

ANNA UNIVERSITY:: CHENNAI 600 025
AFFILIATED INSTITUTIONS
M.TECH.TEXTILE TECHNOLOGY
REGULATIONS – 2017
CHOICE BASED CREDIT SYSTEM

1. Programme Educational Objectives (PEOs):

To enable the graduate students of Textile Technology and allied students to

- a. Enhance their knowledge related to the theory of textile processes and textile machinery
- b. Enhance their knowledge on advances in textile processes
- c. Design, conduct and interpret the results of the textile experiments
- d. Design new textile processes and products
- e. Engross in life-long learning to keep abreast with emerging technologies

2. Programme Outcomes (POs):

Upon completion of the programme, the student shall be able to

1. Effectively teach the students at the undergraduate level
2. Innovate new process or product at the textile industry or textile research organizations.
3. Effectively carryout fundamental and applied research, and manage research and development activities in industry and research organizations
4. Manage textile industry and solve technological problems
5. Use the advanced techniques, skills, and modern tools necessary for practicing in the textile industry.
6. Communicate effectively and work in interdisciplinary groups.
7. Review, comprehend and report technological development.

PEO / PO Mapping

PEO	POs						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
a	✓	✓	✓	✓			
b	✓	✓	✓		✓		✓
c			✓	✓	✓	✓	
d		✓	✓		✓	✓	✓
e	✓	✓	✓				✓

1. Semester Course wise PO Mapping

Y E A R	S E M E S T E R	Course Title	1	2	3	4	5	6	7
		I	S	Theory of Short Staple Spinning	✓	✓	✓	✓	
	E	Process Control and Fabric Engineering	✓	✓	✓	✓	✓		
	S	Statistical Application in Textile Engineering	✓		✓	✓	✓		
	T	Polymer Physics	✓	✓	✓			✓	
	E	Clothing Science	✓	✓	✓			✓	
	R	Colorations and Functional Finishes	✓	✓	✓	✓	✓		
	I	Textile Quality Evaluation	✓			✓		✓	✓
	S	Structural Mechanics of Yarns and Fabrics	✓	✓	✓	✓			
	E	Textile Quality Evaluation Lab	✓		✓	✓	✓	✓	
	R	Technical Seminar	✓				✓	✓	✓
	II								
Y E A R	S E M E S T E R	Course Title	1	2	3	4	5	6	7
		Project Work (Phase I)		✓	✓	✓	✓	✓	✓
		Computer Aided Textile Design	✓	✓		✓	✓		
		Internship	✓	✓		✓	✓	✓	✓
		Project Work (Phase II)		✓	✓	✓	✓	✓	✓
II	S								
	E								
	M								
	S								
	T								
	E								
	R								
	III								
	S								
	E								
	M								
	S								
	T								
	E								
	R								
	IV								

	Course Title	1	2	3	4	5	6	7
PROFESSIONAL ELECTIVES	Alternative Spinning Systems	✓	✓	✓	✓			
	Characterization of Textile Polymers	✓	✓	✓				
	Medical textiles	✓	✓	✓			✓	
	Theory of Drafting and Twisting	✓	✓	✓	✓			
	High Performance and Specialty Fibres	✓	✓	✓				
	Nano Technology in Textiles	✓	✓	✓		✓	✓	
	Process Control and Optimization in Yarn Spinning		✓		✓			✓
	Enzyme Technology for Textile Processing		✓	✓	✓		✓	
	Financial Management in Textile Industry	✓			✓		✓	
	Design Concepts in High Speed Fabric Formation		✓	✓			✓	✓
	Management of Textile Effluents				✓		✓	✓
	Textile Reinforced Composites		✓	✓			✓	
	Control Systems and Automation in Textile Engineering		✓			✓	✓	
	Design and Analysis of Textile Experiments		✓	✓		✓		
	Advances in Textile Printing	✓	✓			✓		✓
	Protective Textiles	✓	✓	✓				
	Project Planning and Management		✓		✓		✓	✓
	Process Control in Textile Wet Processing		✓	✓	✓			

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CHOICE BASED CREDIT SYSTEM
I TO IV SEMESTERS CURRICULUM AND SYLLABUS

SEMESTER I

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	TX5101	Theory of Short Staple Spinning	PC	4	4	0	0	4
2.	TX5102	Process Control and Fabric Engineering	PC	4	4	0	0	4
3.	TX5103	Polymer Physics	PC	3	3	0	0	3
4.	TX5151	Statistical Application in Textile Engineering	PC	4	4	0	0	4
5.		Professional Elective I	PE	3	3	0	0	3
6.		Professional Elective II	PE	3	3	0	0	3
TOTAL				21	21	0	0	21

SEMESTER II

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	TX5201	Colorations and Functional Finishes	PC	4	4	0	0	4
2	TX5202	Textile Quality Evaluation	PC	3	3	0	0	3
3	TX5203	Structural Mechanics of Yarns and Fabrics	PC	4	4	0	0	4
4	TX5251	Clothing Science	PC	4	4	0	0	4
5		Professional Elective III	PE	3	3	0	0	3
6		Professional Elective IV	PE	3	3	0	0	3
PRACTICAL								
7	TX5211	Textile Quality Evaluation Lab	PC	2	0	0	2	1
8	TX5212	Technical Seminar	EEC	2	0	0	2	1
TOTAL				25	21	0	4	23

SEMESTER III

Sl. No	COURSE CODE	COURSETITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
THEORY								
1		Professional Elective V	PE	3	3	0	0	3
2		Professional Elective VI	PE	3	3	0	0	3
PRACTICAL								
3	TX5311	Computer Aided Textile Design	PC	2	0	0	2	1
4	TX5312	Internship	EEC	-	0	0	0	1
5	TX5313	Project Work (Phase I)	EEC	12	0	0	12	6
TOTAL				20	6	0	14	14

SEMESTER IV

Sl. No	COURSE CODE	COURSETITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
PRACTICAL								
1	TX5411	Project Work (Phase II)	EEC	24	0	0	24	12
TOTAL				24	0	0	24	12

TOTAL CREDITS: 70

LIST OF ELECTIVES SEMESTER I, PROFESSIONAL ELECTIVE I

Sl. No	COURSE CODE	COURSETITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1.	TX5001	Alternative Spinning Systems	PE	3	3	0	0	3
2.	TX5002	Characterization of Textile Polymers	PE	3	3	0	0	3
3.	TX5091	Medical Textiles	PE	3	3	0	0	3

SEMESTER I, PROFESSIONAL ELECTIVE II

Sl. No	COURSE CODE	COURSETITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1.	TX5003	Theory of Drafting and Twisting	PE	3	3	0	0	3
2.	TX5092	High Performance and Specialty Fibres	PE	3	3	0	0	3
3.	TX5093	Nano Technology in Textiles	PE	3	3	0	0	3

SEMESTER II, PROFESSIONAL ELECTIVE III

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	TX5004	Process Control and Optimization in Yarn Spinning	PE	3	3	0	0	3
2.	TY5071	Enzyme Technology for Textile Processing	PE	3	3	0	0	3
3.	TX5071	Financial Management in Textile Industry	PE	3	3	0	0	3

SEMESTER II, PROFESSIONAL ELECTIVE IV

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	TX5005	Design concepts in High Speed Fabric Formation	PE	3	3	0	0	3
2.	TX5006	Management of Textile Effluents	PE	3	3	0	0	3
3.	TX5094	Textile Reinforced Composites	PE	3	3	0	0	3

SEMESTER III, PROFESSIONAL ELECTIVE V

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	TX5007	Control Systems and Automation in Textiles Engineering	PE	3	3	0	0	3
2.	TX5072	Design and Analysis of Textile Experiments	PE	3	3	0	0	3
3.	TY5091	Advances in Textile Printing	PE	3	3	0	0	3

SEMESTER III, PROFESSIONAL ELECTIVE VI

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	TX5073	Protective Textiles	PE	3	3	0	0	3
2.	TX5074	Project Planning and Management	PE	3	3	0	0	3
3.	TX5008	Process Control in Textile Wet Processing	PE	3	3	0	0	3

PROFESSIONAL CORE (PC)

S. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	TX5101	Theory of Short Staple Spinning	PC	4	4	0	0	4
2.	TX5102	Process Control and Fabric Engineering	PC	4	4	0	0	4
3.	TX5151	Statistical Application in Textile	PC	5	3	2	0	4

		Engineering						
4.	TX5103	Polymer Physics	PC	3	3	0	0	3
5.	TX5251	Clothing Science	PC	4	4	0	0	4
6.	TX5201	Colorations and Functional Finishes	PC	4	4	0	0	4
7.	TX5202	Textile Quality Evaluation	PC	3	3	0	0	3
8.	TX5203	Structural Mechanics of Yarns and Fabrics	PC	4	4	0	0	4
9.	TX5211	Textile Quality Evaluation Lab	PC	2	0	0	2	1
10.	TX5311	Computer Aided Textile Design	PC	2	0	0	2	1

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S. No	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	TX5212	Technical Seminar	EEC	2	0	0	2	1
2.	TX5313	Project Work (Phase I)	EEC	12	0	0	12	6
3.	TX5312	Internship	EEC	-	0	0	0	1
4.	TX5411	Project Work (Phase II)	EEC	24	0	0	24	12

OBJECTIVES

- To enable the students to learn the theory of various operations carried out at different stages of yarn spinning, which would be helpful them in understanding the influence of various parameters on quality and productivity of short staple yarn.

UNIT I FIBRE DISPERSION AND CLEANING 18

Necessity of fibre-individualization; fibre opening and cleaning in blow-room machinery; forces acting on the fibre during carding operation; the mechanism of fibre dispersion, fibre transfer, short fibre removal and trash removal; entanglement and disentanglement of fibres; theory of hook formation; the new approaches to improve fibre-dispersion in carding operation; mechanism of removal of short fibre, neps and trash in comber.

UNIT II ATTENUATION AND FIBRE STRAIGHTENING 18

Principle of roller drafting and its application in yarn production; ideal drafting; factors affecting drafting force, fibre dynamics during drafting, drafting irregularities and their causes and remedies; amount of draft and draft distribution on strand irregularity; the function of aprons in roller drafting; limitation of apron-drafting and the scope for improvement; mechanism of wire-point drafting and its application in yarn production; merits and demerits of wire-point drafting; comparison of wire-point drafting with roller drafting; influence of fibre- extent on yarn quality; improvement of fibre-extent by carding, drafting and combing actions.

UNIT III TWISTING 12

Twisted yarn geometry, forces acting on fibre and yarn during twisting, effect of fibre helix angle on strength, parameters affecting optimum twist level; balloon and spinning triangle formation and their effects on yarn quality and productivity; fundamental requirement to create real twist in a strand, mechanism of twisting principles in ring spinning; separation of twisting and winding actions of yarn; ply twisting, twist balance; modified twisting principles - open end twisting, false twisting, air-jet twisting, air-vortex twisting, up-twisting, two-for-one twisting, hollow-spindle twisting; merits and demerits of modern twisting system.

UNIT IV FIBRE BLENDING AND LEVELLING 12

Importance of achieving homogeneous blending in fibre-mix; types of mixing during spinning preparatory process; lateral and longitudinal fibre blending; analysis of fibre blend index values; process parameters of spinning machinery for processing blended material; influence of intermediate product uniformity on yarn uniformity; different methods of levelling adopted during spinning processes.

TOTAL : 60 PERIODS**OUTCOMES**

Upon completion of this course, the student shall be able apply the knowledge gained for

- Selecting suitable machine and process variables at different processes of yarn spinning to produce better quality yarn with maximum productivity and
- Designing processes for producing yarn of required parameters and Innovating design and process modification.

REFERENCES

1. Carl A. Lawrence "Fundamentals of Spun Yarn Technology", CRC Press, 2003, ISBN: 978-1-56676-821-4.
2. Doraiswamy I., Chellamani P., and Pavendhan A., "Cotton Ginning", Textile Progress, Vol. 24, No.2, The Textile Institute, Manchester 1993. ISBN: 1870812484.
3. Grosberg P. and Iype C, "Yarn Production: Theoretical Aspects", Textile Institute, 1999, ISBN: 1870372034.
4. Klein W., "A Practical Guide to Combing, Drawing and the Roving Frame", The Textile Institute, Manchester, 1999. ISBN: 1870372287.
5. Klein W., "A Practical Guide to Opening and Carding", The Textile Institute, Manchester, 1999. ISBN: 1870812999.
6. Klein W., "A Practical Guide to Ring Spinning", The Textile Institute, Manchester, 1999. ISBN: 1870372298.
7. Klein W., "The Technology of Short-staple Spinning", The Textile Institute, Manchester, 1998. ISBN: 1870812980.
8. Klein W., "Rieter Manual of spinning", Rieter Machine Works, Winterthur, 2014
9. Lord P.R., "Yarn Production: Science, Technology and Economics", The Textile Institute, Manchester, 1999. ISBN: 1870372174.
10. Oxtoby E., "Spun Yarn Technology", Butterworths, London, 1987
11. Salhotra K.R. and Chattopadhyay R., "Book of papers on Blow room, Card", Indian Institute of Technology, Delhi, 1998.
12. Shaw J., "Short-staple Ring Spinning", Textile Progress, The Textile Institute, Manchester, 1982

TX5102

PROCESS CONTROL AND FABRIC ENGINEERING

**L T P C
4 0 0 4**

OBJECTIVES

To enable the students to learn the

- Theory of preparation of yarn for fabric formation and different types of fabric formation techniques and
- Selection and control of process variables during preparatory and fabric formation.

UNIT I WEAVING PREPARATION

12

Yarn quality requirements - weaving and knitting; winding - yarn faults, quality of splice/knot, knot factor and clearing efficiency, Optimum clearing of yarn; wound yarn package requirements for different weft insertion system and high speed knitting warping; control of ends break in warping, warp beam quality requirements; quality control in size recipe, size pick-up control, yarn stretch control, quality requirements of sized beam – defects and their causes and remedies. Control of productivity in winding, warping and sizing; Waste control in winding, warping and sizing.

UNIT II WEAVING

12

Loom accessories – quality requirements and its effects on loom performance; control of cross ends and missing ends. Loom shed productivity control – loom speed, loom efficiency, loom stops. Fabric quality control – fabric defects and their causes and remedies; process control for weaving filament, blend yarn and dyed yarn.

UNIT III KNITTING **12**

Types of stitches and their influence on knit fabric properties; weft knitting – method of setting the machine, factors affecting the formation of loops in weft knitting, performance of different yarns, Fabric defects- causes and remedies.

UNIT IV NON-WOVEN **12**

Quality control in web preparation; Influence of material and process parameters on fabric quality and performance.

UNIT V UNCONVENTIONAL FABRIC FORMATION **12**

3D Fabrics – Structure, Comparison of 2D and 3D fabrics, classifications; Multilayer fabrics – theory, weaving process, fabric properties, applications; 3 D orthogonal weaving – weaving principles, properties and applications; 3D Braiding – 2D braiding, 3 D braiding, multilayer interlock braiding, properties and applications of braided fabric ; concept of 3D multi axial warp knitting.

TOTAL : 60 PERIODS

OUTCOMES

- Upon completion of this course, the student shall be able to select and control the process variables at preparatory and fabric formation to achieve the fabric with required qualities.

REFERENCES

1. Ajaonkar D.B., "Knitting technology", Universal Publishing Corporation, Mumbai, 1998, ISBN: 8185027-34-X.
2. Albrecht W., Fuchs K. and Kittleman W., "Nonwoen fabrics", Wiley Vch, 2003, ISBN :3- 527-30406-1
3. Anadur S., "Handbook of weaving", CRC Press, London, 2001.
4. Booth J.E., "Textile Mathematics-Volume 3", The Textile Institute, Manchester, 1977, ISBN:090073924X.
5. Chandrasekhar Iyer, Bernd Mammel and Wolfgang Schach., "Circular knitting", Meisenbach GmbH, Bamberg, 1995, ISBN: 3-87525-066-4.
6. Hu J., "3-D fibrous assemblies: Properties, applications and modelling of three dimensional textile structures", Woodhead Publishing Ltd., ISBN 1 84569 377 9.
7. Lord P.R. and Mohamed M.H., "Weaving: Conversion of yarn to fabric", Merrow, 1992, ISBN: 090409538X
8. Lunenschloss J., Albrecht W. and David Sharp, "Non-woven Bonded Fabrics", Ellis Harwood Ltd., New York, 1985, ISBN: 0-85312-636-4.
9. Paliwal M.C. and Kimothi P.D., Process control in weaving, ATIRA Publications.
10. Russel S.J., "Hand book of nonwovens", Wood head Publishers, Cambridge, England, 2007.
11. Samuel Raz., "Warp knitting production", Melliand Textilberichte, GmbH, Rohrbacher, 1987, ISBN: 3-87529-022-4.
12. Spencer D.J., "Knitting Technology", III Ed., Textile Institute, Manchester, 2001, ISBN:185573 333 1.
13. Talukdar M.K., Sriramulu P.K. and Ajaonkar D.B., "Weaving: Machines, Mechanisms, Management", Mahajan Publishers, Ahmedabad, 1998, ISBN: 81-85401-16-0

OBJECTIVES

To enable the students to learn about

- Fibre forming polymer characteristics and their related and models describing fibre structure.
- Conducting of experiments to characterize the polymers and fibres

UNIT I**9**

Synthetic fibre forming polymers, definition, terms and fundamental concepts of polymerization; molecular architecture in polymers-configuration and conformation, random chain model and rms end-to-end distance of polymeric chain

UNIT II**9**

Glass transition temperature (T_g), Factors affecting T_g, WLF equation; Rubber Elasticity; Melting and Crystallization, polymer solutions- solubility parameter and its significance to fibre spinning.

UNIT III**9**

Newton's law of viscosity, velocity distribution in flow systems Newtonian and non-newtonian fluids; mass transfer operations: Fick's law of diffusion, solid-liquid extraction and drying operations with application to polymer chips.

UNIT IV**9**

Deformation of elastic solid, viscoelasticity and its measurement, non-linear viscoelasticity, yield behavior of solids and breaking phenomena

UNIT V**9**

Mechanical properties of natural and synthetic fibres, moisture sorption behaviour of natural and synthetic fibres. Models describing fibre structure, Fringed fibrillar and fringed micellar model, One phase model.

TOTAL: 75 PERIODS**OUTCOMES**

Upon completion of this course, the student shall be

- able to correlate the physical properties of polymer to its microstructure
- able to characterize polymers and fibres

REFERENCES

1. Billmeyer, "Textbooks of Polymer Science", 3rd ed., Wiley, 1984.
2. Gordon, "High Polymers", Addison-Wesley, 1963.
3. Gupta.V.B. and Kothari V.K., "Man Made Fibre Production", Chapman and Hall, 1985
4. Hongu T. and Philips G., "New Fibres", Wood Head Publishing Ltd, 1997
5. Kothari V.K., "Textile Fibres: Developments and innovations", IAFL Publication, 2000
6. Odian, "Principle of Polymerization", 3rd ed., Wiley, 1991.
7. Sperling, "Introduction to Physical Polymer Science", Wiley, 1986.

REFERENCES :

1. Douglas C. Montgomery, "Design and analysis of experiments", John Wiley & Sons, Singapore, 2000.
2. Leaf G.A.V., "Practical Statistics for the Textile Industry, Part I and II", the Textile Institute, Manchester, 1984.
3. Montgomery D.C., "Introduction to Statistical Quality Control", John Wiley and Sons, Singapore, 2002.
4. Ronald D. Moen, Thomas W. Nolan, Lloyd P. Provost, "Quality improvement through planned experimentation", McGraw-Hill, 1998.

TX5201

COLOURATIONS AND FUNCTIONAL FINISHES

**L T P C
4 0 0 4**

OBJECTIVES

- To enable the students to learn various finishes applied on the textile fabrics for different applications.

UNITI INKJETPRINTING

12

Concept and, methods of inkjet printing; colour separation; selection of dyes and developments in inks; techno-economical features.

UNITII ENZYMESINPROCESSING

12

Enzymes; Enzymes Kinetics; Enzymes in Chemical processing

UNITIII COATING

12

Coating polymers and auxillaries; Coating techniques and Coated fabric assessment.

UNITIV SOILRELEASEANDANTISTATICFINISHING

12

Detergency and soil release concepts; soil release agents; applications of soil- release finishes and testing; antistatic finishes- measurement, mechanism and antistatic agents applied on substrates.

UNITV UVPROTECTION ANDAPPLICATIONSOFNANOTECHNOLOGY

12

UV radiation; factors affecting UV protection; UV protection finishes; measurement of UV protection. Synthesis of Nanomaterials used in Textiles; Nanocoating methods on textile substrates.

TOTAL:60 PERIODS

OUTCOME

- Upon completion of this course, the student shall be able to state the Need for functional finishes and methods of application of finishes and its evaluation

REFERENCES

1. Cavaco-PauloA. andGubitzG., "Textile processing with enzymes", Woodhead Publishing Ltd, Cambridge, UK, 2003.

2. Choudhury A.K.R., "Modern concepts of colour and appearance", Oxford and IBH Publishing Ltd, 2000.
3. Freifelder D., "Molecular Biology", Jones and Bartlett Publishers Inc. 1987. Nierstrasz V. and Cavaco-Paulo A., "Advances in textile biotechnology", Woodhead Publishing Ltd, Cambridge, UK, 2010.
4. McLaren K., "The color science of Dyes & Pigments", Adam Hilger Ltd., 1983, ISBN 0-85274-426-9.
5. Park J., "Instrumental Colour formulation: A Practical guide", Woodhead Publishing, 1993, ISBN 0901956546.
6. Sule A.D., "Computer colour analysis", New Age International Publishers, 2002.
7. Ujiie H., "Digital Printing of Textiles", Woodhead Publishing Ltd, Cambridge, UK, 2006.

TX5202

TEXTILE QUALITY EVALUATION

**L T P C
3 0 0 3**

OBJECTIVES

To make the students to

- Understand different characteristics of yarns and fabrics
- Understand the effects of fabric characteristics on its end uses
- Test the yarn and fabric samples
- Analyze the various reports generated during quality evaluation of yarns and fabrics and
- Interpret the results obtained through these reports for process and quality control.

UNIT I MASS VARIATION OF TEXTILE STRANDS

5

Depiction of mass variation of textile strands in time and frequency domain; interpretation and significance of U% and CV% for textile strands; classification and analysis of yarn faults created by mass variation

VARIANCE LENGTH CURVES AND SPECTROGRAM OF TEXTILE STRANDS

13

Effect of specimen length and total length on mass variation measurements of textile strands; theory of construction of VL curve; analysis of variance length curves to understand and avoid the introduction of mass variation during the spinning operation; determination of periodic mass variation in the form of spectrogram; determination of theoretical wave length from spectrum; comparison between normal and ideal spectrum; type of faults and their representation in spectrogram; interpretation of superimposed waves in spectrogram

UNIT II TENSILE PROPERTIES OF YARN

5

Influence of testing factors on yarn tensile properties; measurement and application of yarn modulus; creep and stress relaxation of yarn; significance of estimating minimum yarn strength

UNIT III MECHANISM OF FABRIC FAILURE

4

Mode of fabric failure – tensile, tear, abrasion, slippage, bursting and fatigue; influence of fibre, yarn characteristics and fabric structure on fabric failure

UNIT IV COMFORT AND LOW STRESS MECHANICAL PROPERTIES

9

Role of transmission properties on thermal properties and thermal comfort viz., air permeability, water vapour permeability, resistance to penetration of liquid water, resistance to flow of heat and electrical conductivity; low stress mechanical properties during tensile, compression, bending, shear and buckling deformation; influence of low stress mechanical properties of fabrics on fabric handle, tailorability and sewability

UNIT V FABRIC APPEARANCE AND OTHER PROPERTIES

9

Study of fabric appearance in terms of drape, formability, crease recovery, wrinkle recovery and pilling resistance; influence of fibre, yarn characteristics and fabric structure on the fabric appearance; evaluation of fabric properties like dimensional stability, flammability, impact resistance, absorbency

OUTCOMES

Upon completion of this course, the student shall be able to apply the knowledge gained to

- Analyze and interpret the results obtained from quality evaluating systems of yarns and fabrics and
- Design fabrics with appropriate characteristics for the required end uses.

TOTAL : 45 PERIODS

REFERENCES

1. Bishop D.L., "Fabrics: Sensory and Mechanical Properties", Textile Progress Vol. 26/3, 1994. ISBN: 1870812751.
2. Furter R., "Evenness testing in yarn production: Part I", The Textile Institute, Manchester, 1982.
3. Furter R., "Evenness testing in yarn production: Part II", The Textile Institute, Manchester, 1982.
4. Furter R., "Strength and elongation testing of single and ply yarns", The Textile Institute, Manchester, 1985.
5. Instrumentation in the textile industry", Vol. 1; 1996, Instrument Society of America, 1997, ISBN:1556175973.
6. Kothari V.K., "Progress in Textiles: Science & Technology Vol. 1, Testing and Quality Management", IAFL Publications, New Delhi, 1999, ISBN: 81-s901033-0-X.
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9. Lord P.R. and Grover G., "Roller drafting", Textile Progress, Vol. 23 No.4, Textile Institute, 1993, ISBN:1870812468.
10. Ponmwan, J.O, "The Thermal Insulation Properties on fabrics", Textile Progress, Vol. 24, No.4, Textile Institute, 1993, ISBN: 1870812654.
11. Seyam, "Structural Design of Woven Fabric: Theory and Practice", Textile Progress, Vol., 31/3, 1999.
12. Slater K., Charles C., Thomas Springfield I.L., "Human Comfort", 1985.
13. Steadman R.G., "Cotton testing", Textile Progress, Vol. 27, No.1. Text. Inst, 1997, ISBN:1870812859.
14. Ukponmwan J., Mukhopadhuau A. and Chatterjee K., "Pilling", Textile Progress, Vol. 28/3, 1996. ISBN: 1870372153.

OBJECTIVES

To enable the students to learn about

- The structure of ideal and real yarn, migration of fibres in the yarn, breakage mechanism of yarn, mechanics of blended yarns and relationship between structure and property of yarns.
- Geometrical properties of fabrics and its relationship with the mechanical properties of fabric and
- Theory and evaluation of fabric hand.

UNIT I**GEOMETRY OF TWISTED YARNS****12**

Idealized helical yarn structure; yarn count and twist factors, twist contraction; Limits of twist.

PACKING OF FIBERS IN YARNS

Idealized packing; measurement of packing density and radial packing density of yarn; Packing in actual yarns; Specific volume of yarns; measurement of yarn diameter.

UNIT II**12****FIBRE MIGRATION**

Ideal migration, tracer fiber technique, characterization of migration behavior, migration in spun yarns, mechanisms of migration, effect of various parameters on migration behavior.

UNIT III**12****MECHANICS OF CONTINUOUS FILAMENT YARNS**

Analysis of tensile behavior; prediction of breakage; analysis of yarn modulus by energy method; observed extension and breakage of continuous filament yarns;

MECHANICS OF STAPLE FIBRE YARNS

Theoretical analysis of tensile behavior; deduction based on fiber obliquity and slippage; influence of fiber length, fineness and friction on tensile behavior ; strength prediction model for blended yarns.

UNIT IV**12****GEOMETRY OF CLOTH STRUCTURE**

Geometry of Plain and Non-Plain weaves; Peirce and Olofsson models; crimp ratio and thread spacing; Jamming of threads; Crimp interchange; Balance of crimp.

FABRIC DEFORMATION

Fabric deformation under tensile stress; prediction of modulus; tensile properties in bias direction; other fabric deformation – compression, shear, bending and buckling; fabric handle; spiral and skewness formation and its control.

UNIT V**12****KNITTED FABRIC STRUCTURES**

Geometry of weft and warp knitted structures, influence of friction on knit geometry; load extension of warp knit fabrics; biaxial stress behavior of plain-knit fabrics

NONWOVEN STRUCTURES

Structure of felts; mechanical behavior of needle felts; structure of stitch bonded fabrics

OUTCOME

Upon completion of this course, the student shall be able to apply the knowledge gained to

- Estimate the parameters related by structure of yarn and
- Engineer the structure of yarn with required properties and end uses.
- Determine the geometrical parameters of woven, knitted and bonded fabrics and
- Correlate the geometry of fabric with the mechanical properties of fabrics

REFERENCES

1. Goswami B. C., "Textile Yarns: Technology, Structure and Applications", Wiley-Interscience, New York, 1977, ISBN: 0471319007
2. Hassan M. Berery., "Effect of Mechanical and Physical Properties on Fabrics Hand", Wood head publishing Ltd., 2005, ISBN: 13: 978 – 1- 85573 -9185
3. Hearle J. W. S., "Structural Mechanics of Fibers, Yarns and Fabrics", Wiley Interscience, New York, 1969, ISBN: 0471366692
4. Hearle J. W. S., John J., Thwaites. and JafargholiAmirbayat., "Mechanics of Flexible Fibre Assemblies", Sijthoff and Noordhoff, 1980, ISBN : 902860720X
5. Jinlian Hu., "Structure and Mechanics of Woven Fabrics", Woodhead Publishing Ltd., 2004, ISBN: 1855739046

TX5251**CLOTHING SCIENCE****L T P C****4 0 0 4****OBJECTIVES**

To enable the students to learn about the

- Important characteristics of the fabric responsible for its comfort properties and
- Different phenomena which take place in the fabric related to the comfort properties of the fabric.

UNIT I CONCEPT OF CLOTHING**12**

Need and selection of clothing - definition of comfort - components of clothing comfort - Subjective perception of comfort: Psycho-Physiological factors of clothing - Aesthetic concepts of clothing - Various aspects of clothing comfort: thermal comfort - sensorial comfort - body movement comfort. Comfort variables: Thermal and non-thermal comfort variables

UNIT II THERMAL MANAGEMENT IN CLOTHING**12**

Human-clothing-environment system - Thermo-regulation in human body - Heat balance - Heat loss - Thermoregulation through clothing system: Heat exchange through clothing. Thermal comfort of clothing - Measurement of thermal transmission characteristics - Parameters for expressing thermal characteristics - Effect of body motion and wind.

UNIT III MOISTURE MANAGEMENT IN CLOTHING**12**

Moisture transport - Liquid water transfer: wicking and water absorption - Principles of moisture vapour transfer - Evaluation of moisture vapour transmission - Factors affecting heat and mass transfer through fabrics- Parameters expressing heat and mass transmission- Air permeability and measurement.

UNIT IV COMFORT PROPERTIES OF FIBERS, YARNS AND FABRICS**12**

Comfort properties of fibers: Physical modification of fibers - Comfort properties of yarns: Effect of yarn structure characteristics, effect of spinning technique, texturizing - Comfort properties of fabric structures: Fabric constructional parameters, finishing.

UNIT V COMFORT PROPERTY OF CLOTHING**12**

Physical Properties of Clothing and Comfort: Thermal resistance – Water vapor diffusion resistance – Water holding property – Effect of fabric properties – Radiation exchange – Flammability – Clothing with internal spaces.

TOTAL: 60 PERIODS**OUTCOME**

Upon completion of this course, the student shall be able to

- Understand different phenomena such as wetting, wicking and, heat and moisture interaction and
- Correlate the property of the fabric with comfort to the wearer.

REFERENCES:

1. A Das, R.Alagirusamy, "Science in clothing comfort", Woodhead publishing, India ISBN: 978184596789, Jan 2010.
2. G.song, "Improving comfort in clothing", woodhead publishing services in textiles : 106, ISBN: 184569 539, Jan 2011

TX5211**TEXTILE QUALITY EVALUATION LABORATORY****L T P C****0 0 2 1****OBJECTIVE:**

- To practice the students in testing of fibres, yarns and fabrics for important properties.

List of Experiments

1. Testing of neps in card web, sliver, roving and yarns
2. Testing of yarns for appearance, twist and diameter using microscope
3. Measurement of evenness and hairiness
4. Analysis of evenness, hairiness data, diagram, spectrogram and VL curve
5. Measurement of single yarn tensile properties
6. Analysis of tensile property values and stress strain diagrams
7. Measurement and classification of yarn faults
8. Analysis of yarn faults
9. Study of creep and stress relaxation behavior of yarns and fabrics

OUTCOMES:

After the completion this practical course, the students will be able to

- Evaluate fiber, yarn and fabric characteristics using different equipments
- Analyse the results generated from these equipments
- Apply statistical techniques for better explanation

List of Equipments (1 each for 30 students)

Projection Microscope, Nep Count Template, Wrap Reel, Wrap Block, Yarn Twist Tester, Single Yarn Strength Tester, Yarn Unevenness tester, Weighing balance, Yarn appearance Board Winder, Yarn appearance Board (Standards), Yarn fault classifier (optional)

TOTAL: 30 PERIODS

TX5311

COMPUTER AIDED TEXTILE DESIGN

L T P C

0 0 2 1

OBJECTIVE:

- To impart practical knowledge to the students in developing various textile designs using software.

LIST OF EXPERIMENTS

1. Different tools used in computer aided textile design software
2. Development of Dobby design with different weaves
3. Development of Jacquard design for any two designs
4. Development of various motifs using software tools

TOTAL:30 PERIODS

Equipment required for 30 students

Licensed CAD textile design software – 6 licenses

Computer – 6 No.

OUTCOMES:

After the completion this practical course, the students will be able to

- Use different tools in computer aided textile design software
- Development of Dobby design, Jacquard design and various motifs using software tools

TX5001

ALTERNATIVE SPINNING SYSTEMS

L T P C

3 0 0 3

OBJECTIVES

To enable the students to learn the

- Theory of yarn formation by rotor spinning, friction spinning, air-jet spinning and other spinning systems and
- Effect of process parameters used in the spinning system on yarn quality.

UNIT I ROTOR SPINNING

18

Principle of open end spinning; description of the working of the rotor spinning; requirements of the raw materials; preparation of the sliver for rotor spinning; yarn formation and its structure; yarn withdrawal and winding; design of rotor, opening roller, transport tube, navel and their implications on production and yarn quality; developments in rotor spinning machine; production limits; process control; techno economic comparison with ring spinning.

group analysis, osmometry, light scattering, viscometry, gel permeation chromatography, high performance liquid chromatography.

UNIT II MOLECULAR STRUCTURE CHARACTERISATION 13

Infrared, NMR, UV–visible, Raman spectroscopy, mass spectroscopy

UNIT III THERMAL PROPERTIES 9

Thermal properties by differential scanning calorimetry, differential thermal analysis, thermo gravimetry, thermo-mechanical analyzer, dynamic mechanical and dielectric analysis

UNIT IV OTHER PROPERTIES 14

Optical and electron microscopy; TEM, SEM, AFM, X-ray scattering from polymers, birefringence, crystallinity by density measurements, Surface area, pore volume measurements by B.E.T. method, porosimetry, surface energy measurements and particle size measurement.

TOTAL: 45 PERIODS

OUTCOMES

- Upon completion of this course, the student shall be able to interpret data obtained from various analytical instruments.

REFERENCES

1. Bill mayer, "Textbooks of Polymer Science," 3rd ed., Wiley, 1984.
2. Campell D. and White J.R, "Polymer characterization, Physical Techniques", McGraw – Hill, New York, 1969.
3. Gupta V.B. and Kothari V.K., "Man Made Fibre production," Chapman and Hall, 1985.
4. Sperling, "Introduction to Physical Polymer Science," Wiley, 1986.
5. Stamm M., "Polymer surfaces and Interfaces", Springer1st ed., 2008.

TX5091

MEDICAL TEXTILES

**L T P C
3 0 0 3**

OBJECTIVES

To enable the students to learn about

- Different types of biomaterials and
- Biomedical application of textile structures.

UNIT I 9

Biomaterials–introduction, types; natural, polymeric and biological biomaterials

UNIT II 9

Textile based healthcare and hygiene products; application of nano technology in medical hygiene textiles; advanced textile materials in healthcare; infection control and barrier materials; plasma treated barrier materials.

UNIT III **9**
Bandages and pressure garments - elastic and non elastic compression bandages, support and retention bandages; bandaging textiles; evaluation of bandages; bandages for various end uses.

UNIT IV **9**
Wound – types, healing process; requirements of wound dressing; wound care materials – types, advantages and limitations; Testing of wound dressings; advanced wound dressings

UNIT V **9**
Implantable products; sutures – requirements, classifications, specifications, materials and their applications; vascular grafts, artificial ligaments, artificial tendons; scaffolds for tissue engineering; intelligent textiles for medical applications

OUTCOMES

Upon completion of this course, the student shall know the

- Types of materials available for biomedical applications
- Functional requirements of textile structures for specific end uses and
- Selection and characterization of textile materials used for biomedical applications.

TOTAL: 45 PERIODS

REFERENCES

1. Adanur S., “ Wellington Sears Handbook of Industrial Textiles” Technomic Publishing Co., Inc., Lancaster Pennsylvania 1995, ISBN 1-56676-340-1.
2. Allison Mathews and Martin Hardingham ., “Medical and Hygiene Textile Production - A hand book”, Intermediate Technology Publications, 1994.
3. Anand S.C., Kennedy J.F. Miraftab M. and Rajendran S., “Medical Textiles and Biomaterials for Health care”, Wood head Publishing Ltd. 2006.
4. Anand S., “ Medical Textiles”, Textile Institute, 1996, ISBN: 185573317X
5. Horrocks A.R. and Anand S.C, “Technical Textiles”, Textile Institute,1999, ISBN: 185573317X.
6. Joon B. Park. and Joseph D. Bronzino., “Biomaterials – Principles and Applications”,CRC Press Boca Raton London, NewYork, Washington , D.C. 2002
7. Michael Szycher and Steven James Lee, “Modern Wound Dressing: A Systematic Approach to Wound Healing”, Journal of Biomaterials Applications, 1992
8. Rajendran S., “Advanced Textiles for Wound Care”, Woodhead Publishing Ltd., 2009, ISBN 184569 2713.

TX5003

THEORY OF DRAFTING AND TWISTING

L T P C

3 0 0 3

OBJECTIVES

- To enable the students to learn about theory of drafting, twist insertion in ring and alternate spinning systems.

UNIT I

5

Definition of ideal drafting; conditions required to achieve ideal drafting in a roller drafting system; deviations from ideal drafting situation during actual drafting conditions.

UNIT II **13**

Drafting Wave – Condition for drafting wave formation during roller drafting, methods to avoid drafting wave formation, role of apron in controlling drafting wave formation.

Roller Slip – Conditions for the formation of forward and backward slips in the roller drafting systems, measures to avoid roller slip occurrence, causes and control of roller nip movement and roller speed variation during drafting.

UNIT III **5**

Comparison of roller drafting system with wire point drafting system; application of wire point drafting in card and rotor spinning machine.

UNIT IV **5**

Mechanics of imparting strength to a stable-fibre strand by twisting; twist multiplier and the basis of selection of required twist; principles of false twisting; fundamental requirements to create real twist in the strand.

UNIT V **17**

Principle of twist insertion in ring spinning; limitation of ring twisting; principles of twist insertion in open-end spinning; application of this principle in rotor spinning and friction spinning machines; twist formation in air jet spinning and vortex spinning; principle of two-for-one twisting; operating principle involved in the twisting of wrap spun yarns.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course, the student shall be able to

- understand the theory of drafting and principle of twist insertion in ring and other alternative spinning systems.

REFERENCES

1. Foster G.A.R, "The Principles of Roller Drafting and the Irregularity of Drafted Materials", The Textile Institute, Manchester, 1958.
2. Grosberg P. and Iype C., "Yarn Production: Theoretical Aspects", The Textile Institute, Manchester, 1999, ISBN 9781870372039
3. Heinz Ernst, "The Rieter Manual of Spinning", Vol. 5- Rotor Spinning, Rieter Machine works Ltd, 2014, ISBN 13 978-3-9523173-5-8.
4. Herbert Stalder, "The Rieter Manual of Spinning", Vol. 6- Alternative Spinning System, Rieter Machine works Ltd, 2014, ISBN 13 978-3-9523173-6-5.
5. Peter R. Lord, "Handbook of Yarn Production: Technology, Science and Economics", Woodhead Publishing, 2003, ISBN-13: 978-1855736962.

TX5092

HIGH PERFORMANCE AND SPECIALITY FIBRES

L T P C
3 0 0 3

OBJECTIVES

To enable the students to learn about

- Advanced spinning technology for manufacturing high performance fibres, their properties and applications

UNIT I	ADVANCED SPINNING TECHNOLOGY	9
Advances in conventional fibre forming process; gel spinning; liquid crystal spinning; electro-spinning		
UNIT II	HIGH PERFORMANCE FIBRES FOR INDUSTRIAL APPLICATIONS	9
Manufacturing, properties and applications of glass fibres, basalt fibres; carbon fibres, high performance polyethylene fibres; ceramic fibres		
UNIT III	HIGH PERFORMANCE FIBRES FOR MEDICAL APPLICATIONS	13
Manufacturing, properties and applications of alginate fibres; chitosan fibres; regenerated silk and wool protein fibres; synthetic biodegradable fibres		
UNIT IV	SPECIALITY FIBRES	14
Hollow and profile fibres; blended and bi-component fibres; film fibres and functionalized fibres for specific applications; manufacturing, properties and applications of chemical and thermal resistant fibres		

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course, the student shall be able to

- Understand the method of producing high performance fibres
- Select a high performance fibres for right type of end uses

REFERENCES

1. Hearle J. W. S., "High Performance Fibres", Woodhead Publishing Ltd., Cambridge, England, 2001.
2. Hongu T. and Phillips G.O., "New Fibres", Woodhead Publishing Ltd., England, 1997.
3. Kothari V. K., "Textile Fibres: Development and Innovations", Vol. 2, Progress in Textiles, IAFL Publications, 2000.
4. Peebles L.H., "Carbon Fibres", CRC Press, London, 1995.

TX5093	NANO TECHNOLOGY IN TEXTILES	L T P C
		3 0 0 3

OBJECTIVES

- To enable the students to study about
- basic concepts of Nano Technology, preparation, characterization and application of various particles on textile substrates and principle and factors involved in electrospinning

UNIT I		9
Nano Technology: definition and basic concepts, particle size, nano particles; Different types of process: Top down approach, bottom up approach; Synthesis of nano materials used in textiles.		

UNIT II		9
Preparation, characterization, and application of silver, iron, ZnO, TiO ₂ , MgO, SiO ₂ & Al ₂ O ₃ , Indium-tin oxide on textile substrates		

UNIT III **9**
Preparation, Characterisation and application of Ceramic, Carbon black, Clay, and Cellulose Nanowhiskers; Self- assembled nanolayer films; Nano structuring of polymers with cyclodextrins,

UNIT IV **9**
Preparation, Characterization and properties of CNT, application of CNT in polymer and textiles. Effect of process conditions upon CNT structure and properties

UNIT V **9**
Principle of electrospinning. Factors involved in electrospinning of nanofibres; methods to produce nanoyarns, Ecological considerations of nanoparticles and nanofibres

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course, the student shall be able to know about

- Basic concepts of Nano Technology preparation,
- Characterization and application of various particles on textile substrates
- Principle and factors involved in Electrospinning

REFERENCES:

1. Ashutosh Sharma, Jayesh Bellare and Archana Sharma, "Advances in Nanosciences and Nanotechnology", NISCAIR, First Edition, 2004.
2. Bhushan Bharat, "Springer Handbook of Nanotechnology", Springer, 2007.
3. Brown P and Stevens K, "Nano fibres and Nanotechnology in Textiles", Woodhead Publishing Limited, 2007.
4. Brown P and Stevens K., "Nano fibres and Nanotechnology in Textiles", Woodhead Publishing Limited, 2007.
5. "Industry insight Indian nanotechnology", Cygnus Business Consulting and Research, 2006.
6. Jurgen Schulte, "Nanotechnology: Global strategies, industry trends and applications", Wiley Publications, 2005.
7. Lynn E. Foster, "Nanotechnology: Science, Innovation and Opportunity", Prentice Hall Professional Technical Reference, 2005.
8. Mark Ratner & Daniel Ratner, "Nanotechnology: A Gentle Introduction to Next Big Idea", Prentice Hall Professional Technical Reference, 2002

TX5004 **PROCESS CONTROL AND OPTIMIZATION IN YARN SPINNING** **L T P C**
3 0 0 3

OBJECTIVES:

To enable the students to understand

- The process control at different stages of spinning preparatory and ring spinning process to achieve yarn of required quality

UNIT I **BLOWROOM PROCESS** **9**

Opening and cleaning efficiency-assessment and control; optimization of trash removal, control of lint in waste; causes for neps generation, control; role of blowroom accessories; assessment and control of blowroom output quality, its influence on yarn quality; process changes for processing manmade fibres

OBJECTIVES

To enable the students to learn about

- Enzymes, types and kinetics of enzyme reaction on textile fibres
- Application of enzymes on different fibres and
- Treatment of enzyme effluents.

UNIT I ENZYMES**9**

Nomenclature and classification of enzymes; characteristic features of enzymes; modifiers of enzyme activity - activators and inhibitors; specificity of enzyme action; extraction and purifications of enzymes.

UNIT II ENZYME KINETICS**9**

Kinetics of single-substrate enzyme-catalysed reactions; Basics of kinetics of multi-substrate enzyme-catalysed reactions.

UNIT III ENZYMES FOR COTTON FIBRE**9**

Chemistry and structure of cotton fibre; enzymes in pretreatment of cotton substrates – desizing, scouring, bleaching and bio finishes.

UNIT IV ENZYMES FOR OTHER FIBERS**9**

Enzymes for processing and functionalizing protein fibres; enzymatic modification of polyester, polyamide, polyacrylonitrile and cellulose acetate fibres.

UNIT V ENZYMES IN EFFLUENT TREATMENT**9**

Enzyme technology and biological remediation, Enzyme decolourisation and decolouration by biosorption and enrichment cultures.

TOTAL : 45 PERIODS**OUTCOMES**

Upon completion of this course, the student shall be able to

- Give the rationale for selecting enzymes for particular processing and
- Appreciate limitations of existing processing operations using chemicals.

REFERENCES

1. Cavaco-Paulo A. and Gubitza G., "Textile processing with enzymes", Woodhead Publishing Ltd, Cambridge, UK, 2003.
2. Freifelder D., "Molecular Biology ", Jones and Bartlett Publishers Inc. 1987.
3. Nierstrasz V. and Cavaco-Paulo A., "Advances in textile biotechnology", Woodhead Publishing Ltd, Cambridge, UK, 2010.

OBJECTIVES

To enable the students to learn about

- Costing of textile products
- Different sources of finance, cost of capital and investment appraisal techniques
- Financial statements

UNIT I**14**

Goals and functions of finance; types of costs; costing – concepts, classification; preparation of cost sheet; costing of yarn, fabric and garments; breakeven analysis

UNIT II**9**

Investment appraisal; Payback period method, Accounting Rate of Return; DCF methods - IRR, NPV, PI; depreciation - concept, methods

UNIT III**9**

Capital structure; sources of finance-debt, equity; cost of capital; working capital management; estimation of working capital

UNIT IV**13**

Tools of financial analysis and control – profit and loss account, balance sheet; financial ratio analysis; analysis of operating and financial leverage; dividend policy; illustrations for spinning mill, composite mill and garment industry

OUTCOMES

Upon completion of this course, the student shall be able to

- Calculate the cost of yarn, fabric and garment
- Identify the sources for capital and calculate cost of capital
- Calculate depreciation and carryout investment appraisal
- Interpret and analyze financial statements

TOTAL: 45 PERIODS**REFERENCES**

1. Aswat Damodaran, "Corporate finance theory and practice", John Wiley and Sons, Asia., 2000.
2. Bhave P.V. and Srinivasan V., "Costing accounting to textile mills", ATIRA, Ahmadabad, 1976.
3. Hrishikes Bhattacharya, "Working capital management", strategies and techniques", Prentice – Hall of India Pvt.Ltd., New Delhi, 2001.
4. James C. Vanhorne, "Financial management and policy", Pearson Education Asia (Low priced edition) 12th edition, 2002.
5. Khan and Jain, "Basic financial management and practice", Tata McGraw Hill, New Delhi, 5th edition, 2001.
6. Narang, G. B. S. and Kumar V., "Production and costing", Khanna Publishers, New Delhi, 1988.

3. Advances in Carpet Manufacture, K.K. Goswami, Woodhead Publishing, ISBN: 978-1-84569-353-6.
4. Advances in Modern Woven Fabric Technology by SavvasVassiliadis, In Tech, Croatia, 2011, ISBN 978-953-307-337-8.
5. Braiding Technology for Textiles, Y.Kyosev, Woodhead Publishing, 2015, ISBN: 978-0-85709-1352.
6. D.J. Spencer, "Knitting Technology", 2nd Edn., Pergamon Press, 1989.
7. O. Talavasek and V. Svaty, "Shuttleless Weaving Machine", Elsevier Scientific Publishing Co. Amsterdam, 1981.
8. Principles of Fabric Formation, P.K.Banerjee, CRC Press, 2015, ISBN: 978-1-4665-5445-0.

TX5006

MANAGEMENT OF TEXTILE EFFLUENTS

L T P C

3 0 0 3

OBJECTIVES

To enable the students to learn about

- Pollutants from textile chemical processing industry, treatment and Government regulations.

UNIT I

9

Industrial policy of India; pollution monitoring and control; functions and activities of Ministry of environment; Central and State pollution control boards; environmental clearance and guidelines for industries; environment impact assessment; fiscal incentives for environmental protection; environmental auditing.

UNIT II

9

Wastewater characteristics; wastewater treatment - objectives, methods and implementation considerations; recycling of effluents.

UNIT III

9

Identification and reduction of pollution sources in textile wet processing; pollution control in man - made fibre industry; analysis of textile processing effluents – colour, odour, pH, total solids, suspended solids, total dissolved solids, BOD, COD, total alkalinity, chloride, sulphates, calcium and chromium; tolerance limits for effluents; bio - degradability of textile chemicals and auxiliaries.

UNIT IV

9

Technical regulations on safety and health aspects of textile materials – banned dyes and chemicals; eco labeling, eco friendly textile processes - machines and specialty chemicals; natural dyes and environmental considerations.

UNIT V

9

Need for solid and hazardous waste management in textile industry, types and sources of solid and hazardous wastes, storage, collection and transport of wastes, waste processing technologies, waste disposal

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of this course, the student shall know

- The hazards due to pollutants from textile chemical processing industry
- Method of treatment of pollutants
- Managing pollutants as per Government regulations and Methods of green processing.

REFERENCES

1. Chritie R., "Environmental aspects of textile dyeing", Woodhead Publishing Ltd, 2007.
2. Cooper P., " Colour in Dyehouse Effluent", Woodhead Publishing Ltd, 1995.
3. Eco-Textiles: Regulations, Labels, Processing and Testing, A Special Report", The Bombay Textile Research Association, Mumbai, 1996.
4. George Thobanoglous and Franklin L. Burton., "Waste Water Engineering and Treatment, Disposal, Reuse (Metcalf & Eddy Inc., California)", Tata McGraw-Hill Publishing co Ltd, New Delhi, 1995.
5. Manivasakam N., "Treatment of Textile Processing Effluents (including analysis)", Sakhi Publications, Coimbatore, 1995.
6. Skelly J. K., "Water Recycling in Textile wet Processing", Woodhead Publishing Ltd, 2003.
7. Slater K., "Environmental impact of textiles: Production Processes and Protection", Woodhead Publishing Ltd, 2003.
8. Symposium Proceedings on Eco - Friendly Textile Processing", Department of textile Technology, Indian Institute of Textile Technology, New Delhi, 1995.
9. Trivedi R.K., "Handbook of Environmental laws, Acts, Guidelines, Compliances and Standards", Vol. 1, Enviro Media, India, 1996.

TX5094

TEXTILE REINFORCED COMPOSITES

L T P C

3 0 0 3

OBJECTIVES

To enable the students to learn about

- Reinforcements, matrices used for the composites
- Manufacture and testing of composites and
- Mechanics of failure of composites

UNIT I REINFORCEMENTS

9

Manufacturing, properties and applications of Glass, Quartz, Boron, Silicon carbide, Carbon, HPPE and Aramid fibers.

UNIT II MATRICES

9

Preparation, Chemistry, Properties and applications of thermoplastic and thermoset resins- Unsaturated Polyester, Vinyl Ester, Epoxy, Phenolics, polyimides, polyurethanes, polyamides, Polypropylene, PEEK and Polycarbonate

UNIT III COMPOSITE MANUFACTURING

9

Composites manufacturing for both thermoplastics and thermosets- Hand layup, Filament

Winding, Resin transfer moulding, prepregs and autoclave moulding, pultrusion, vacuum impregnation methods, compression moulding; post processing of composites and Composite design requirements

UNIT IV TESTING 9

Fibre volume and weight fraction, specific gravity of composites, tensile, flexural, impact, compression, interlaminar shear stress and fatigue properties of thermoset and thermoplastic composites.

UNIT V MECHANICS 9

Micro mechanics, macro mechanics of single layer, macro mechanics of laminate, classical lamination theory, failure theories and prediction of interlaminar stresses using software

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course, the student shall be able to

- Select different types of textile reinforcements and matrices for the manufacture of composites for getting different characteristics and
- Evaluate the characteristics of composites

REFERENCES

1. Bor Z.Jang, "Advanced Polymer composites", ASM International, USA, 1994.
2. Carlsson L.A. and Pipes R.B., "Experimental Characterization of advanced composite Materials", Second Edition, CRC Press, New Jersey, 1996.
3. George Lubin and Stanley T. Peters, "Handbook of Composites", Springer Publications, 1998.
4. Mel. M. Schwartz, "Composite Materials", Vol. 1 & 2, Prentice - Hall PTR, New Jersey, 1997.
5. Richard M. Christensen, "Mechanics of composite materials", Dover Publications, 2005.
6. Sanjay K. Mazumdar, "Composites Manufacturing: Materials, Product, and Process Engineering", CRC Press, 2001.

**TX5007 CONTROL SYSTEMS AND AUTOMATION IN TEXTILE ENGINEERING L T P C
3 0 0 3**

OBJECTIVES

To enable the students to know about the

- Automation and control systems in spinning , weaving and processing textile machinery.

UNIT I INTRODUCTION ABOUT CONTROL SYSTEM 9

Instrumentation and Transducers: Functional Description of Instruments; Types and applications of Instrumentation - generalized configuration - Tribo electric pick-up, Infrared Transducers - Torque Measurement Elastic transducers - sound level meter - vibration measurements. Control System Components: Basics of control system – Control system examples - Stepper motors - Hydraulic valves - Pneumatic switches, proximity switches and flapper valves - Hydraulic and Pneumatic automation in textile machines- simple sequential logic circuit design - Programmable Logic

Controllers (PLC), Block diagram – programming methods – programs – applications of PLC in textile machinery.

UNIT II INDUSTRIAL AUTOMATION 9

Industrial Automation: Introduction, integration, material handling system, simple systems for motions by electrical and mechanical devices- Mechanical design for automatic feeding assembly and transfer lines. Electronic Textile Instruments: Electronic principles in evenness tester, classification of faults, digital fibrograph, hairiness meter, Vibroscope - thickness measuring instruments, HVI, AFIS, Universal tensile testers.

UNIT III CONTROL SYSTEM & AUTOMATION IN SPINNING INDUSTRY 9

Control System and Automation in Spinning Machinery: Machinery material flow and its variation controls – Feeders and Stop motions – Auto levelers – safety switches. Production and quality monitors – Full doff and pre-set length monitors. Data acquisition system for spinning preparatory, ring spinning and rotor spinning. On-line monitoring system, case studies.

UNIT IV CONTROL SYSTEM & AUTOMATION IN WEAVING INDUSTRY 9

Control System and Automation in Weaving Machinery: Yarn clearer controls - knotter /splicer carriage controls - pre-set length/full cone monitors. Warping machine monitors and controls - sizing machine monitors and controls - auto-reaching/drawing-in and knotting machine monitors and controls. Data acquisition system in weaving preparatory and weaving – humidification system.

UNIT V COMPUTERISED PROCESSING IN TEXTILES 9

Computerised Processing: CAD/CAM/CIM in spinning, Weaving, Dyeing, Printing and Apparel production. Electronic Data Interchange and E-com, internet commerce, Business strategy in E-com, Application of E-com in textile industry – Robotics in textile industries.

TOTAL : 45 PERIODS

OUTCOMES

- Upon completion of this course the student shall be able to know about the Need and techniques of automation in spinning , weaving and processing textile machinery.

REFERENCES:

1. Berkstresser G A, Buchanan D R and Grady P, "Automation in the Textile Industry from Fibres to Apparel", The Textile Institute, UK, 1995.
2. George stylios, "Textile objective measurement and automation in garment manufacture", E.Horwood, 1991.
3. Nalura B C, "Theory and Applications of Automatic Controls", New Age International (P) Ltd Pub, 1998.
4. Ormerod A, "Modern Development in Spinning and Weaving Machinery", Butterworths, 1993. Gordon A. Berkstresser III et.al, "Automation and Robotics in the Textile and Apparel Industries", Noyers Publication Park Ridge, 1996.
5. Textiles Go On-line", The Textile Institute, UK, 1996.
6. Vassiliadis S G, "Automation and the Textile Industry", Eurotex, 1996.

OBJECTIVES

To make the students to learn about the

- Fundamentals of experimental design and
- Selection of suitable design and analysis of the results

UNIT I EXPERIMENTAL DESIGN FUNDAMENTALS 9

Importance of experiments, experimental strategies, basic principles of design, terminology, ANOVA, steps in experimentation, sample size, normal probability plot, linear regression model.

UNIT II SINGLE FACTOR EXPERIMENTS 9

Completely randomized design, Randomized block design, Latin square design. Statistical analysis, estimation of model parameters, model adequacy checking, pair wise comparison tests, in respect of textile process, machine and quality parameters.

UNIT III MULTIFACTOR EXPERIMENTS 9

Two and three factor full factorial experiments, 2K factorial Experiments, Confounding and Blocking designs; application in textile experiments.

UNIT IV SPECIAL EXPERIMENTAL DESIGNS 9

Fractional factorial design, nested designs, Split plot design, Introduction to Response Surface Methodology, Experiments with random factors, rules for expected mean squares, approximate- F - tests for textile applications.

UNIT V TAGUCHI METHODS 9

Steps in experimentation, design using Orthogonal Arrays, data analysis, Robust design- control and noise factors, S/N ratios, parameter design, case studies related to textile engineering.

TOTAL: 45 PERIODS

OUTCOME

Upon completion of this course, the student shall be able to

- Design the experiment suitable for a given study and
- Conduct statistical tests and analyze the results to arrive at the conclusions.

REFERENCES

1. Leaf G.A.V., "Practical Statistics for the Textile Industry, Part I and II", The Textile Institute, Manchester, 1984, ISBN:0900739517.
2. Montgomery, D.C., Design and Analysis of experiments, John Wiley and Sons, 2003.
3. NicoloBelavendram, Quality by Design; Taguchi techniques for industrial experimentation, Prentice Hall, 1995.
4. Phillip J.Rose, Taguchi techniques for quality engineering, McGraw Hill, 1996.

OBJECTIVES

- To enable the students to study about
- evolution of digital printing, digital image and colour management, pre treatments for inkjet printing, quality evaluation and special printing techniques

UNIT I**9**

Ink jet printing-evolution of digital printing, Comparison with conventional printing techniques, theoretical foundations for inkjet technologies- Continuous and drop on demand technologies

UNIT II**9**

Digital image design, editing and data storage systems, Pixel and image formation in digital printers, Digital colour management- Colour gamut and rendering intent, Colour communication.

UNIT III**9**

Pretreatment of substrates for inkjet printing; Ink jet heads;Inks used for printing- dye fibre interaction, surface energy of inks, dye ink formulation; fixation procedures for inks on substrates; washing of ink jet prints; heat and sublimation printing.

UNIT IV**9**

Quality evaluation of textile substrates used for ink jet printing and inks used for inkjet printing, advantages and limitation in inkjet printing, technoeconomics of ink jet printing.

UNIT V**9**

Special printing techniques- Developments in Photo printing, Blast printing with Indigo, Developments in Xerox printing and Laser printing for fancy effects; Yarn printing; printing of carpets, velvets and knits; Ecofriendly alternatives for auxiliaries used in conventional printing

TOTAL :45 PERIODS**OUTCOMES**

- Upon completion of this course the student shall be able to know about evolution of digital printing, digital image and colour management
- Pre treatments for inkjet printing
- Quality evaluation and special printing techniques

REFERENCES

1. Miles L W C, "Textile Printing", Society of Dyers and Colourists, Hobbs The Printers, Hampshire, UK, 2003.
2. Shenai V A, "Technology of Printing", Sevak Publishers, Mumbai, 1990.
3. Shore J, "Colorants & Auxiliaries", Vol. I & II, Society of Dyers and Colourists, UK, 1990.
4. Tyler D, "Textile Digital Printing Technologies", Textile Institute Publication UK, Vol.37 No.4, 2005
5. Ujjiie, "Digital Printing of Textiles", CRC, Wood Head Publishing Ltd, UK, 2006.

OBJECTIVES:

To enable the students to understand about

- Functional requirements of protective clothing
- Selection of fibre, yarn and fabric for developing protective clothing
- Evaluation of protective clothing

UNIT I FIBRE REQUIREMENTS 9

Suitability and properties of high performance fibres for various protective clothing – chemical composition and physical structure

UNIT II YARN AND FABRIC REQUIREMENTS 9

Types of yarns; woven, knitted and non - woven fabric structures, methods of production, effect of structure on their performance

UNIT III CLOTHING CONSTRUCTION 9

Method of construction of garments according to various protective end uses like protection against cold, ballistic protection, use of different fabric type (knitted, woven, and Non-woven), coated / laminated in different places; use of inter lining and composites; 3D structures; high tech textiles – variable electronics; protective garments for industrial and apparel end uses

UNIT IV FINISHING OF PROTECTIVE CLOTHING 9

Types of finishes - fire retardant finishes, water repellent finishes, anti - microbial finishes; chemical finishes against radiation and chemicals; method of application of finishes; protective finishes for health care garments

UNIT V QUALITY EVALUATION 9

Evaluation of protective fabrics; desirable properties of protective textiles, method of testing for thermal protective performance, abrasion and wear resistance, evaluation of resistance to mildew, ageing, sunlight, chemical, electrostatic and electrical resistivity, impact properties; ASTM standards for protective garments

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to

- Select fibre, yarn and fabric for developing protective clothing for different applications
- Understand different types of finishes given to develop protective clothing
- Understand the evaluation of protective clothing

REFERENCES:

1. Adanur S., "Wellington sears handbook of Industrial textiles" Technomic publishing co. inc., 1995, ISBN : 1 – 56676 – 340 – 1
2. Allison Mathews. and Martin Hardingham, "Medical and Hygiene Textile Production – A hand book" Intermediate Technology Publications, 1994.
3. Anand S.C., Kennedy J.F., Miraftab.M and Rajendran.S., "Medical textiles and biomaterials for health care", Woodhead Publishing Ltd, Cambridge, UK,2006, ISBN 1-85573-683-7.

4. Anand S.C., "Medical Textiles", Textile Institute, Manchester, 2001, ISBN:185573494X.
5. Chellamani K.P. and Chattopadhyay D., "Yarns and Technical Textiles", SITRA, 1999.
6. Fung W, "Coated and laminated textiles", Woodhead Publishing Ltd, Cambridge, UK, 2002, ISBN 1-85573-576-8.
7. Fung W. and Hardcastle, "Textiles in automotive engineering", Woodhead Publishing Ltd, Cambridge, UK, 2001, ISBN 1-85573-493-1.
8. Horrocks A.R. and Anand S.C., "Handbook of Technical Textiles", The Textile Institute, Manchester, 2000, ISBN: 1855733854.
9. John N.W.M., "Geo Textile", Blackie and Sons Ltd, London, U.K. , 1987, ISBN 0-412-01351-7.
10. Long A.C., "Design and manufacture of Textile Composites", Woodhead Publishing Ltd., Cambridge, UK, 2005, ISBN 1-85573-744-2.
11. Mukhopadhyay S.K. and Partridge J.F., "Automotive Textiles", Textile Progress, Vol29, No1/2, 1999, ISBN:1870372212
12. Pushpa Bajaj and Sengupta A.K, "Protective clothing", the Textile Institute, 1992, ISBN 1-870812 – 44-1
13. Saville B.P., "Physical testing of textiles", Woodhead Publishing Ltd., Cambridge, UK, 1999, ISBN 1-85573-367-6.
14. Scott R.A., "Textiles for protection", Woodhead Publishing Ltd., Cambridge, UK, 2005, ISBN 1 85573-921-6.

TX5074

PROJECT PLANNING AND MANAGEMENT

**L T P C
3 0 0 3**

OBJECTIVES

- To enable the students to study about
- the introduction to project management, planning and budgeting process, scheduling and resource allocation, control and completion, project organization and conflict management

UNIT I

9

INTRODUCTION TO PROJECT MANAGEMENT: Project Management –Definition, Goal; Lifecycles; project selection methods; project formulation; project manager – roles, responsibilities and selection; project teams

UNIT II

9

PLANNING AND BUDGETING: Planning process – work break down structure, role of multidisciplinary teams; budgeting the project – Methods; cost estimating and improvement; budget uncertainty and risk management

UNIT III

9

SCHEDULING & RESOURCE ALLOCATION: PERT & CPM Networks, crashing; project uncertainty and risk management; simulation, Gantt charts, expediting a project – resource loading and leveling; allocating scarce resources, Goldratt's Critical Chain

UNIT IV **9**
CONTROL AND COMPLETION: Plan-Monitor-Control cycle; data collecting and reporting; project control; designing the controlsystem; project evaluation, auditing and termination

UNIT V **9**
PROJECT ORGANISATION & CONFLICT MANAGEMENT: Formal organisation structure; Organisation design, types of project organizations; conflict – origin & consequences; managing conflict, team methods for resolving conflict.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course the student shall be able to know

- Introduction to project management, planning and budgeting process
- Scheduling and resource allocation
- Control, Completion, Project organization and Conflict management

REFERENCES

1. Clifford Gray and Erik Larson, Project Management, Tata McGraw Hill Edition, 2010
2. Gido and Clements, Successful Project Management, 5th Edition, Thomson Learning, 2011
3. Harvey Maylor, Project Management, 4th Edition, Pearson Education, 2010.
4. John M. Nicholas, Project Management for Business and Technology - Principles and Practice, 4th Edition, Pearson Education, 2012.

TX5008 **PROCESS CONTROL IN TEXTILE WET PROCESSING** **L T P C**
3 0 0 3

OBJECTIVES

To enable the students to study about

- the process control at machinery involved in the chemical processing, familiarize the importance of process and quality control and various quality control tests involved in chemical processing

UNIT I **9**
Definition of Process control and Quality control – Need for quality control in textile wet processing – Flow charts indicating Process control and Quality control tests to be carried out in Desizing, Scouring, Bleaching, Souring, Mercerizing, Dyeing, Printing and finishing – Identification and estimation of residual starch – Determination of weight loss during Desizing and Scouring – Estimation of Residual Wax content and Total wax content by Soxhlet extraction method – Estimation of Copper number – Determination of Cuprammonium fluidity – Determination of Acid groups by methylene blue absorption method – Absorbency tests by Drop test method and wicks method.

UNIT II **9**
Determination of ash content – Determination of Whiteness and Whiteness retention -Determination of Barium Activity number – Shrinkage of fabric – Determination of Light fastness by xenon Arc lamp – Determination of fastness to Washing – Determination of fastness to Dry and Wet rubbing –

Determination fastness to Alkaline and Acidic Perspiration – Determination fastness to Hotpressing – Determination fastness to Dry cleaning and sublimation.

UNIT III

9

Determination of efficiency of Water Proofing – Determination of efficiency of Flame Proofing – Determination of efficiency of Starching, by Bending length method – Determination of efficiency of Resin finishing by CRA. Estimation of residual formaldehyde present in resin finished fabric, Evaluation of efficiency of wetting agent by Sinking Time method – Evaluation of Dispersing agent – Evaluation of efficiency of detergents by Foam stability test – Identification of various fibres like Cotton, Viscose, Polyester, Wool, Acrylic and Nylon – Quantitative and Qualitative analysis of mixtures of blends like P/C, P/V, Acrylic/Cotton, Cotton/Viscose/Wool and Nylon/Acrylic/Cotton.

UNIT IV

9

Estimation of Purity of dyes by Dyeing Trails and by using Spectrophotometer. Concept of Computer Colour matching – Advantages of Computer colour matching system and its limitations – Working principle of computer colour matching – Estimation of purity of Sodium Hydrosulphite, Sodium Nitrite, Sodium silicate – Estimation of strength of Hydrogen peroxide, Estimation of available Chlorine in Hypochlorite solution. Identification of dyes on Cellulose fibre, Protein fibre and synthetic fibre.

UNIT V

9

Necessity of Eco-friendly processing – Concept of Eco-Friendly processing – The German Ban – List of banned Amines and Chemicals – Alternatives – Eco-labelling. – Tolerance limits of chemicals and auxiliaries in the export fabrics – Possible sources of contamination of red listed chemicals – ISO 14000 certification. Brief mention about the instruments used for measuring the various eco parameters.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to

- Measure the quality particulars of textile material at different stages of chemical processing and know the standards
- carry out the various process and quality control measures during the chemical processing of textile materials

REFERENCES:

1. AATCC Technical manual, 2008 Association of Textile chemists and Colorists. USA.
2. Indian Standard Institution (Delhi) – ISI Handbook of Textile Testing, Indian Standards Inst., New Delhi, 2004
3. Orientation Programme on Wet Processing-Quality & Process Control, BITRA Publications, 1986.
4. Shenai V.A. – Technology of Textile Processing, Vol.8 Evaluation of Textile Chemicals, Edn.3, Sevak Publications, Mumbai 1995.
5. Vaidya A.A. and Datye, K.K “Chemical processing of synthetic fibres and blends”, John Wiley and Sons, New York, 1995.