeing of nylon/wool blends, Blends of wool with other acid-dyeable fibres, Blends of nylon with other acid-dyeable fibres, Dyeing methods and dye selection for AA blends. (2)

7. Wool/acrylic and other AB blends:

Dyeing of wool/acrylic blends, Dyeing of nylon/acrylic blends, Blends of acid-dyeable and basic-dyeable acrylic variants, Blends of modacrylic and acrylic fibres, Blends of amide fibres with modacrylic or acid-dyeable acrylic variants, Blends of basic-dyeable polyester with wool or nylon, Dyeing methods and dye selection for AB blends. (2)

8. Wool/ cellulosic and other AC blends:

Dyeing of wool/cellulosic blends, Exhaust dyeing of nylon/cellulosic blends, Continuous dyeing of nylon/cellulosic blends, Dyeing methods and selection for AC blends. (3)

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9. Cellulosic/ acrylic and other CB blends:

Exhaust dyeing of cellulose/ acrylic blends, Continuous dyeing of cellulosic/ acrylic blends, Blends of cellulosic fibres with modacrylic or acid-dyeable acrylic variants, Blends of basic-dyeable polyester with cotton, Dyeing methods and dye selection for CB blends. (3)

10. Cotton/viscose and other CC blends:

Properties and performance of cellulosic fibres in their blends, Dyeing behavior of cellulosic fibres in their blends, Dyeing methods and dye selection for CC blends. (4)

11. Polyester/ wool and other DA blends:

Dyeing of polyester/ wool blends, Blends of cellulose acetate or triacetate with wool, Dyeing of polyester/ nylon blend, Blends of cellulose acetate or triacetate with nylon, Blends of poly(vinyl chloride) fibres with wool or nylon, Dyeing methods and dye selection for DA blends. (3)

UNIT – III

12. Polyester/ acrylic and other DB blends:

Dyeing of polyester/ acrylic blends, Blends of cellulose acetate or triacetate with acrylic fibres, Dyeing of normal/basic-dyeable polyester blends, Dyeing methods and dye selection for DB blends. (5)

13. Polyester/ cellulosic and other DC blends:

Exhaust dyeing of polyester/ cellulosic blends, Continuous dyeing of polyester/ cellulosic blends, Blends of cellulose acetate or triacetate with cellulosic fibres, Blends of poly(vinyl chloride) fibres with cellulosic fibres, Dyeing methods and dye selection for DC blends. (5)

14. Triacetate/ Polyester and other DD blends

Dyeing properties of disperse-dyeable fibre blends, Dyeing methods and dye selection for DD blends. (5)

15. Dyeing properties of three-component blends

Dyeing of AAA blends, Dyeing of AAB blends, Dyeing of AAC blends, Dyeing of CBA blends, Dyeing of DAA blends, Dyeing of DAC blends, Dyeing of DBA blends, Dyeing of DBC blends, Dyeing of DDA blends, Dyeing of DDC blends, Dyeing methods and dye selection for three component blends. (8)

Text Book:

Blends Dyeing Edited by John Shore (1998 Edition). Chapters 1-15. The Society of Dyers and Colorists (SDC), UK.

TCL-307

PRINTING TECHNOLOGY-II

Credits: 3-0-0

UNIT – I

1. Discharge printing:

Print pastes for discharge printing, problems in discharge printing, application procedures in discharge printing: vat discharges on cellulosic fibres, pigment illuminated discharges, discharges on wool and silk, discharges on secondary cellulose acetate and cellulose triacetate, discharge and discharge-resist processes on polyester fibre, discharges on nylon, acrylic fibres and polyester cellulose blends. (15)

UNIT – II

2. Resist printing:

Resists under aniline black, resists under reactive dyes, vat resists under vat dyed grounds, resists under azoic colorants, resist printing of wool. (10)

3. Special styles: Africa prints, bleeder styles, crimp style and burnt- out styles. (10)

UNIT – III

4. The production and properties of printing pastes:

The requirements, Thickeners, raw materials: Polysaccharides, viscous emulsions, synthetic-polymer thickeners, Print paste rheology, Print paste production, color shop organization. (15)

5. Fixation and after treatment processes:

Fixation of pigment prints, Steamers: batch and continuous steamers, mechanism of fixation processes, dye fixation in steam, high temperature steaming, miscellaneous techniques. Washing - off processes, Washing- off equipment. (10)

Text Books:

1. Textile Printing Edited by Leslie W.C. Miles (1994 Edition). Chapters (1-8).
Published by Society of Dyers and Colourists, Bradford.
2. An Introduction to Textile Printing by W. Clarke, Newnes-Butterworths.

TCL-308

FINISHING TECHNOLOGY-II

Credits: 3-0-0

UNIT – I

1. Water Repellency and Waterproofing:

Introduction, theory of wetting and repellency, fabric construction and preparation for water repellent finishing, water repellent finishes other than fluorochemicals, fluorochemical repellent finishes, repellent finishes, novel treatments with potential for water, oil, soil and stain repellency, waterproofing of textiles, test methods for water repellency, oil repellency and stain resistance (10)

2. Flame Retardant Finishes:

Introduction, hazards of burning textiles, burning and flame retardancy, Mechanisms of flame retardancy, Flame retardant chemistry, Flame retardants for cellulose, Flame retardants for wool, Flame retardants for polyester, Flame retardants for nylon, Flame retardants for other fibres, Flame retarding fibre blends, Novel approach to flame retardancy: Intumescent, Evaluation of flame retardants. (10)

UNIT – II

3. Anti-static and Soil Release Finishes:

Mechanism of antistatic finishes, chemistry of antistatic finishes, conductive fibres, evaluation of antistatic finishes, mechanism of soil release, soil-release chemistry, evaluation of soil release. (7)

4. Antimicrobial Finishes:

Introduction, properties of an effective antimicrobial finish, Mechanisms of antimicrobial finishes, Chemistry of antimicrobial finishes, Evaluation of antimicrobial finishes. (5)

5. Insect Resist and Mite Protection Finishes:

Application of insect resist finishes, Evaluation of insect resist finishes troubleshooting insect resist finishes- Finishes for protection from dust mites, References (10)

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UNIT – III

6. Ultraviolet Protection Finishes:

Introduction, Mechanism of UV protection, Chemistry of UV protection finishes, Evaluation of UV protection finishes, Troubleshooting UV protection finishes and combinability (5)

7. Finishing with Enzymes: Bio-finishes for Cellulose:

Introduction, Action of cellulase enzymes on cellulose, Chemistry of enzyme finishing, Evaluation of bio-finishing, Troubleshooting bio-finishing (5)

8. Coating Laminating, Bonding, Flocking and Prepegging:

Introduction, application of coated fabrics, coating compounds, coating methods and machines, new technological developments in the laminating market, bonding, flocking, prepegging, ovens, environmental considerations, test methods. (8)

Text Books:

- i) Chemical Finishing of Textiles, by W.D. Schindler and P.J. Hauser, Woodhead Publishing Ltd, Aug 2004.
- ii) Textile Finishing, (Ed.) Derek Heywood, Society of Dyers and Colorists, 2003.
- iii) Handbook of Fiber Science and Technology: Volume–II, Chemical Processing of Fibres and Fabrics Functional Finishes Part–A and Part–B, Edited by Menachem Lewin and Stephen B. Sello.

TCL-309 QUALITY & PROCESS CONTROL IN TEXTILE WET PROCESSING

Credits: 3-0-0

UNIT – I

1. Introduction:

Introduction about process control, important functions of a control laboratory in a modern processing house, Major areas of process and quality control in textile wet processing, schematic guidelines for process control in various processing sections. (5)

2. Measures for the important process control operations in textile wet processing:

Inspection of grey fabric, bleaching and mercerizing: desizing, scouring, bleaching (hypochlorite bleaching, H₂O₂ bleaching, Chlorite bleaching), Scouring, mercerizing, drying, Test methods for the determination of concentration of caustic soda and silica in peroxide bleach bath.

- Quality and Process control in Dyeing: General, Quality and Process control in jigger dyeing, package dyeing, continuous dyeing etc.

- Quality and Process control in Printing: General, Tests for the suitability of thickener in the print paste formulation and other concepts.

- Quality and Process control in Finishing: Optimization of finishing parameters to impart various finishes on different fibres. (20)

UNIT – II

3. Process parameters, process modification, any other changes, change in quality due to selection of impure chemicals/faulty fabrics/machine handling. (10)

4. Analysis of various chemical processing steps in terms of process and quality control. Methods to assess quality of processed product after every stage of processing and that of final product. (10)

UNIT – III

5. Standardization of instruments/machines. Analysis of colour to check impurity percentage, evaluation of chemicals to check their efficiencies. (10)

6. Control measures of garment processing. (5)

Text Book:

Process & Quality Control in Chemical Processing – ATIRA Tablet.

TCL-310

HIGH-TECH APPLICATION OF DYES

Credits: 3-0-0

UNIT – I

Hi-tech applications based on optoelectronics, such as dye sensitized solar cells, chemosensors, photochromic materials, liquid crystal displays, and the newer emissive displays such as organic light emitting devices; electronic materials, such as organic semiconductors;

UNIT – II

Imaging technologies, such as electrophotography (photocopying and laser printing), thermal printing, and especially ink-jet printing;

UNIT – III

“Invisible” imaging by using infrared absorbers in optical data storage, computer-to-plate and security printing.

Books:

1. Z. Yoshida and T. Kitao, *Chemistry of Functional Dyes*, Mita Press, Tokyo, Japan, 1989.
2. S.H. Kim, *Functional Dyes*, Elsevier, Amsterdam, 2006.

References:

1. A. Hagfeldt and M. Gratzel, “Molecular Photovoltaics,” *Accounts of Chemical Research*, Vol. 2000, 33, 269.
2. R. M. El-Shishtawy, “Functional Dyes” and Some Hi-Tech Applications, *International Journal of Photoenergy*, 2009, 1-21.

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-VI
(Under Credit Based Continuous Evaluation Grading System)

TCL-311 TEXTILE TESTING STANDARDS/REGULATIONS

Credits: 3-0-0

UNIT – I

Textile testing as an instrument of process improvement and quality upgradation, review of cotton fibre testing methods-High Volume Instruments, testing foreign fiber contamination in cotton, raw silk testing methods-visual examination, winding test, size test, seriplane and serigraph test, cohesion test and conditioned size test, degradation measurements of linen fabric

UNIT – II

ISO standards and regulations for quality: Introduction, ISO 9000 quality standards, benefits of ISO 9000 registration, registration process, associations for standards, regulations and specifications.

UNIT – III

Fabric quality evaluation by objective measurement: Kawabata and FAST systems of testing: Fabric Assurance by Simple Testing (FAST 1,2,3,4 tests), Oko-tex standards and certification procedure. Objective evaluation of silk fabrics.

Books:

1. Nadiger G.S. & Subramanian S., "Testing as An Instrument for Process Improvement and Quality Upgradation", Asian Textile Journal, February-March 2002, page 59-62.
2. Itagi A A, "Raw Silk Testing Methods", Asian Textile Journal, February-March 2002, page 69-75.
3. Rane G.P., Panse V.C. & Choudhary R.B., "Siro FAST in RMG", Proceeding of Developments in Testing Instruments – Workshop at IIT Delhi, September 2002, page 156-162.
4. Lal MB & Iyer KRK, "Cotton Fibre Testing–New Indices and New Challenges", Asian Textile Journal, March 2003, pg 32-34.
5. Giri C C , "Okotex: A Holistic Approach for Textile Testing", Colourage, May 2003, page 49.
6. Micheal M.N., Tera F.M. & Othman E.M., "Degradation Measurements of Linen Fabrics" Colourage, June 2004, page 39.
7. Wellington Sears Handbook of Technical Textiles by Sabit Adanur, page 747-754, (Chapter 23 Standards and Regulations)

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-VI
(Under Credit Based Continuous Evaluation Grading System)

TCL-312 RECENT TRENDS IN PRINTING & GARMENT PROCESSING

Credits: 3-0-0

UNIT – I

A new millennium of textile printing, Introduction, market trends, pre-print procedures, print design, print paste preparation, fabric preparation, screen making. Printing machinery developments: flat-screen machines, rotary-screen machine, digital printing systems, Direct printing styles: pigments reactive dyes on cellulosic fibres, vat dyes on cotton, Transfer printing, Special printing styles, Printing thickeners and rheological studies, Developments in dyes for printing, After treatment of prints, Environmental considerations.

UNIT – II

Digital Printing-Trends & Technique. Introduction, Trends in use of textile printing machines, Merits of digitalization, Inkjet printing, Continuous stream printing, Drop-on-demand, Bubble jet, Valve jet, machinery range in digital printing.

UNIT – III

Spray applications of direct fixing colour on garment. Introduction, Important Features, Application on garment: Direct application on garment, discharge and DPDF colour application, one step discharge/DPDF colour application on denim.

(Current trends in garment processing. Traditional garment processing, Current garment processing, dyeing processes Dyeing machinery, Finishing processes, Finishing machinery, Advantages and disadvantages of garment dyeing, The future of garment processing.

Quality control in the apparel sector. Quality parameters in textiles, quality requirements, care labeling, colorfastness tests, dimensional stability, drying processes employed, flammability, quality norms and the Indian industry

References: The journal articles published during past ten years only.

TCL-313

BIO-PROCESSING OF TEXTILES**Credits: 3-0-0****UNIT – I****Introduction :**

Introduction to enzymes, Classification and nomenclature of enzymes, models of enzyme action, area of application in textile processing.

Bio-Preparation:**Cotton:**

Desizing: Recent developments in desizing process.

Scouring: use of pectinases, proteases, lipases, cutinases and cellulases for scouring, recipes and effect of process condition like pH, temperature, surfactant type and mechanical agitation on scouring efficiency.

Bleaching: Use of oxidoreductases in bleaching processes. Recipes and effect of process condition like pH, temperature.

UNIT – II

Combined processing of desizing, scouring and bleaching with enzymes

Advantages and disadvantages over conventional process of desizing, scouring and bleaching.

Protein fibers

Descaling and bio-carbonization of wool, degumming of silk

UNIT – III**Synthetic fibers**

Pretreatment of synthetic fibers with enzymes

Bio-Dyeing

Reduction of indigo dyes with enzymes, use of enzymes in washing process

References:

1. “*Textile Processing with Enzymes*”; Edited by A. Cavaco-Paulo and G. M. Gübitz, Woodhead Publishing Limited.
2. “*Bio-preparation of Cotton Fabrics*” Tzanko Tzanov, Margarita Calafell, George M. Guebitz, Artur Cavaco-Paulo; *Enzyme and Microbial Technology* 29 (2001) 357–362
3. “*Combined Bio-carbonization and Dyeing of Wool: A Possibility of Using Cell Wall-Degrading Enzymes and 1:1 Metal–Complex Dyes*”; I. C. Gouveia; J. M. Fiadeiro; J. A. Queiroz; *Eng. Life Sci.* 2008, 8, No. 3, 250–259
4. “*Optimization of Papain Treatment for Improving The Hydrophilicity of Polyester Fabrics*”; Hye Rim Kim and Wha Soon Song; *Fibers and Polymers* 2010, Vol.11, No.1, 67-71

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-VI
(Under Credit Based Continuous Evaluation Grading System)

TCL-314

TECHNICAL TEXTILES

Credits: 3-0-0

UNIT – I

Introduction: Definition and scope for technical textiles, History of technical textiles, present and future status of technical textiles, application areas of technical textiles. (3)

Coating and lamination textiles: Introduction, Chemistry of coated textiles, Material used for coating, substrate used for coating, Methods of coating, Physical properties of coated textiles and application of coated textiles. (3)

Textile reinforced composite materials: Introduction to composite material, Textile reinforced structure, Woven structure, knitted, braided and its application in different areas. (4)

Filtration textiles: introduction, theory of dust collection and solid-liquid separation, filtration requirements, concept of pore size and particle size, role of fiber, fabric construction and finishing treatments. (8)

UNIT – II

Geotextiles: Brief idea about geosynthetics and their uses, essential properties of geotextiles, geotextile testing and evaluation, application examples of geotextiles. (7)

Medical textiles: introduction, classification of medical textiles, description and basic requirements of material used for medical textiles. (6)

Protective Clothing: Brief idea about different type of protective clothing, functional requirement of textiles in defense including ballistic protection materials, thermal insulation, Biological and chemical warfare protection, water proof breathable fabrics and high attitude fabrics.(6)

Sports and recreation textiles: Functional requirement of different type of product and their construction. Application areas like Synthetic turfs, sports equipments, accessories and apparel.(6)

UNIT – III

Automotive Textiles: Application of textiles in automobiles, requirement and design for different tyres, airbags and belts, methods of production and properties of textiles used in these applications like railways, aeroplane, marine etc. (7)

Sewing threads, cords and ropes: Types, method of production and applications, functional requirements, structure and properties and application like parachute and bridge. (4)

Other uses of technical textile: Functional requirements and types of textiles used for paper making, agricultural, Sound insulation electronics, power transmission belting, hoses, canvas covers and tarpaulins. (6)

Book Recommended:

“Handbook of Technical Textiles”, Ed., A.R. Horrocks and S.C. Anand, Woodhead Publication Ltd., Cambridge.

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-VI
(Under Credit Based Continuous Evaluation Grading System)

TCP-304

BLENDS DYEING LAB

Credits: 0-0-3

1. To conduct dyeing of all available blends of textile fibres such as cotton, viscose, polyester, wool, nylon, acrylic, silk, lycra.
2. To apply all possible dyeing methods such as single bath dyeing of two components as well as two bath-two stage yeing of two components of a blend.
3. To optimise the dyeing parameters w.r.t temperature, time, role of auxiliaries etc.
4. To develop all possible shade types such as solid shade, contrast etc of the constituting components of a blend.
5. To develop semi-cont. dyeing protocols on Pad mangle.
6. To develop different shades and to match these with standards.

Text Book:

Blends Dyeing Edited by John Shore (1998 Edition). Chapters 1-15. The Society of Dyers and Colorists (SDC), UK.

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-VI
(Under Credit Based Continuous Evaluation Grading System)

TCP-305

PRINTING LAB – II

Credits: 0-0-2

1. Printing of cotton with Direct, Reactive, Vat, sulphur dyes & pigments.
2. Printing of wool with acid & metal complex dyes.
3. Printing of polyester with disperse dyes & pigments.
4. Printing of various blends e.g. polyester/cotton, polyester/wool and other available blends.
5. Printing of textile fabrics with different styles of printing i.e. Direct, discharge & resist.

Text Books:

- i) Textile Printing Edited by Leslie W.C.Miles (1994 Edition)
- ii) An Introduction to Textile Printing by W. Clarke, Newnes – Butterworths

Reference:

The Thames & Hudson Manual of Textile Printing by Joyce Storey. (1974 Edition)

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-VI
(Under Credit Based Continuous Evaluation Grading System)

TCP-306

FINISHING LAB

Credits: 0-0-2

- 1 Crease-resistance finishing of cotton and viscose fabrics
- 2 Crease-resistance finishing of polyester/cotton and polyester/viscose fabrics
- 3 Determination of free formaldehyde in resin finished fabrics
- 4 Simultaneous dyeing and finishing
- 5 Softening and stiffening finishes
- 6 Carbonizing of wool and polyester/cotton fabrics
- 7 Anti-shrink treatments for wool
- 8 Determination of relaxational and washing shrinkage of woolen fabrics

Text Books:

1. Chemical Finishing of Textiles, by W.D. Schindler and P.J. Hauser, Woodhead Publishing Ltd, Aug 2004.
2. Textile Finishing, (Ed.) Derek Heywood, Society of Dyers and Colorists, 2003.
3. Handbook of Fiber Science and Technology: Volume-II, Chemical Processing of Fibres and Fabrics Functional Finishes Part-A and Part-B, Edited by Menachem Lewin and Stephen B. Sello.

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-VI
(Under Credit Based Continuous Evaluation Grading System)

TCE-301

INDUSTRIAL TRAINING

Credit: 0-0-6

Interdisciplinary Course – V

Interdisciplinary Course – VI

TCD-301

RESEARCH PROJECT

Credits: 0-0-2

Evaluation of literature survey

TCL-401

BUSINESS AND FINANCIAL MANAGEMENT

Credit: 3-1-0

UNIT – I

PART-I: Business Management

- 1. Definition and Scope of Management:** Fundamental principles, concept and philosophy of management, its use in major and small scale industries, types of organisation, elements of management. Characteristics and classification of wants. Law of demand, elasticity of demand and supply, market competition, monopoly and monopolistic competition, price determination under competition and monopoly. (6)
- 2. Plant Layout:** Location of factory, layout of plant, building equipment, factors important in decision making about the location of an industry. (4)
- 3. Management Policy:** Concept of scientific management in industry. General understanding of functions of management like decision making, planning, organising, directing and control. Practice of management control and delegation of authority, division into various departments, office management, joint stock companies, cooperative societies, board of directors, managing director, division into various sections. (10)
- 4. Production Management and Control:** Main considerations, factors influencing production control, Product design & development. (5)
- 5. Personnel Administration:** Personnel department, its organisation and function. Management of human resources, selection and training of employees, their welfare and safety, labour incentives/wages and remuneration. Absenteeism and its control. Factory Acts effecting industrial undertaking and workers in the factory. (5)
- 6. TQM and ISO Quality Management systems** (4)

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-VII
(Under Credit Based Continuous Evaluation Grading System)

UNIT – II

7. Role of Sugar/Textile Industry in Promoting Economic Growth Through Social Good.

- a) Microeconomics:- Monoplistic and oligoplistic market, optimisation of production
- b) Microeconomics:- Concept of excise Modvat, VAT, CT-3, Stock Exchange
- c) Textile/sugar economy of India and world. Its impact due to GATT agreement.

(10)

PART – II: FINANCIAL MANAGEMENT:

- 1. Objectives and Functions of Financial Management:** General understanding of marketing management, concept of market and marketing management, pricing policy, marketing media. Factors involved in project estimation, methods employed for the estimation of capital investment. Capital formation, Capital Structure: different sources of finance, types of capital and its cost determination. Capital budgeting decisions, method of appraising investment decision. Depreciation. Methods of determining depreciation, taxes. Optimum batch sizes, production scheduling.

(7)

UNIT – III

2. Capital Budgeting Decisions: method of appraising investment decisions. (3)

3. Costing and Cost Control: Elements of cost, cost factors, budgetry control, forms of budget and their integration, variation f cost with capacity, Break Even point. (3)

4. Invenry Management: Purchase, organisation and control. General understanding of the concept of material management. (3)

Texts:

- (i) Cost Accounting by Jain & Narang. Kalyani Publishers.
- (ii) Financial Management by Khan & Jain, Tata McGraw Hills.
- (iii) Principal & Practice of Management by T.N. Chabra. Dhanpat Rai & Sons, Delhi.
- (iv) Fundamentals of Book keeping & Accountancy by Sharma, Chug & Katyal. S. Dinesh & Comp., Jalandhar.
- (v) Production / Operation Management by B.S. Goyal. Pragti Precaution, Merrut.

TCL-402

WASTE MANAGEMENT IN TEXTILE INDUSTRY**Credit: 3-1-0****UNIT – I**

- 1. Introduction:** Basic understanding of terms such as pollution, industrial pollution, waste, point and non point sources, impact of textile industry on environment (Air, water & soil), toxicity of dyes & processing chemicals, Industrial hygiene & safety. (5)
- 2. Water Quality:** Water sources, water quality parameters such as colour, turbidity, pH, dissolved solids, suspended solids, alkalinity, hardness, chlorides, sulphates, silica, iron etc. and their harmful effects, water consumption, water quality requirement for textile processing and for boilers, Water purification by soda-alum process, Lime-soda process and base exchange process. (5)
- 3. Pollution Aspects in Pre-treatment Processes of Textiles:** Wastewater generation and its characterization from different processes, effects of textile effluents on environment such as effect of colour, biochemical oxygen demand, chemical oxygen demand, phenols, chromium, residual chlorine, oil and grease etc., Pollution loads in pre-treatment processing of cotton, wool and synthetic fibres, Desizing effluents, scouring effluents, bleaching effluents, auxiliary effluents, dyeing effluents. (10)

UNIT – II

- 4. Wastewater Treatment Techniques:** Physical/physico-chemical- Screening, primary sedimentation, adsorption, ion-exchange, coagulation/flocculation, membrane filtration such as reverse osmosis, radiations; Chemical- Neutralisation, Oxidation processes (Chlorination, Hydrogen peroxide), Advanced oxidation processes like Fenton's reagent, ozonation; Electrochemical treatment; Biological treatment- Aerobic (activated sludge, trickling filter, rotating biological contactor), Anaerobic and Sequential aerobic and anaerobic processes, Flow sheet for textile waste effluent. (15)
- 5. Waste Management:** Waste reduction, reducing pollution in textile dyeing, recycling and reuse of dyestuffs and chemicals, waste minimization by using eco-friendly technologies for textile processing such as ecofibres, environmental friendly chemical processing, minimization of chemical usage. (10)

UNIT – III

- 6. Environmental Regulation and Environmental Management Systems:** Regulatory measures for environmental management- Environmental (protection) Act, 1986, The environmental (protection) rules, 1986, International standards-ISO-14000, Discharge standards for textile industrial effluents, Environmental management systems (EMS) and Asset Management (AM), REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals). (5)
- 7. Recent Developments in Wastewater Management in Textile Industry:** Eco-friendly technologies for textile chemical processing, Reducing pollution load: sustainable water consumption and energy, recent developments in colour removal technologies for synthetic textile wastewater as well as real textile industrial effluent, Developments in biological treatment of textile effluents, Recent environmental legislations relating to textile industry. (10)

Texts:

1. Environmental Aspects of Textile Dyeing, Edited by R.M. Christie, Woodhead Publishing Limited, Cambridge, England, 2007.
2. Training Report on The Programme on Treatment and Reuse of Textile Industry Effluents, December 10th to 12th, 2008, Organized by Department of Textile Technology, IIT, Delhi.
3. Chemical Technology in The Pre-treatment Processes of Textiles, Edited by S.R. Karmakar, Elsevier Publications, The Netherlands.
4. Wastewater Management for Textile Industry–An Overview, A.S. Bal, Indian J. Environ. Hlth. 41(4), 264-290, 1990.
5. ISI Standards for Effluent Treatment in Textile Industries.

TCL- 403 GARMENT MANUFACTURING & PROCESSING TECHNOLOGY

Credit: 3-1-0

UNIT – I

1. **Garment Manufacturing Technology:** Brief outlook of garment manufacturing industry and its classification. Concept of garment design and production. Low stress mechanical properties of fabrics and their effect on garment production sequences. Garment sizing. Pattern making and grading, Principles of marker making (spreading and cutting, cutting methods). Sewing faults, their causes and remedies. Different types of sewing machines and their principles, Choice of sewing needles and threads etc. Fusing and pressing machines. Quality control systems in garment manufacturing. (15)

UNIT – II

2. **Garment Processing Machinery:** Introduction to the machinery used for garment processing, its differences / similarities with the machinery used for fabric processing. Principles, sketches and working of wash-wheel, hydro extractor and dryers used in Garment processing. (8)
3. **Garment Dyeing Machines:** Side-paddle machines, overhead paddle machines, Rotating drum machines, Tumblers, High temperature garment dyeing machines, dye boarding machines. (5)
4. **Machine-Washable Knitwear Production Routes:** Introduction, Garment treatments: equipment, scouring and milling procedures for woolen spun knitwear , scouring and anti-cockle procedures for worsted spun knitwear, Garment shrink –resist treatments for knitwear, polymer-only treatments, yarn treatment, continuous treatments, environmental considerations etc. (10)

UNIT – III

5. **Garment Printing:** Introduction, selection of dye classes, printing methods, block printing, roller printing, rotary printing, manual screen printing, flat belt printing, transfer printing, pigment printing, trends in garment printing, foam or raise binder, leathery or plastic printing, khadi printing, metallic print Gold, silver, copper print, Fluorescent & Phosphorescent printing, pearl printing, gliter printing, thermo colour printing and label printing. (8)

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-VII
(Under Credit Based Continuous Evaluation Grading System)

6. **Garment Finishing:** Removal of stains, DP Garments, Permanent silting of woolen garments, wash-n-wear garments, novelty effects, short gun, stone wash, bio wash, sand busting treatments etc. (12)
7. **Defects and Remedies:** Occurrence of defects in the processing of garments and its remedial measures shall be discussed. (2)

Books:

1. Engineering in Textile Coloration Edited by C. Duckworth (1983 Edition), Chapter-1 Pages 1-68. The Dyers Company Publication Trust, Distributed by The Society of Dyers and Colorists (SDC), UK.
2. Chemistry of the Textiles Industry, C.M. Carr.
3. Printing by W.C. Miles.
4. Introduction to Garment Manufacture by G. Cooklin (Blackwell Sciences).

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-VII
(Under Credit Based Continuous Evaluation Grading System)

Interdisciplinary Course – VII
Interdisciplinary Course – VIII

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-VII
(Under Credit Based Continuous Evaluation Grading System)

TCS-401

SEMINAR

Credits: 4

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-VII
(Under Credit Based Continuous Evaluation Grading System)

TCD- 401

RESEARCH PROJECT

Credits: 0-0-4

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-VIII
(Under Credit Based Continuous Evaluation Grading System)

TCD-402

RESEARCH PROJECT

Credits: 0-0-4

B. TECH. (TEXTILE CHEMISTRY) SEMESTER-VIII
(Under Credit Based Continuous Evaluation Grading System)

TCE-401

INDUSTRIAL TRAINING
(Jan-April)

Credits: 16