DEPARTMENT OF TEXTILE TECHNOLOGY

VISION:

To be a leader in textile and apparel technology education, research and innovation to benefit the society.

MISSION:

The mission of the Department of Textile Technology, Anna University is

- To maintain and upgrade the ambiance that expands the frontiers of knowledge in textile, apparel and technical textiles.
- To develop the highest quality textile and apparel technologists with societal values.
- To carryout cutting-edge research and develop innovative technology for the benefit of society.

ANNA UNIVERSITY, CHENNAI

UNIVERSITY DEPARTMENTS

M.TECH. TEXTILE TECHNOLOGY

REGULATIONS – 2023

CHOICE BASED CREDIT SYSTEM

PROGRAM EDUCATIONAL OBJECTIVES(PEOs):

Master of Textile Technology curriculum is designed to prepare the graduates to

I. Have advanced knowledge, skill and attitude for the successful professional career with ethical values.
II. Engineer new products and processes.
III. Manage research & development activities for textile industry and research institute.

PROGRAM OUTCOMES(Pos):

The Textile Technology Post Graduates will have the ability to

1. Independently carry out research/investigation and development work to solve real time problems.
2. Articulate and present a substantial technical report/document.
3. Demonstrate a degree of mastery over the area as per the specialization of the programme. The mastery shall be at a level higher than the requirements in the appropriate bachelor programme.
4. Apply knowledge of textile technology towards disruptive innovation.
5. Analyze engineering concepts and apply sustainability goals to manage projects in multidisciplinary environments.
6. Lead quality assurance and research & development activities of textile industry.

Mapping of Programme Educational Objective with Programme Outcomes

PEO	PO					
	1	**2**	**3**	**4**	**5**	**6**
I	2	3	3	1	2	1
II	3	2	1	3	2	2
III	3	2	2	3	2	3

Mapping of Programme Outcomes with Course Outcomes

CO						
Program Outcome	**1**	**2**	**3**	**4**	**5**	**6**
Professional core						
Polymer and fibre physics	2.8	1.4	2.6	2.4	2.4	1.2
Theory of short staple spinning	3	1	3	2.8	2	2.4
Advances in fabric formation	3	2	2.4	2.2	1	1.4
Evaluation of textile materials	3	1	2	2	2.6	2.4
Wetting and wicking of textile materials	3	1	2	2	1	2
Textile product development lab	3	3	3	3	1	2
Theory of textile structures	2	1	3	3	1	3
Automotive textiles	2	2	2.4	2.2	2.8	2.6
Textiles for protection	2.8	1.2	3	2	1.8	2
Theory of coloration and functional finishes	3	1	2	2	3	3
Evaluation of technical textile lab	3	1	2	2	2	3
Advanced textile testing lab	3	1	2	2	2	3
Professional Electives						
Alternative spinning system	2	1	3	2.2	2	2.2
Process control and optimization in yarn spinning	3	2	2.2	3	2.8	3
Bioprocessing of textiles	2	2	3	2	2	2
High performance textiles	3	1.2	2.2	3	2	3
Coated and laminated textiles	2.4	2.6	2	2.6	2	1.8
Sustainability in textile industry	3	2	2	1	3	2
Textile reinforced composites	3	3	2.6	1.6	1.8	2
Filtration textiles	2.8	1	3	3	2	3
Clothing science	3	2	2	2	2	2
Functional dyes	3	2	2	1	2	2
Sports and agro textiles	3	2	2	2.6	2	2
Synthesis and application of nanomaterials in textile	2.2	2	2	3	3	3
Electrically conductive and electronic wearable textiles	3	3	2.4	3	2	2
Medical and hygiene textiles	2	1	3	2.8	2.4	3
Recycling of textiles	2	2	3	1	3	3
Surface treatments for textiles	3	2	3	1	1	2
FOUNDATION COURSE (FC)						
Statistics for technologists	3	3	3	2	-	3
RESEARCH METHODOLOGY AND IPR COURSES (RMC)						
Research methodology and IPR	2.8	2.4	2	2.4	2.8	3
EMPLOYABILITY ENHANCEMENT COURSES (EEC)						
Textile product engineering	3	1	3	2	2	2
Project work I	3	2	-	2	2	-
Project work II	3	2.6	-	2	2	-
	3	2	-	2	2	-

ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS
M.TECH. TEXTILE TECHNOLOGY
REGULATIONS - 2023
CHOICE BASED CREDIT SYSTEM
CURRICULUM AND SYLLABI FOR I TO IV SEMESTERS

SEMESTER I

S. NO.	COURSE CODE	COURSETITLE	CATE GORY	PERIODS PERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	TX3101	Polymer and Fibre Physics	PCC	3	0	3	6	4.5
2.	TX3102	Theory of Short Staple Spinning	PCC	3	0	0	3	3
3.	TX3103	Advances in Fabric Formation	PCC	3	0	0	3	3
4.	TX3104	Statistics for Technologists	FC	3	1	0	4	4
5.	RM3151	Research Methodology and IPR	RMC	2	1	0	3	3
6.	TX3105	Wetting and Wicking of Textile Materials	PCC	3	0	0	3	3
PRACTICALS								
7.	TX3111	Textile Product Development Laboratory	PCC	0	0	3	3	1.5
			TOTAL	**17**	**2**	**6**	**25**	**22**

SEMESTER II

S. NO.	COURSE CODE	COURSETITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	TX3201	Theory of Textile Structures	PCC	2	1	0	3	3
2.	TX3202	Automotive Textiles	PCC	3	0	0	3	3
3.	TX3203	Textiles for Protection	PCC	3	0	0	3	3
4.	TX3204	Theory of Coloration and Functional Finishes	PCC	3	0	0	3	3
5.		Professional Elective I	PEC	3	0	0	3	3
6.	TX3205	Evaluation of Textile Materials	PCC	3	0	0	3	3
PRACTICALS								
7.	TX3211	Evaluation of Technical Textile Laboratory	PCC	0	0	3	3	1.5
8.	TX3212	Advanced Textile Testing Laboratory	PCC	0	0	3	3	1.5
			TOTAL	**17**	**1**	**6**	**24**	**21**

SEMESTER III

S. NO.	COURSE CODE	COURSETITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.		Professional Elective II	PEC	3	0	0	3	3
2.		Professional Elective III	PEC	3	0	0	3	3
3.		Professional Elective IV	PEC	3	0	0	3	3
PRACTICALS								
4.	TX3311	Textile Product Engineering Laboratory	EEC	0	0	4	4	2
5.	TX3312	Project Work I	EEC	0	0	12	12	6
			TOTAL	**9**	**0**	**16**	**25**	**17**

SEMESTER IV

S. NO.	COURSE CODE	COURSETITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
PRACTICALS								
1.	TX3411	Project Work II	EEC	0	0	24	24	12
			TOTAL	**0**	**0**	**24**	**24**	**12**

TOTAL NUMBER OF CREDITS: 72

PROGRAM CORE COURSES (PCC)

S. NO.	COURSE CODE	COURSETITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	TX3101	Polymer and Fibre Physics	PCC	3	0	0	3	1
2.	TX3102	Theory of Short Staple Spinning	PCC	3	0	0	3	1
3.	TX3103	Advances in Fabric Formation	PCC	3	0	0	3	1
4.	TX3205	Evaluation of Textile Materials	PCC	3	0	0	3	1
5.	TX3105	Wetting and Wicking of Textile Materials	PCC	3	0	0	3	1
6.	TX3111	Textile Product Development Laboratory	PCC	0	0	3	1.5	1
7.	TX3212	Advanced Textile Testing Lab I	PCC	0	0	3	1.5	1
8.	TX3201	Theory of Textile Structures	PCC	2	1	0	3	2
9.	TX3202	Automotive Textiles	PCC	3	0	0	3	2
10.	TX3203	Textiles for Protection	PCC	3	0	0	3	2
11.	TX3204	Theory of Coloration and Functional Finishes	PCC	3	0	0	3	2
12.	TX3211	Evaluation of Technical Textile laboratory	PCC	0	0	3	1.5	2
13.	TX3212	Advanced Textile Testing Lab II	PCC	0	0	3	1.5	2

RESEARCH METHODOLOGY AND IPR COURSES (RMC)

S. NO.	COURSE CODE	COURSETITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	RM3151	Research Methodology and IPR	RMC	2	1	0	3	3

FOUNDATIONAL COURSE (FC)

Sl. No	COURSE CODE	Course Title	Periods per week			Credits	Semester
			Lecture	Tutorial	Practical		
1	TX3104	Statistics for technologist	3	1	0	4	1
					Total Credits:	**4**	

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

SL. NO	COURSE CODE.	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			Lecture	Tutorial	Practical		
1	TX3311	Textile product engineering	0	0	4	2	3
2	TX3312	Project work I	0	0	12	6	3
3	TX3411	Project work II	0	0	24	12	4
					Total Credits:	EEC	

PROFESSIONAL ELECTIVE (PE) COURSES

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	TX3001	Alternative Spinning System	PEC	3	3	0	0	3
2	TX3002	Process Control and Optimization in Yarn Spinning	PEC	3	3	0	0	3
3	TX3003	Bioprocessing of Textiles	PEC	3	3	0	0	3
4	TX3004	High Performance Textiles	PEC	3	3	0	0	3
5	TX3005	Coated and Laminated Textiles	PEC	3	3	0	0	3
6	TX3006	Sustainability in Textile Industry	PEC	3	3	0	0	3
7	TX3007	Textile Reinforced Composites	PEC	3	3	0	0	3
8	TX3008	Filtration Textiles	PEC	3	3	0	0	3
9	TX3009	Clothing Science	PEC	3	3	0	0	3
10	TX3010	Functional Dyes	PEC	3	3	0	0	3
11	TX3011	Sports and Agro Textiles	PEC	3	3	0	0	3
12	TX3012	Synthesis and Application of Nanomaterials in Textile	PEC	3	3	0	0	3
13	TX3013	Electrically Conductive and Electronic Wearable Textiles	PEC	3	3	0	0	3
14	TX3014	Medical and Hygiene Textiles	PEC	3	3	0	0	3
15	TX3015	Recycling of Textiles	PEC	3	3	0	0	3
16	TX3016	Surface Treatments for Textiles	PEC	3	3	0	0	3

SUMMARY

		Credits per Semester				Credits Total
	Subject Area					
		I	**II**	**III**	**IV**	
1	PCC	18	15	-	-	33
2	PEC	-	3	9		12
3	EEC	-	-	8	12	20
4	RMC	-	3	-	-	3
5	FC	4	-	-	-	4
	Total	**22**	**21**	**17**	**12**	**72**

TX3101 **POLYMER AND FIBRE PHYSICS** **L T P C**
3 0 3 4.5

OBJECTIVES

To enable the students to learn about

- Fundamentals of fibre forming polymer and its characteristics, polymerization techniques.
- Different types of polymer and its nature, properties of polymeric fibres.
- Conducting of experiments to characterize the polymers,fibres, yarn.

UNIT I FUNDAMENTALS OF POLYMER **9**

Classification of polymers; Fundamental definitions; synthetic fibre forming polymers; fundamental concepts of polymerization; molecular architecture in polymers – configuration, conformation; molecular weight and its influence on fibre formation

UNIT II POLYMERIZATION AND KINETICS OF POLYMERIZATION **9**

Chemistry of polymerization – chain polymerization, step polymerization; free radical polymerization – cationic polymerization – anionic polymerization; polycondensation; dilute solution properties, thermodynamics, kinetics of chain and step polymers, concentrated polymer solutions and polymer melts; molecular weight and size; viscosity, average molecular weight, degree of polymerization and polydispersity

UNIT III RUBBERY AND GLASSY POLYMERS **9**

Polymer micro structure – chemical, geometrical; rubber elastic state – thermo-elastic behaviour and thermodynamics: energetic and entropic elastic forces; mechanical theory of rubber elasticity; swelling of rubbers in solvents; the glassy amorphous state- amorphous polymers, the glass transition temperature, non-equilibrium features of glassy polymers and physical ageing, theories for the glass transition, mechanical behaviour of glassy, amorphous polymers, structure of glassy, amorphous polymers

UNIT IV MOLTEN AND CRYSTALLINE POLYMERS **9**

The molten state - fundamental concepts in rheology, measurement of rheological properties of molten polymers, flexible-chain polymers, liquid-crystalline polymers; crystalline polymers- polymer crystallography, the crystal lamella, crystals grown from the melt and the crystal lamella stack, lattice indices, super molecular structure-methods of assessing super molecular structure, relaxation processes in semicrystalline polymers

UNIT V STRUCTURE-PROPERTY RELATIONSHIPS **9**

Mechanical properties of natural and synthetic fibres; moisture sorption behaviour of natural and synthetic fibres; thermal, frictional and optical properties of fibres

THEORY: 45 PERIODS

LIST OF EXPERIMENTS

1. Molecular weight determination using GPC
2. Rheological studies using Brookefield viscometer
3. Determination of MFI
4. Birefringence measurement
5. Creep and Stress relaxation of filament
6. DSC Thermogram analysis of different fibres
7. Analysis of spectrogram
8. Analysis of VL curve
9. Interpretation of imperfections and faults
10. Analysis of tensile behavior of yarns
11. Thermal stability studies on fibres using TGA
12. Analysis – FTIR spectrograph and NMR graphs
13. Determination of crystallinity by XRD

LAB: 45 PERIODS

TOTAL: 90 PERIODS

OUTCOMES

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

CO1: Describe the fundamentals of polymers and polymerization
CO2: Illustrate chemistry and kinetics of polymerization
CO3: Correlate the nature of rubbery and glassy polymers
CO4: Elucidate the properties of molten and crystalline polymers
CO5: Analyze the properties of fibers
CO6: Determine the characteristics of polymers using advanced characterizing techniques
CO7: Analyze the graphs of TGA, FTIR spectrometer and X-ray Diffractometer for textile materials
CO8: Evaluate the tensile behaviour of yarns and thermal stability of fibres

REFERENCES

1. U W Gedde, “Polymer physics”, Chapman and Hall, 1995.
2. Billmeyer, “Textbooks of Polymer Science”, 3rd ed., Wiley, 1984.
3. Sperling, “Introduction to Physical Polymer Science”, Wiley, 1986.
4. Odian, “Principle of Polymerization”, 3rd ed., Wiley, 1991.
5. Gordon, “High Polymers”, Addision-Wesley, 1963.
6. Gupta.V.B. and Kothari V.K., “Man Made Fibre Production”, Chapman and Hall, 1985.
7. Kothari V.K., “Textile Fibres: Developments and innovations”, IAFL Publication, 2000.
8. Hongu T. and Philips G., “New Fibres”, Wood Head Publishing Ltd,1997.
9. Xiangwu Zhang, **“**Fundamentals of Fiber Science**”,** DEStech Publications, Inc, 2014.
10. Donald G. Baird, Dimitris I. Collias, “Polymer Processing: Principles and Design”, Wiley Edition, 2014.
11. Walczak Z.K., “Processes of Fiber formation”, Elsevier Science,2002.

Course Articulation Matrix:

Course Outcomes	Program Outcomes					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	1	2	3	2	1
CO2	2	2	2	2	2	1
CO3	3	1	3	2	3	1
CO4	3	1	3	2	3	1
CO5	3	2	3	3	2	2
CO6	3	1	2	2	2	3
CO7	3	1	2	2	2	3
CO8	3	1	2	2	2	3
Overall CO	2.9	1.3	2.4	2.3	2.3	1.9

1, 2 and 3 are correlation levels with weightages as Slight (Low), Moderate (Medium) and Substantial (High) respectively

TX3102 THEORY OF SHORT STAPLE SPINNING L T P C
3 0 0 3

OBJECTIVES

To enable the students to learn the theory of various operations carried out at different stages of yarn spinning.

UNIT I FIBRE DISPERSION AND CLEANING 9

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; the new approaches to improve fibre-dispersion in carding operation; mechanism of removal of short fibre and trash in comber

UNIT II FIBRE STRAIGHTENING, NEPS REMOVAL 9

Theory of hook formation; measurement of fibre extent, influence of fibre extent on yarn quality; improvement of fibre-extent by carding, drafting and combing actions; generation of neps, neps removal in carding and combing

UNIT III ATTENUATION 9

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; effect of 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

UNIT IV TWISTING 9

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 in ring spinning, separation of twisting and winding actions of yarn; ply twisting, twist balance; modified twisting principles - open end twisting, false twisting, two nozzle air-jet twisting, air-vortex twisting, up-twisting, two-for-one twisting, hollow-spindle twisting; merits and demerits of modern twisting system

UNIT V FIBRE BLENDING AND LEVELLING 9

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: 45 PERIODS

OUTCOMES

Upon completion of this course, the student shall

CO1: Explain the theory of opening and cleaning in spinning preparatory machinery and select suitable parameters for optimization

CO2: Explain the theory of generation of hooks, neps and rectification

CO3: Differentiate wire and roller drafting and explain the technology involved, their limitations and scope for improvement

CO4: Explain the theory of twisting in different systems of yarn spinning

CO5: Describe the fibre blending and leveling carried out at different stages of yarn production process

REFERENCES

1. Carl A. Lawrence., “Fundamentals of Spun Yarn Technology”, CRC press, 2003, ISBN 1-56676-821-7.
2. Eric Oxtoby, “Spun Yarn Technology “, Butterworth, Boston, London, 1987, ISBN: 0408014644/9780408014649.
3. Klein W., “The Rieter Manual of Spinning, Vol.1”, Rieter Machine Works Ltd., Winterthur, 2014, ISBN 10 3-9523173-1-4 / ISBN 13 978-3-9523173-1-0.
4. Klein W., “The Rieter Manual of Spinning, Vol.2”, Rieter Machine Works Ltd., Winterthur, 2014, ISBN 10 3-9523173-2-2 / ISBN 13 978-3-9523173-2-7.
5. Klein W., “The Rieter Manual of Spinning, Vol.1-3”, Rieter Machine Works Ltd., Winterthur, 2014, ISBN 10 3-9523173-3-0 / ISBN 13 978-3-9523173-3-4.
6. Lord P.R., “Yarn Production: Science, Technology and Economics”, The Textile Institute, Manchester, 1999.
7. Iredale John A., “Yarn Preparation: A Handbook”, Intermediate Technology, London, 1992, ISBN:1853390429.
8. Salhotra K.R. and Chattopadhyay R., "Book of papers on Blow room, Card", Indian Institute of Technology, Delhi, 1998.

9. Shaw J., "Short-staple Ring Spinning", Textile Progress, The Textile Institute, Manchester, 1982.
10. Grosberg P. and Iype C, "Yarn Production: Theoretical Aspects", Textile Institute, 1999, ISBN: 1870372034.

Course Articulation Matrix:

Course Outcomes	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
)1	3	1	3	3	2	2
)2	3	1	3	2	2	2
)3	3	1	3	3	2	3
)4	3	1	3	3	2	3
)5	3	1	3	3	2	2
Overall CO	3	1	3	2.8	2	2.4

1, 2 and 3 are correlation levels with weightages as Slight (Low), Moderate (Medium) and Substantial (High) respectively

TX3103 ADVANCES IN FABRIC FORMATION L T P C
3 0 0 3

OBJECTIVES

To enable the students to learn about

- Advances in fabric formation and their structural features, characteristics and application.

UNIT I WOVEN FABRICS 9

Principle of fabric formation and fabric structure - circular woven fabrics, narrow fabric; advances in 3-D woven fabrics – principle of hollow, shell and nodal fabric formations; Noobing – principle and fabric structure; applications

UNIT II KNITTED FABRICS 9

Advances in circular knitting – loop transfer, seam less knitting and sliver knitting techniques; 3-D knitted fabrics – circular and flat weft knit techniques, applications; spacer fabrics – weft and warp knit techniques, applications

UNIT III BRAIDED FABRICS 9

Principle and production of 3-D braided structures - Cartesian braiding, rotary braiding, and hexagonal; advances in track and column braiding - production of tubular and bifurcated structure; applications

UNIT IV AUXETIC FABRICS 9

Introduction to auxetic materials – polymer, fiber and yarn; Auxetic fabric structure; principle and production of woven, weft knit, warp knit and nonwoven auxetic fabrics; 3D auxetic fabrics; braided auxetic fabrics; applications

UNIT V SMART FABRICS 9

Definition and classifications; production and development of smart fibre and yarn; smart fabric structure and preparation - weaving, knitting and braiding technique; applications

TOTAL: 45 PERIODS

OUTCOMES

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

CO1: Summarize the advancement in weaving and 3D weaving techniques
CO2: Discuss the advanced knit structures and techniques
CO3: Comprehend the advancements in braiding techniques
CO4: Demonstrate the auxetic structures and their production methods
CO5: Elucidate the Smart fabric technology and their production methods

REFERENCES:

1. Xiaogang Chen, " Advances in 3 D Textiles" Woodhead Publishing Limited, 2015.
2. K. F. Au, "Advances in knitting technology" Woodhead Publishing Limited, 2011.
3. John McLoughlin and Tasneem Sabir, "High-Performance Apparel" Woodhead Publishing Limite, 2018.
4. George Kellie, Advances in Technical Nonwovens, Woodhead Publishing Limited, 2016.
5. Savvas Vassiliadis, Advances in Modern Woven Fabrics Technology, InTech publications, 2011.
6. Yordan Kyosev, Recent Developments in Braiding and Narrow Weaving, Springer, 2016.

Course Articulation Matrix:

Course Outcomes	Program Outcomes					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	2	3	2	1	2
CO2	3	2	3	2	1	2
CO3	3	2	2	2	1	1
CO4	3	2	2	2	1	1
CO5	3	2	2	3	1	1
Overall CO	3	2	2.4	2.2	1	1.4

1, 2 and 3 are correlation levels with weightages as Slight (Low), Moderate (Medium) and Substantial (High) respectively

TX3104 STATISTICS FOR TECHNOLOGISTS L T P C
3 1 0 4

OBJECTIVES

To make the students to learn about the

- Probability distributions, sampling and testing of hypothesis.
- Process control using charts and process capability.
- Design of experiments for industry applications and
- Modeling the probabilistic phenomena.

UNIT I PROBABILITY DISTRIBUTION AND ESTIMATIONS 9

Applications of Binomial, Poisson, normal, t, exponential, chi-square, F and Weibull distributions in engineering; point estimates and interval estimations of the parameters of the distribution functions

UNIT II HYPOTHESIS TESTING 9

Sampling distribution; significance tests applicable– normal test, t-test, chi-square test and F-test; p-Values; selection of sample size and significance levels with relevance to industry applications; acceptance sampling

UNIT III ANALYSIS OF VARIANCE AND NON-PARAMETRIC TESTS 9

Analysis of variance for different models; non-parametric tests - sign test, rank test, concordance test

UNIT IV PROCESS CONTROL AND CAPABILITY ANALYSIS 9

Control charts for variables and attributes - basis, development, interpretation, sensitizing rules, average run length; process capability analysis

UNIT V DESIGN AND ANALYSIS OF EXPERIMENTS 9

2k full-factorial designs; composite designs; robust designs; development of regression models, regression coefficients; adequacy test; process optimizations

TUTORIAL 15 PERIODS

Solving the problems using spread sheet

TOTAL: 60 PERIODS

OUTCOMES

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

CO1: Comprehend and analyze the probability distribution

CO2: Apply hypothesis testing

CO3: Analyze the results of ANOVA and nonparametric tests

CO4: Construct control charts to understand the process

CO5: Design the experiment, conduct statistical tests and analyse the results to arrive at the conclusion

REFERENCES

1. Montgomery D.C., "Introduction to Statistical Quality Control", John Wiley and Sons, Inc., Singapore, 2002, ISBN: 997151351X.
2. Leaf G.A.V., "Practical Statistics for the Textile Industry, Part I and II", The Textile Institute, Manchester, 1984, ISBN: 0900739517.
3. Douglas C. Montgomery, "Design and analysis of experiments", John Wiley & Sons, Inc., Singapore, 2000, ISBN 9971-51-329-3.
4. Ronald D. Moen, Thomas W. Nolan, Lloyd P. Provost, "Quality improvement through planned experimentation', McGraw-Hill, 1998, ISBN 0-07-913781-4.
5. Chatfield, C., "Statistics for Technology: A Course in Applied Statistics", Third Edition (3rd Ed.). New York, 1983, Routledge. https://doi.org/10.1201/9780203738467.

Course Articulation Matrix:

Course Outcomes	Program Outcomes					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	3	3	2	-	3
CO2	3	3	3	2	-	3
CO3	3	3	3	2	-	3
CO4	3	3	3	2	-	3
CO5	3	3	3	2	-	3
Overall CO	3	3	3	2	-	3

1, 2 and 3 are correlation levels with weightages as Slight (Low), Moderate (Medium) and Substantial (High) respectively

RM3151 RESEARCH METHODOLOGY AND IPR L T P C
2 1 0 3

OBJECTIVES:

To impart knowledge on

- Formulation of research problems, design of experiment, collection of data, interpretation and presentation of result
- Intellectual property rights, patenting and licensing

UNIT I RESEARCH PROBLEM FORMULATION 9

Objectives of research, types of research, research process, approaches to research; conducting literature review- information sources, information retrieval, tools for identifying literature, Indexing

and abstracting services, Citation indexes, summarizing the review, critical review, identifying research gap, conceptualizing and hypothesizing the research gap

UNIT II RESEARCH DESIGN AND DATA COLLECTION 9

Statistical design of experiments- types and principles; data types & classification; data collection - methods and tools

UNIT III DATA ANALYSIS, INTERPRETATION AND REPORTING 9

Sampling, sampling error, measures of central tendency and variation,; test of hypothesis- concepts; data presentation- types of tables and illustrations; guidelines for writing the abstract, introduction, methodology, results and discussion, conclusion sections of a manuscript; guidelines for writing thesis, research proposal; References – Styles and methods, Citation and listing system of documents; plagiarism, ethical considerations in research

UNIT IV INTELLECTUAL PROPERTY RIGHTS 9

Concept of IPR, types of IPR – Patent, Designs, Trademarks and Trade secrets, Geographical indications, Copy rights, applicability of these IPR; , IPR & biodiversity; IPR development process, role of WIPO and WTO in IPR establishments, common rules of IPR practices, types and features of IPR agreement, functions of UNESCO in IPR maintenance.

UNIT V PATENTS 9

Patents – objectives and benefits of patent, concept, features of patent, inventive steps, specifications, types of patent application; patenting process - patent filling, examination of patent, grant of patent, revocation; equitable assignments; Licenses, licensing of patents; patent agents, registration of patent agents.

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon completion of the course, the student can

CO1: Describe different types of research; identify, review and define the research problem

CO2: Select suitable design of experiment s; describe types of data and the tools for collection of data

CO3: Explain the process of data analysis; interpret and present the result in suitable form

CO4: Explain about Intellectual property rights, types and procedures

CO5: Execute patent filing and licensing

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1. Cooper Donald R, Schindler Pamela S and Sharma JK, “Business Research Methods”, Tata McGraw Hill Education, 11e (2012).
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TX3105 WETTING AND WICKING OF TEXTILE MATERIALS L T P C

3 0 0 3

OBJECTIVE

To enable the students to learn about the moisture distribution in textiles during dyeing and printing applications.

UNIT I FUNDAMENTALS ON WETTING 9

Surface tension of liquids and theories on its measurements; equilibrium state of a liquid on a solid; solid-liquid interaction in immersion, penetration, adhesion and spreading

UNIT II CHARACTERIZATION OF WETTING 9

Determination of wetting force and work of adhesion; measurement of contact angle using Goniometry and tensiometry; critical assessment of the above techniques; importance of wetting of fabrics and its assessment

UNIT III WICKING IN YARNS AND FABRICS 9

Fundamentals of wicking; wicking in yarns and its measurement; wicking in fabrics from an infinite and finite reservoirs; studies on factors affecting wetting and wicking in fibres and fibrous assemblies; mathematical models of wetting and wicking

UNIT IV MODIFICATION OF SUBSTRATES 9

Effect of substrate modification on wetting and wicking behavior: chemical, enzyme, plasma; coating and lamination; finishing

UNIT V APPLICATION 9

Areas of wetting and wicking of fibrous materials; role of wetting and wicking on dyeing and printing, and comfort behavior of textiles; significance of wetting and wicking in medical and hygiene products; usefulness of wetting and wicking in industrial and domestic products

TOTAL: 45 PERIODS

OUTCOMES

On completion of this course, the students shall be able to

CO1: Comprehend the fundamentals of wetting and wicking
CO2: Evaluate the wetting behavior of textile substrates
CO3: Analyze the liquid-fibre interaction
CO4: Interpret the wetting behavior based on surface modification
CO5: Recognize the applications of wetting and wicking in textiles.

REFERENCES

1. Patnaik A , R. S. Rengasamy , V. K. Kothari & A. Ghosh, “Wetting and Wicking in Fibrous Materials”, Journal of Textile Progress, 2006, Volume 38, Issue 1.
2. Pan N. and Zhong W., “Fluid Transport phenomenon in fibrous materials”, Journal of Textile Progress, 2006, Volume 38, Issue 1.
3. Huaxiong Huang, Changhua Ye, Weiwei Sun, “Moisture Transport in fibrous clothing assemblies”, Journal of engineering mathematics, 2008.
4. Pan N. and Gibson P., “Thermal and moisture transport in fibrous materials”, Woodhead Publishing Limited, 2006, ISBN-13: 978-1-84569-057-1.
5. Ningtao, “Liquid transport and wicking in nonwoven materials”, VDM Verlag Dr. Müller, 2009, ISBN 3639114213/ 978-3639114218.

Course Articulation Matrix:

Course Outcomes	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	2	2	1	2
CO2	3	1	2	2	1	2
CO3	3	1	2	2	1	2
CO4	3	1	2	2	1	2
CO5	3	1	2	2	1	2
Overall CO	3	1	2	2	1	2

1, 2 and 3 are correlation levels with weightages as Slight (Low), Moderate (Medium) and Substantial (High) respectively

TX3111 TEXTILE PRODUCT DEVELOPMENT LABORATORY L T P C
0 0 3 1.5

OBJECTIVES:
To enable the students to select the raw materials and design the textile product

LIST OF EXPERIMENTS

1. Development of narrow fabric
2. Development of flat bed- knit structure
3. Development of seamless garment
4. Development of nanofibrous web
5. Development of fibrous web
6. Development of textile reinforced composite
7. Development of core spun yarn
8. Development of metalized yarn
9. Development of metalized fabric
10. Development of electronic textile
11. Development of multilayer fabric and laminated fabric

TOTAL: 45 PERIODS

OUTCOMES:
Upon the completion of this course the student will be able to
CO1: Design and develop narrow fabrics and knitted fabrics
CO2: Demonstrate the development of nanofibres and non woven web
CO3: Develop composite and metalized fabrics
CO4: Design and integrate sensors in textile and develop multilayer fabric

Course Articulation Matrix:

Course Outcomes	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	1	2
CO2	3	3	3	3	1	2
CO3	3	3	3	3	1	2
CO4	3	3	3	3	1	2
Overall CO	3	3	3	3	1	2

1, 2 and 3 are correlation levels with weightages as Slight (Low), Moderate (Medium) and Substantial (High) respectively

TX3201 THEORY OF TEXTILE STRUCTURES L T P C
2 1 0 3

OBJECTIVE
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 produced by different spinning systems.

UNIT I YARN GEOMETRY 6
Elements of yarn geometry; geometry of helix and its application to yarn structures; yarn diameter, packing of fibres in yarn; relation between yarn parameters; estimation of packing density and radial packing density of yarn; effect of yarn packing density on quality of fabric; geometry of folded yarns

UNIT II FIBRE MIGRATION 6
Twist contraction and retraction; migration characteristics in continuous filament and spun yarns; effect of various parameters on migration; measurement of fibre migration in yarn; effect of migration on tensile behaviors and hairiness of the yarn

UNIT III YARN MECHANICS 6

Analysis of tensile behavior, prediction of breakage - continuous filament yarn and spun yarn; effect of fibre properties and geometrical configuration of yarn on the tensile and bending properties of yarn; design of yarn structures for certain functional uses

UNIT IV BLENDED YARN MECHANICS 6

Concept of elongation balance; effect of properties of constituent fibres and blend composition on behavior of blended yarns; blend irregularity- lateral and longitudinal blend irregularity, measurement, effect on yarn and fabric property

UNIT V FABRIC MECHANICS 6

Pierce's geometry of plain weave fabrics; crimp balance equation; theoretical treatment of fabric deformation in tension, bending and shear; geometry of nonwoven and knitted fabrics

Solving the problems using computer spreadsheet

TOTAL: 45 PERIODS

OUTCOMES:

Upon the completion of this course the student can

CO1. Explain the geometry of yarn; solve the relationship between different structural parameters of yarn

CO2. Explain the migration of filaments, fibres in yarn; measure fibre migration characteristics of yarn

CO3. Interpret the theory of tensile behaviour of filament and spun yarns and factors influencing it; predict the strength of yarn

CO4. Evaluate the blending irregularity and analyze the effect on fabric quality

CO5. Demonstrate Pierce's models explaining the geometry of woven fabric

REFERENCES

1. Hearle J.W.S., Grosberg P. and Baker S., "Structural Mechanics of fibres, yarns and fabrics", Wiley Interscience, New York, 1969.
2. Goswami B.C., Martindale J.G. and Scardino F.L., "Textile Yarns: Technology, Structure and Applications", Wiley Interscience, New York, 1985.
3. Hearle J.W.S., Thwaitesand J.J. and Amikrbayhat A., "Mechanics of Flexible Fibre Assemblies", Maryland, 1980.
4. Postle P., Dejong S.and Carnaby G.A., "The Mechanics of Wool Structure", Ellis Horwood, London, 1988.
5. Jinlian Hu., "Structure and mechanics of woven fabrics", Woodhead publishing, 2004, ISBN 9781855739048.

Course Articulation Matrix:

Course Outcomes	Program Outcomes					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	2	1	3	3	1	3
CO2	2	1	3	3	1	3
CO3	2	1	3	3	1	3
CO4	2	1	3	3	1	3
CO5	2	1	3	3	1	3
Overall CO	2	1	3	3	1	3

1, 2 and 3 are correlation levels with weightages as Slight (Low), Moderate (Medium) and Substantial (High) respectively

TX3202 AUTOMOTIVE TEXTILES L T P C
3 0 0 3

OBJECTIVES

To enable the students to learn about

- Textiles used in automotive textiles and their functional requirements
- Evaluation of textile materials used for automobile applications.

UNIT I OVERVIEW OF AUTOMOTIVE TEXTILES 9

Automotive textiles: Market and future trends, characteristics requirements of fiber, yarn and fabric for transportation, advancement in fabric manufacturing for automotive sector; NVH requirements in automotive application

UNIT II AUTOMOTIVE TRIMS 9

Properties requirements and manufacturing of textile materials used in automobiles – tire cord, seat covers, floor covering; textile materials for automotive exterior trims - convertibles, truck covers, front end cover, tire cover; automotive safety restraint system in automobiles- air bag, seat belt.

UNIT III NON WOVENS FOR AUTOMOBILE APPLICATION 9

Role of non woven in automotive industry- critical issues in non woven applications in automobiles; applications of non woven in boot liners, headliners, trunk, upholstery backing, door trim pad, etc; non woven in automobile filters- Oil, fuel, cabin and air filter.

UNIT IV COMPOSITE IN AUTOMOTIVE TEXTILES 9

Polymer composites for automobiles and road safety – bumper, headliner, crash absorber element etc; textile reinforced composites in automobile: design and manufacturing; application of coated fabrics in transportation field. Multilayer textile composite for seat upholstery – property requirements and manufacturing

UNIT V EVALUATION 9

Automotive legislation in India – performance, safety and durability evaluation of textile material used in transportation industry; evaluation of coated fabrics for transportation

TOTAL: 45 PERIODS

OUTCOMES

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

CO1: Explain the textile requirements for automobile applications
CO2: Demonstrate and design product for automobile applications
CO3: Summarize the requirements and use of non woven in automobiles
CO4: Illustrate the role of composite in automotive industry
CO5: Identify and analyze the performance of textiles to be used in automotive industry

REFERENCES

1. Horrocks A.R. and Anand S.C., “Handbook of Technical Textiles”, The Textile Institute, Manchester, 2000, ISBN: 1855733854.
2. R. A. Chapman, “Application of non wovens in technical textiles”, Woodhead Publishing, ISBN-13: 978-1-84569-974-1
3. H. Sezgin and O B Berkalp, “Composite and advanced materials for industry applications’,IGI Global, ISBN-9781522552161.
4. Mukhopadhyay S.K. and Partridge J.F., “Automotive Textiles”, Textile Progress, Vol.29, No1/2, 1999, ISBN:1870372212.
5. Adanur S., “Wellington sears handbook of Industrial textiles”, Technomic publishing co inc., 1995, ISBN : 1–56676–340–1.
6. Eugeniooñate and Bern kröplin “Textile Composites and Inflatable Structures”, Springer Dordrecht, Berlin, Heidelberg, New York, ISBN-10 1-4020-3316-8

Course Articulation Matrix:

Course Outcomes	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	2	3	2	3	3
CO2	3	3	3	2	2	2
CO3	1	2	2	2	3	3
CO4	3	2	2	2	3	3
CO5	2	1	2	3	3	2
Overall CO	2	2	2.4	2.2	2.8	2.6

1, 2 and 3 are correlation levels with weightages as Slight (Low), Moderate (Medium) and Substantial (High) respectively

TX3203 TEXTILES FOR PROTECTION L T P C
3 0 0 3

OBJECTIVES:

To enable the students to learn about

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

UNIT I PROTECTIVE TEXTILES 9

Introduction and types of protection; classification of protective textiles; consumption and growth of protective textiles; standard for protective textiles; requirements for protective textiles – social and technical, health and safety; risk assessment; progress and future of protective textiles in India.

UNIT II MECHANICAL IMPACT PROTECTION 9

Introduction and nature of mechanical impact; types of mechanical impact; requirements of fibre, yarn and fabric for different mechanical impact; factors in designing of protective garment for soldiers, policeman, security person, motorcyclist; concept of cut resistance garment; standards and testing.

UNIT III THERMAL AND COLD PROTECTION 9

Introduction to fire, heat and cold protection; fibre, yarn and fabric requirements; designing of multilayer fabric; chemical finishes for fabric; designing of protective garment for thermal and cold protection; standards and testing.

UNIT IV CHEMICAL AND RADIATION PROTECTION 9

Nature and type of chemical environment; fibre, yarn and fabric requirements for chemical protection; designing of protective garment for chemical protection; introduction to radiation protection; types of radiation; development of fibre, yarn and fabric for radiation protection; design of protective garments for radiation protection; standards and testing.

UNIT V BIOLOGICAL PROTECTION 9

Introduction and types of biological protection; microorganism and their types; fibre, yarn and fabric requirements for biological protection; fabric finishes for biological protection; designing of protective garment for biological protection; standards and testing.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Elucidate the properties of textile materials required for protective clothing
CO2: Recommend the textiles for construction of impact protective textile
CO3: Design and develop protective clothing for thermal and cold protection
CO4: Describe the application of textiles in chemical and radiation protection
CO5: Design protective garments for biological hazards

REFERENCES

1. Adanur S., “Wellington sears handbook of Industrial textiles” Technomic publishing co. inc., 1995, ISBN : 1 – 56676 – 340 – 1
2. Pushpa Bajaj and Sengupta A.K, “Protective clothing”, the Textile Institute, 1992, ISBN 1-870812 – 44-1
3. Chellamani K.P. and Chattopadhyyay D., “Yarns and Technical Textiles”, SITRA, 1999.
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5. Horrocks A.R. and Anand S.C., “Handbook of Technical Textiles”, The Textile Institute, Manchester, 2000, ISBN: 1855733854.
6. Anand S.C., “Medical Textiles”, Textile Institute, Manchester, 2001, ISBN:185573494X.
7. Scott R.A., “Textiles for protection”, Woodhead Publishing Ltd., Cambridge, UK, 2005, ISBN 1-85573-921-6.
8. Saville B.P., “Physical testing of textiles”, Woodhead Publishing Ltd., Cambridge, UK, 1999, ISBN 1-85573-367-6.
9. Long A.C., “Design and manufacture of Textile Composities”, Woodhead Publishing Ltd., Cambridge, UK, 2005, ISBN 1-85573-744-2.
10. Fung W, “Coated and laminated textiles”, Woodhead Publishing Ltd, Cambridge, UK, 2002, ISBN 1-85573-576-8.
11. 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.
12. Fung W. and Hardcastle, “Textiles in automotive engineering”, Woodhead Publishing Ltd, Cambridge, UK, 2001, ISBN 1-85573-493-1.
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14. Allison Mathews. and Martin Hardingham, “Medical and Hygiene Textile Production – A hand book” Intermediate Technology Publications, 1994.
15. Eugene W., “Military textiles” Woodhead Publishing in Textiles., 2008, ISBN:9781420079609.

Course Articulation Matrix:

Course Outcomes	Program Outcomes					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	2	2	3	2	1	2
CO2	3	1	3	2	2	2
CO3	3	1	3	2	2	2
CO4	3	1	3	2	2	2
CO5	3	1	3	2	2	2
Overall CO	2.8	1.2	3	2	1.8	2

1, 2 and 3 are correlation levels with weightages as Slight (Low), Moderate (Medium) and Substantial (High) respectively

TX3204 THEORY OF COLORATION AND FUNCTIONAL FINISHES L T P C
3 0 0 3

OBJECTIVES

To enable the students to learn about theory of coloration, coating techniques and substrate modification of the textile fabrics.

UNIT I THEORY OF DYEING 9

Dyeing equilibrium; dye-fibre interaction; adsorption isotherm; dye affinity; heat of dyeing; half dyeing time

UNIT II INK JET PRINTING 9

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

UNIT III COATING **9**

Coating polymers and auxiliaries, coating techniques and coated fabric assessment.

UNIT IV ENZYMES IN PROCESSING I **9**

Enzymes – classifications of enzymes and nomenclature of enzymes, synthesis of enzymes, enzyme kinetics

UNIT V ENZYMES IN PROCESSING II **9**

Substrates and their structure, scaling of enzyme production, textile processing enzymes

TOTAL: 45 PERIODS

OUTCOME

Upon completion of this course, the student can

CO1: Comprehend the theories and concepts of dyeing

CO2: Compare the various methods of printing and to study about the concepts of ink jet printing

CO3: Categorize and evaluate the coated fabrics

CO4: Classify various types of enzyme and to understand the process involved in synthesis of enzyme

CO5: Distinguish the application of enzyme in wet processing

REFERENCES

1. Park J., “Instrumental Colour formulation: A Practical guide”, Woodhead Publishing, 1993, ISBN 0 901956 54 6.
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3. Sule A. D., “Computer colour analysis”, New Age International Publishers, 2002.
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9. Ashish Kumar Sen, “Coated Textiles: Principles and Applications”, CRC Press, New York, 2008, ISBN 978-1-42005-345-6.

Course Articulation Matrix:

Course Outcomes	Program Outcomes					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	1	2	2	3	3
CO2	3	1	2	2	3	3
CO3	3	1	2	2	3	3
CO4	3	1	2	2	3	3
CO5	3	1	2	2	3	3
Overall CO	3	1	2	2	3	3

1, 2 and 3 are correlation levels with weightages as Slight (Low), Moderate (Medium) and Substantial (High) respectively

TX3205 EVALUATION OF TEXTILE MATERIALS L T P C
3 0 0 3

OBJECTIVE

To enable the students to

- Understand testing of yarn.
- Analyze the various reports generated during quality evaluation of fabrics and
- Interpret the results obtained through these reports for process and quality control.

UNIT I ANALYSIS OF DEFECTS AND MASS VARIATION 9

Depiction of mass variation of textile strands in time and frequency domain; interpretation and significance of U% and CV% for textile strands; irregularity index; classification and analysis of yarn faults created by mass variation, their causes and remedies; yarn faults in fabrics - causes and remedies

UNIT II VARIANCE LENGTH CURVE AND SPECTGROGRAM 9

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 III EVALUATION OF YARN TENSILE PROPERTIES AND FABRIC COMFORT PROPERTIES 9

Influence of testing factors on yarn tensile properties; measurement and application of yarn modulus; creep and stress relaxation of yarn; mechanical conditioning of yarn; fabric comfort related transmission properties- air permeability, moisture management, thermal conductivity, water vapor permeability and wicking; antistaticity

UNIT IV EVALUATION OF TECHNICAL TEXTILE I 9

Performance evaluation and standard test methods of non woven; geotextiles – tensile strength, tear strength, water permeability, abrasion resistance, seam strength etc., medical textile – biocompatibility, antimicrobial, resistance to microbial penetration, liquid penetration, linting etc.

UNIT V EVALUATION OF TECHNICAL TEXTILE II 9

Performance evaluation and standard test methods of composite materials- tensile strength, flexural rigidity, impact strength, compression strength, interlaminar shear strength etc. test methods for coated textiles - tensile strength, bursting strength, abrasion resistance, hydrolysis resistance, resistance to UV and chemicals; accelerated ageing, high & low temperature exposure; evaluation and standard test method for bullet proof, UV resistant fabric, acoustic textiles, antiodour textile

TOTAL: 45 PERIODS

OUTCOMES

On completion of this course, the students can

CO1: Analyze the yarn faults and apply knowledge in reducing yarn faults
CO2: Analyze the variance length curve and spectrogram
CO3: Assess yarn tensile properties and fabric comfort properties
CO4: Determine the performance of technical textile
CO5: Assess the properties of composite and other functional textiles

REFERENCES

1. Pan N. and Gibson P., “Thermal and moisture transport in fibrous materials”, Woodhead Publishing Limited, 2006, ISBN-13: 978-1-84569-057-1.
2. B. P. Saville., “Physical testing of textiles”, Woodhead publisher,1999, ISBN: 978-1-85573-367-1.
3. Apurba Das and R. Alagirusamy., “Science in clothing comfort”, Woodhead publisher,2010,ISBN: 978-1-84569-789-1.

4. Ningtao, “Liquid transport and wicking in nonwoven materials”, VDM Verlag Dr. Müller, 2009, ISBN 3639114213/ 978-3639114218.
5. M Raheel,“Modern Textile Characterization Methods”, Marcel Dekker, Inc, 1996.
6. Patnaik A , R. S. Rengasamy , V. K. Kothari & A. Ghosh, “Wetting and Wicking in Fibrous Materials”, Journal of Textile Progress, 2006, Volume 38, Issue 1.
7. Pan N. and Zhong W., “Fluid Transport phenomenon in fibrous materials”, Journal of Textile Progress, 2006, Volume 38, Issue 1.
8. Huaxiong Huang, Changhua Ye, Weiwei Sun, “Moisture Transport in fibrous clothing assemblies”, Journal of engineering mathematics, 2008.
9. Ashish Kumar Sen, “Coated Textiles: Principles and Applications”, CRC Press, New York, 2008, ISBN 978-1-42005-345-6.

Course Articulation Matrix:

Course Outcomes	Program Outcomes					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	1	2	2	3	2
CO2	3	1	2	2	3	2
CO3	3	1	2	2	3	2
CO4	3	1	2	2	2	3
CO5	3	1	2	2	2	3
Overall CO	3	1	2	2	2.6	2.4

1, 2 and 3 are correlation levels with weightages as Slight (Low), Moderate (Medium) and Substantial (High) respectively

TX3211 EVALUATION OF TECHNICAL TEXTILE LABORATORY L T P C
0 0 3 1.5

OBJECTIVES:
To enable the students to learn about
- Characteristics of technical textile materials and their related models to describe their properties .
- Conducting of experiments to characterize technical textile.

LIST OF EXPERIMENTS
1. Evaluation of water absorbency and liquid transmission of healthcare and hygiene textiles
2. Evaluation of transverse and vertical wicking characteristics of technical textile
3. Evaluation of thermal insulation and water vapor permeability of fabrics
4. Determination of the mechanical properties of bullet proof fabric
5. Determination of fabric seam efficiency
6. Estimation of seam sealing tape performance (Water repellency, thickness, tensile strength, liquid and gas tight integrity)
7. Evaluation of fire-retardant fabric performance at different environmental condition
8. Evaluation of permeation rate and breakthrough time of chemical protective fabric
9. Evaluation of conductivity of fabrics
10. Evaluation of the geotextiles (water permeability, abrasion resistance, resistance to chemical, heat and microbes)
11. Determination of toxicity of the fabric
12. Determination of tensile, flexural and impact strength of composites

TOTAL: 45 PERIODS

OUTCOMES:
Upon the completion of this course the student will be able to
CO1: Determine the liquid interaction with different technical textile material
CO2: Carryout confirmative tests to understand the properties of technical textile

CO3: Illustrate the principle of seam sealing and determine the performance different protective fabrics

Course Articulation Matrix:

Course Outcomes	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	2	2	2	3
CO2	3	1	2	2	2	3
CO3	3	1	2	2	2	3
Overall CO	3	1	2	2	2	3

1, 2 and 3 are correlation levels with weightages as Slight (Low), Moderate (Medium) and Substantial (High) respectively

TX3212 ADVANCED TEXTILE TESTING LABORATORY L T P C
0 0 3 1.5

OBJECTIVES:
To enable the students to learn about

- Characteristics of textile materials.

LIST OF EXPERIMENTS

1. Determination of residual formaldehyde in fabrics
2. Evaluation of filtration efficiency of different woven and non woven filter fabrics.
3. Evaluation of flame retardant finish
4. Evaluation of antimicrobial finish
5. Evaluation of water repellant finish
6. Evaluation of stain repellent finish
7. Determination of surface tension of liquids
8. Determination of contact angle for porous substrates
9. Evaluation of mechanical properties of non porous film fabric
10. Determination of UPF of fabrics

TOTAL: 45 PERIODS

OUTCOMES:
Upon the completion of this course the student will be able to
CO1: Evaluate the functional properties of textile materials
CO2: Determine the performance of finished fabric
CO3: Characterize the porous and nonporous substrates

Course Articulation Matrix:

Course Outcomes	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
)1	3	1	2	2	2	3
)2	3	1	2	2	2	3
)3	3	1	2	2	2	3
Overall CO	3	1	2	2	2	3

1, 2 and 3 are correlation levels with weightages as Slight (Low), Moderate (Medium) and Substantial (High) respectively

TX3311 TEXTILE PRODUCT ENGINEERING LABORATORY L T P C
0 0 4 2

OBJECTIVES:
To enable the students to analyze the given product for reverse engineering.

LIST OF EXPERIMENTS
Reverse engineering of product including identification of fibre, yarn and fabric specifications, method of production, machine used for production, testing protocols and cost estimation – Four products for each student

TOTAL: 60 PERIODS

OUTCOMES:
Upon the completion of this course the student can
CO1: Examine the product to identify the construction of product
CO2: Conduct confirmative tests to describe the raw materials used
CO3: Organize the procedure to produce the product
CO4: Estimate the cost of product

Course Articulation Matrix:

Course Outcomes	Program Outcomes					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	1	3	2	2	2
CO2	3	1	3	2	2	2
CO3	3	1	3	2	2	2
CO4	3	1	3	2	2	2
Overall CO	3	1	3	2	2	2

1, 2 and 3 are correlation levels with weightages as Slight (Low), Moderate (Medium) and Substantial (High) respectively

TX3312 PROJECT WORK I LT P C
0 0 12 6

OBJECTIVES:
The course aims to enable the students to identify the research problem relevant to their field of interest, search databases to define the problem, design experiment, conduct preliminary study and report the findings.

COURSE CONTENT
Individual students will identify a research problem relevant to his/her field of study with the approval of project review committee. The student will collect, and analyze the literature and design the experiment. The student will carry out preliminary study, collect data, interpret the result, prepare the project report and present before the committee.

TOTAL: 180 PERIODS

OUTCOMES:
At the end of the course the students will be able to
CO1: Identify the research problem
CO2: Collect, analyze the relevant literature and finalize the research problem
CO3: Design the experiment, conduct preliminary experiment, analyse the data and conclude
CO4: Prepare project report and present

Course Articulation Matrix:

Course Outcomes	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	-	2	2	-
CO2	3	2	-	2	2	-
CO3	3	2	-	2	2	-
CO4	3	2	-	2	2	-
Overall CO	3	2	-	2	2	-

1, 2 and 3 are correlation levels with weightages as Slight (Low), Moderate (Medium) and Substantial (High) respectively

TX3411 **PROJECT WORK II** **L T P C**
0 0 24 12

I. Continuation of Project Work I (at Institution/Industry)

OBJECTIVES:
The course aims to enable the students to conduct experiment as per the plan submitted in Project work I to find solution for the research problem identified.

COURSE CONTENT
The student shall continue Project work I as per the formulated methodology and findings of preliminary study. The student shall conduct experiment, collect data, interpret the result and provide solution for the identified research problem. The student shall prepare the project report and present before the committee.

TOTAL: 360 PERIODS

OUTCOMES:
At the end of the course the students will be able to
CO1: Conduct the experiment and collect data
CO2: Analyze the data, interpret the results and conclude
CO3: Prepare project report and present

Course articulation Matrix

Course Outcomes	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	-	2	2	-
CO2	3	3	-	2	2	-
CO3	3	3	-	2	2	-
Overall CO	3	2.6	-	2	2	-

II. Not the continuation of Project Work I (at Industry)

OBJECTIVES:
The course aims to enable the students to identify the research problem at the company, search databases to define the problem, design experiment, and conduct experiment to find the solution.

COURSE CONTENT
Individual students will identify a research problem relevant to his/her field of study at the company and get approval of project review committee. The student will collect, and analyze the literature and design the experiment. The student will carry out the experiment, collect data, interpret the result, prepare the project report and present before the committee.

TOTAL: 360 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO1: Identify the research problem

CO2: Collect, analyze the relevant literature and finalize the research problem

CO3: Design and conduct the experiment, analyse the data and conclude

CO4: Prepare project report and present

Course Articulation Matrix:

Course Outcomes	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	-	2	2	-
CO2	3	2	-	2	2	-
CO3	3	2	-	2	2	-
CO4	3	2	-	2	2	-
Overall CO	3	2	-	2	2	-

1, 2 and 3 are correlation levels with weightages as Slight (Low), Moderate (Medium) and Substantial (High) respectively

TX3001 ALTERNATIVE SPINNING SYSTEM L T P C
3 0 0 3

OBJECTIVES

To enable the students to learn the

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

UNIT I ROTOR SPINNING I 9

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

UNIT II ROTOR SPINNING II 9

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; structure vs. property relationship

UNIT III FRICTION SPINNING 9

Principle of yarn formation - DREF2, DREF3 spinning systems; developments in friction spinning systems, raw material requirement, theory of yarn formation, effect of process variables on yarn quality, application of these machines for different end products, economics; technological limitations; structure vs. property relationship

UNIT IV TWO NOZZLE AIR-JET AND AIR VORTEX SPINNING 9

Description of yarn production in two nozzle air-jet spinning machine; raw materials requirement, process variables, structure and quality of the air-jet spun yarn; theory of yarn formation by Air vortex system, raw material requirement and structure; structure vs. property relationship

UNIT V OTHER SPINNING TECHNOLOGIES 9

Production of yarn in PLYfil, self-twist, electrostatic, Bobtex spinning systems; working details of production of double-rove yarns, wrap yarns and core spun yarns; raw material requirement in these systems; economics of these methods of yarn production; yarn characteristics and their applications; structure property relationship

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course, the student can

CO1: Explain the theory of yarn formation in open end spinning and demonstrate production of yarn in rotor spinning system

CO2: Design of important elements of rotor spinning machine

CO3: Explain the theory of yarn formation in friction spinning system and relate the structure of yarn with property of yarn

CO4: Explain the theory of yarn formation in two nozzle air-jet and Air vortex spinning system and relate the structure of yarns with property of yarn

CO5: Describe the principle of yarn production by other spinning systems and relate the structure of yarns with property of yarn

REFERENCES

1. Oxtoby E., “Spun Yarn Technology”, Butterworths, London, 1987.
2. Klein W., "New Spinning Methods ", The Textile Institute, Manchester, 1993.
3. Dyson E., "Rotor Spinning, Technical and Economics Aspects ", Textile Trade Press,New Mills, Stock Port, 1975.
4. Salhotra K.R. and Ishtiaque S.M., "Rotor Spinning; its advantages ", Limitations and Prospects in India, ATIRA, Ahmedabad, 1995.
5. Lord P.R, " Yarn Production; Science, Technology and Economics ", The Textile Institute,Manchester, 1999.
6. Trommer G., "Rotor Spinning”, Meliand Textile benchte GmbH, Rohrbacher, 1995.
7. Lawerence C.A and Chen K.Z., "Rotor Spinning ", Textile Progress, The Textile Institute, Manchester, 1984.
8. Lawrence C. A., “Advances in yarn spinning technology” Wood head publishing, 2010, ISBN-13: 978 1 84569 444 9.
9. Klein W., “Rieter Manual of spinning”, Vol.5&6, Rieter Machine Works, Winterthur,2014.

Course Articulation Matrix:

Course Outcomes	Program Outcomes					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	2	1	3	2	2	2
CO2	2	1	3	3	2	3
CO3	2	1	3	2	2	2
CO4	2	1	3	2	2	2
CO5	2	1	3	2	2	2
Overall CO	2	1	3	2.2	2	2.2

1, 2 and 3 are correlation levels with weightages as Slight (Low), Moderate (Medium) and Substantial (High) respectively

TX3002 PROCESS CONTROL AND OPTIMIZATION IN YARN SPINNING L T P C
3 0 0 3

OBJECTIVES:

To enable the students to understand and apply process and quality control measures during spinning of yarn to optimize the productivity and quality.

UNIT I LEVELLING 9

Quality measures and control of intermediate products to achieve required yarn count with minimum dispersion; different levelling methods adopted in the pre-spinning machines; assessment and control of auto levelling; importance of fibre-mix homogeneity on yarn quality; types and levels of mixing in the preparatory processes; assessment of fibre-blend variations, effect of blend variation on fabric quality

UNIT II NEP AND HOOK REMOVAL 9

Causes of nep and hook formation, control measures; measurement of neps and hooks; factors influencing the removal of neps in the carding and combing machines; fibre hook straightening during the preparatory operations, factors

UNIT III WASTE CONTROL 9

Waste determination and cleaning efficiency; control of waste in blowroom, card and combers; influence of machine and processing parameters on waste removal; controlling the lint content in waste; control of pneumafil waste, hard waste in ring frame; determination of yarn realization; centralized waste collection system

UNIT IV PRODUCTION CONTROL 9

Balancing of machinery; factors affecting the production limits of the spinning machinery; new concepts in achieving higher production in the spinning machinery; computation of the productivity indices; automation, improving production and labour efficiency

UNIT V HUMIDITY CONTROL AND MACHINERY MAINTENANCE 9

Effect of humidity, temperature and maintenance of machinery on production and quality of yarn, optimizing ambiance and humidity control; process conditions required for producing polyester, viscose and blended yarns; yarn defects – causes and remedies

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Explain the quality control measures in terms of levelling of material

CO2: Analyse the causes for the formation of neps and hooks and their removal

CO3: Appraise the factors influencing the waste removal in the spinning machinery

CO4: Analyse the factors and explore new concepts to increase the production rate

CO5: Enumerate and analyze the measures to be taken while processing manmade fibres in the spinning machinery

REFERENCES

1. Lord P.R., “Handbook of Yarn Production; Science, Technology and Economics”, Woodhead Publishing, 2003, ISBN: 1855736969 | ISBN-13: 9781855736962.
2. Majumdar A., Das A., Alagirusamy. R., and Kothari V.K., “Process Control in Textile Manufacturing”, Wood Head publishing, 2012, ISBN: 0857090275 | ISBN-13: 9780857090270.
3. Thomas Weide., “The Rieter Manual of Spinning, Vol.7”, Rieter Machine Works Ltd.,Winterthur, 2014, ISBN: 10 3-9523173-7-3 / ISBN: 13 978-3-9523173-0-3.
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5. Van der Sluijs M., and Hunter L., “Neps in Cotton Lint, Textile Progress”,The Textile Institute, Manchester, 1999, ISBN: 1870372239 / ISBN: 978-1870372237.
6. Slater K., “Yarn Evenness”, Textile Progress, The Textile Institute, Manchester, 1986.
7. Townend P.P., “Nep Formation in Carding”, Wira, U.K., 1986, ISBN: 0900739851 / ISBN: 978- 0900739859.

Course Articulation Matrix:

Course Outcomes	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	3	2	3
CO2	3	2	2	3	3	3
CO3	3	2	2	3	3	3
CO4	3	2	3	3	3	3
CO5	3	2	2	3	3	3

Overall CO	3	2	2.2	3	2.8	3

1, 2 and 3 are correlation levels with weightages as Slight (Low), Moderate (Medium) and Substantial (High) respectively

TX3003 BIOPROCESSING OF TEXTILES L T P C
3 0 0 3

OBJECTIVES

To enable the students to learn about

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

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-catalyzed reactions; basics of kinetics of multi-substrate enzyme-catalyzed 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 bio sorption and enrichment cultures

TOTAL: 45 PERIODS

OUTCOMES

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

CO1: Classify various types of enzymes and study the characteristics and activity of enzymes
CO2: Analyze the efficiency of enzymatic process through kinetic studies of single and multi-substrate enzyme
CO3: Explain the activity of enzyme on cotton fibres
CO4: Differentiate the activity of enzyme on protein and synthetic fibres
CO5: Appraise the application of enzymes for effluent treatment

REFERENCES

1. Freifelder D., "Molecular Biology ", Jones and Bartlett Publishers Inc. 1987.
2. Nierstrasz V. and Cavaco-Paulo A., “Advances in textile biotechnology”, Woodhead Publishing Ltd, Cambridge, UK, 2010.
3. Cavaco-Paulo A. and Gubitz G., “Textile processing with enzymes”, Woodhead Publishing Ltd, Cambridge, UK, 2003.
4. Mamun Kabir, Shekh Md and Koh, Joonseok. “Sustainable Textile Processing by Enzyme” 2021 Applications. 10.5772/intechopen.97198.
5. Vigneshwaran C, Ananthasubramanian M and Kandavadivu P, “Bio processing of textiles”, Woodhead Publishing Ltd, India, 2014. ISBN: 978-3-80308-42-5.

Course Articulation Matrix:

Course Outcomes	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	3	2	2	2
CO2	2	2	3	2	2	2
CO3	2	2	3	2	2	2
CO4	2	2	3	2	2	2
CO5	2	2	3	2	2	2
Overall CO	2	2	3	2	2	2

1, 2 and 3 are correlation levels with weightages as Slight (Low), Moderate (Medium) and Substantial (High) respectively

TX3004 HIGH PERFORMANCE TEXTILES 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 AROMATIC POLYAMIDES 9

Fundamentals of high performance fibres; comparison of regular and high performance fibres; fibre forming process; manufacturing, properties and applications - aramid fibres, high performance polyethylene

UNIT II ORGANIC AND INORGANIC FIBRES 9

Manufacturing, properties and applications - glass fibres, basalt fibres; carbon fibres, ceramic fibres

UNIT III NATURAL AND REGENERATED FIBRES 9

Manufacturing, properties and applications - alginate fibres; chitosan fibres; regenerated protein fibres – silk, wool, casein, soy bean fibre; synthetic biodegradable fibres

UNIT IV CHEMICAL AND THERMAL RESISTANT FIBRES 9

Manufacturing, properties and applications of chemical resistance fibres – chlorinated fibres, fluorinated fibres, PPS, PEEK and PEI; thermal resistant fibres – semi carbon fibres, PBI, PBO

UNIT V SPECIALITY FIBRES 9

Manufacturing, properties and applications - hollow fibres, profile fibres blended and bi-component fibres, hybrid fibres; functionalization of fibres – methods and applications

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course, the student shall be able to
CO1: Produce aromatic polyamide fibres
CO2: Synthesize and manufacture of organic and inorganic fibres
CO3: Illustrate the manufacturing of natural and regenerated fibres
CO4: Construct and analyze the chemical and thermal resistant fibres
CO5: Compare the properties of specialty fibres over other fibres

REFERENCES

1. Hearle J. W. S., “High Performance Fibres”, Woodhead Publishing Ltd., Cambridge, England, 2001.
2. Mukhopadhyay S. K., “High performance fibres”Textile institute, textile progress series, 1994.
3. Hongu T. and Phillips G.O., “New Fibres”, Woodhead Publishing Ltd., England, 1997.

4. Kothari V. K., “Textile Fibres: Development and Innovations”, Vol. 2, Progress in Textiles, IAFL Publications, 2000.
5. Peebles L.H., “Carbon Fibres”, CRC Press, London, 1995.

Course Articulation Matrix:

Course Outcomes	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	2	3	2	3
CO2	3	1	2	3	2	3
CO3	3	1	2	3	2	3
CO4	3	1	2	3	2	3
CO5	3	2	3	3	2	3
Overall CO	3	1.2	2.2	3	2	3

1, 2 and 3 are correlation levels with weightages as Slight (Low), Moderate (Medium) and Substantial (High) respectively

TX3005 COATED AND LAMINATED TEXTILES L T P C
3 0 0 3

OBJETIVES

To enable the students to learn the production and applications of coated and laminated textile and their testing.

UNIT I POLYMERS FOR COATING AND LAMINATION 9

Natural latex & synthetic rubbers, synthetic polymers: polyurethanes, poly (vinyl chloride), polyacrylate elastomers, silicone elastomers, poly (Tetrafluoroethylene), polyethylene, chlorinated and chlorosulponated polyethylenes, foams for laminates; textile substrate for coating

UNIT II COATING AND LAMINATING METHODS 9

Knife coating, roll coating, dip coating, transfer coating, gravure coating, rotary screen printing, calendaring, hot melt coating, foam coating, lamination by adhesives, welding

UNIT III APPLICATION OF COATED AND LAMINATED TEXTILE I 9

Breathable textiles, microporous coatings and films, hydrophilic coatings, smart temperature responsive breathable coatings; synthetic leather, architectural textiles, fluid containers, tarpaulins, automotive applications, carpet backing, flocking, fusible interlinings

UNIT IV APPLICATION OF COATED AND LAMINATED TEXTILE II 9

Thermochromic fabrics, temperature adaptable fabrics, fabrics for chemical protection, camouflage nets, high visibility garments, intumescent coating, metal and conducting polymer coated fabrics, coating with hydrogel and shape memory polymers

UNIT V CHARACTERIZATION OF COATED AND LAMINATED TEXTILES 9

Tensile strength, elongation, adhesion, tear resistance, flexing, ageing, weathering behavior, microbiological degradation, yellowing, testing standards

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course the student shall know
CO1: Different kinds of polymers used for coating and lamination
CO2: Different methods of coating and lamination
CO3: Application of coated and laminated textiles in automotive and architectural textiles
CO4: Application of coated and laminated textiles in protective textiles
CO5: Characterization of coated textiles

REFERENCES

1. Walter Fung, “Coated and Laminated Textiles”, Woodhead Publishing Ltd, UK, 2002, ISBN 978-1-85573-576-7.

2. Carr C M, “Chemistry of the Textile Industry”, Blackie Academic & Professional, UK, 1995.
3. Smith W C, “Smart textile Coatings and Laminates”, Woodhead Publishing Ltd, UK, 2010, ISBN 978-1-84569-379-4.
4. Brown P J and Stevens K, “Nanofibers and Nanotechnology in Textiles”, Woodhead Publishing Ltd, UK, 2007, ISBN 978-1-84569-105-9.
5. Ashish Kumar Sen, “Coated Textiles: Principles and Applications”, CRC Press, New York, 2008, ISBN 978-1-42005-345-6.

Course Articulation Matrix:

Course Outcomes	Program Outcomes					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	3	2	3	2	1
CO2	3	3	2	3	2	1
CO3	2	2	2	2	2	2
CO4	2	2	2	2	2	2
CO5	2	3	2	3	2	3
Overall CO	2.4	2.6	2	2.6	2	1.8

1, 2 and 3 are correlation levels with weightages as Slight (Low), Moderate (Medium) and Substantial (High) respectively

TX3006 SUSTAINABILITY IN TEXTILE INDUSTRY L T P C
3 0 0 3

OBJECTIVES
To enable the students to learn the concepts of sustainability and its importance in textile industry.

UNIT I INTRODUCTION TO SUSTAINABILITY 9
Sustainability; Concepts and terminologies in sustainable approach; principles of sustainability; importance and application of sustainable approaches in textile industry

UNIT II SUSTAINABILITY IN TEXTILE INDUSTRY 9
Supply chain in textile industry; sustainable cotton, wool, and synthetic fibre production and processing; sustainability in non-production activities

UNIT III SUSTAINABILITY IN PROCESSING 9
Enzyme biotechnology, plasma technology in textiles; waterless dyeing technologies, low liquor dyeing

UNIT IV RECYCLING 9
Textile recycling: polymer, fibre, yarn and fabric; consumer perception of recycled textile products

UNIT V ECO DESIGNING AND ECOLABELLING 9
Eco-design, building eco-design through supply chain; sustainability for credit rating; environmental management systems; standards for labelling, textile labels and environmental labelling; life cycle analysis of textiles

TOTAL: 45 PERIODS

OUTCOMES
Upon completion of this course the student shall be able to
CO1: Comprehend the concept of sustainability and its importance
CO2: Analyze the scope of sustainability in textile fibre production
CO3: Analyze the scope of sustainability in dyeing of textiles
CO4: Evaluate the importance of recycling in textile industry
CO5: Compare the various eco-labels in industry

REFERENCES

1. Marim I. Tobler. Rohr., “Handbook of Sustainable Textile Production”, Woodhead Publishing Limited, Cambridge, 2011, ISBN 0-85274-426-9.
2. Miraftab M and Horrocks R, “Eco-Textiles”, Woodhead Publishing Limited, Cambridge, 2007, ISBN 978-1-42004-444-7.
3. Youjiang Wang, “Recycling in Textiles”, Woodhead Publishing Limited, Cambridge, 2006, ISBN 1-85573-952-6.
4. Chavan R B and Radhakrishnan J, “Environmental Issues - Technology Options for Textile Industry”, IIT Delhi Publication, 1998.
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6. Manivasakam N, “Treatment of Textile Processing Effluents”, Chemical Publishing Company, U.S.A, 2013, ISBN 978-0-82060-175-5.
7. Peter P Rogers., “An Introduction to Sustainable Development”, Glen Educational Foundation, Inc, 2008, ISBN 978-1-84407-520-1.
8. Blackburn R S., “Sustainable Textiles”, Woodhead Publishing Limited, 2009, ISBN 978-1-84569-453-1.

Course Articulation Matrix:

Course Outcomes	Program Outcomes					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	2	2	1	3	2
CO2	3	2	2	1	3	2
CO3	3	2	2	1	3	2
CO4	3	2	2	1	3	2
CO5	3	2	2	1	3	2
Overall CO	3	2	2	1	3	2

1, 2 and 3 are correlation levels with weightages as Slight (Low), Moderate (Medium) and Substantial (High) respectively

TX3007 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

Introduction – composites –classification of reinforcements - matrices; selection of fibre for reinforcement and their properties; preparation of reinforced materials and quality evaluation; composite-design requirements and its application; preforms for various composites

UNIT II MATRICES 9

Properties and applications of matrices - natural, synthetic - thermoplastic and thermoset; mechanism of interaction of matrices and reinforcements; optimization of matrices

UNIT III COMPOSITE MANUFACTURING 9

Classification; methods of 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

UNIT IV TESTING **9**

Fibre volume and weight fraction, specific gravity of composites, calculations; mechanical behavior of thermoset and thermoplastic composites; non impact testing of composite- ultrasonic C scan, vibrometry, infrared thermography, void analysis, internal damage.

UNIT V MECHANICS **9**

Micro mechanics, macro mechanics of single layer, macro mechanics of laminate, classical lamination theory and its derivations, failure theories – maximum stress, maximum strain, Tsai-Hill and Hashin-Rotem analysis, prediction and derivations; prediction of inter laminar stresses.

TOTAL: 45 PERIODS

OUTCOMES

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

CO1: Elucidate the different types of textile reinforcements
CO2: Comprehend the different types of matrices
CO3: Describe the manufacturing of composites
CO4: Evaluate the properties of composite
CO5: Interpret the mechanics of composites failure

REFERENCES

1. BorZ.Jang,"Advanced Polymer composites",ASM International,USA,1994.
2. Carlsson L.A. and Pipes R.B., "Experimental Characterization of advanced composite Materials",SecondEdition,CRCPress,NewJersey,1996.
3. George Lubinand Stanley T. Peters, "Handbook of Composites", Springer Publications,1998.
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5. Richard M.Christensen, "Mechanics of composite materials", Dover Publications,2005.
6. Sanjay K. Mazumdar, "Composites Manufacturing: Materials, Product, and Process Engineering",CRCPress,2001

Course Articulation Matrix:

Course Outcomes	Program Outcomes					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	3	2	1	2	2
CO2	3	3	2	1	2	2
CO3	3	3	3	2	1	2
CO4	3	3	3	2	2	2
CO5	3	3	3	2	2	2
Overall CO	3	3	2.6	1.6	1.8	2

1, 2 and 3 are correlation levels with weightages as Slight (Low), Moderate (Medium) and Substantial (High) respectively

TX3008 FILTRATION TEXTILES **L T P C**
3 0 0 3

OBJECTIVES

To enable the students to learn about the principles of filtration and design of textile materials used for filtration process.

UNIT I BASIC PRINCIPLES **9**

Aerosol- types, specifications; filtration – theory, models; theory of liquid-solid filtration

UNIT II DESIGN OF HEPA AND ROOM FILTERS 9

HEPA and ULPA filters – types, functional requirements, raw material selection, design of filters; evaluation of filters - standards

UNIT III DESIGN OF MASK AND RESPIRATOR 9

Mask and respirator **-** types, functional requirements, raw material selection, design and production; evaluation of masks and respirators – standards

UNIT IV LIQUID-LIQUID AND LIQUID-SOLID SEPERATORS 9

Water filters, oil-water separators, oil cleaning filters – types, requirements, raw material selection, theory of separation; design and production methods; evaluation and standards

UNIT V GAS SEPERATORS 9

Theory of separation of pure gases from air; different methods of production of pure oxygen, nitrogen, hydrogen and other pure gases from air; estimation of purity; applications

TOTAL: 45 PERIODS

OUTCOME

Upon completion of this course, the student can

CO1: Describe the principles of aerosol and liquid filtration

CO2: Design the filters used for room, clean room

CO3: Design the masks and respirators

CO4: Explain the concepts of solid- liquid and liquid-liquid separation and design such filters

CO5: Explain the process of separation of pure gases from air and design the process

REFERENCES

1. Horrocks A R and Anand S C, “Handbook of Technical Textiles”, Woodhead publication and Textile Institute, England, 2000.
2. Ken Sutherland, “Filters and Filtration Handbook”, Butterworth-Heinemann Elsevier, Burlington, 2008.
3. Alagirusamy R and Das A, “Technical Textile Yarns”, Woodhead Publishers, Cambridge, England, 2010.
4. 4.Philip.J.Brown &Christopher L.Cox,”Fibrous filter media”, Elsevier science,2017, ISBN 9780081005828.
5. 5.Irwin M.Hutten,”Handbook of nonwoven filter media”, Elseiver science, 2007, ISBN 9781856174411.

Course Articulation Matrix:

Course Outcomes	Program Outcomes					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	1	3	3	2	3
CO2	3	1	3	3	2	3
CO3	3	1	3	3	2	3
CO4	2	1	3	3	2	3
CO5	3	1	3	3	2	3
Overall CO	2.8	1	3	3	2	3

1, 2 and 3 are correlation levels with weightages as Slight (Low), Moderate (Medium) and Substantial (High) respectively

TX3009 **CLOTHING SCIENCE** **L T P C**
3 0 0 3

OBJECTIVES

To enable the students to learn about the

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

UNIT I FABRIC HAND 9

Definition and concept of fabric hand; elements relating to fabric hand; development of fabric hand evaluation - subjective evaluation of fabric hand; objective evaluation of fabric hand - The El Mogahzy–Kilinc hand method; effects of fibre and yarn properties on fabric hand

UNIT II CHARACTERISTICS OF POROUS MATERIALS 9

Geometrical characterization of single fibres; structural analysis of fibrous materials with fibre orientations; determination of the fibre orientation; characterization of porous fibrous materials; pore distribution in a fibrous material

UNIT III MOISTURE VAPOUR TRANSFER AND INTERACTIONS 9

Mass transfer by diffusion; moisture vapour transfer – principle of moisture diffusion, methods of measurement of moisture vapour transfer; concept of moisture management tester; effect of fibre, yarn and fabric parameters on moisture vapour transfer

UNIT IV HEAT TRANSFER AND INTERACTIONS 9

Thermal conduction in fibrous materials – thermal conduction analysis; Effective thermal conductivity (ETC) for fibrous materials; prediction of ETC by thermal resistance networks, volume averaging method and homogenization method; structure of plain weave woven fabric composites and the corresponding unit cell

UNIT V PHYSIOLOGICAL COMFORT 9

Neuro physiological comfort – basis of sensory perceptions, measurement techniques – mechanical stimuli and thermal stimuli; fabric tactile and mechanical properties – fabric prickliness, itchiness, stiffness, softness, smoothness, roughness, and scratchiness; predictability of clothing comfort performance

TOTAL: 45 PERIODS

OUTCOMES

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

CO1: Analyse the fabric hand and its comfort parameters

CO2: Demonstrate the permeability and porous nature of fibrous assemblies

CO3: Explain the Moisture vapour transfer phenomenon

CO4: Explicate the phenomenon of Heat transfer

CO5: Interpret the Fabric properties with respect to comfort and correlate the property of the fabric with comfort to the wearer.

REFERENCES

1. Hassan M. Behery, “Effect of Mechanical and Physical Properties on Fabric Hand”, Wood head Publishing Ltd., ISBN 0-8493-3479-9.
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3. Laing, R.M. and Sleivert G.G., “Clothing, Textile and Human Performance, Textile Progress, 32:2.
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5. Apurba Das and R. Alagirusamy, “Science in clothing comfort” Woodhead publishing India, 2010, ISBN: 978-1-84569-789-1.

Course Articulation Matrix:

Course Outcomes	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	2	2	2
CO2	3	2	2	2	2	2
CO3	3	2	2	2	2	2
CO4	3	2	2	2	2	2
CO5	3	2	2	2	2	2
Overall CO	3	2	2	2	2	2

1, 2 and 3 are correlation levels with weightages as Slight (Low), Moderate (Medium) and Substantial (High) respectively

TX3010 FUNCTIONAL DYES L T P C
3 0 0 3

OBJECTIVES

To enable the students to

- Recall the basics of dyes and their use in textile industry.
- Define functional dyes and recognize their use.
- Understand the application of functional dyes.
- Know the importance of toxicity and health aspects of dyes.

UNIT I BASICS OF DYES 9

General survey of dyes; chemical structure of dyes, general properties of dyes, chromophores and dye classes for textile application

UNIT II DYES USED IN TEXTILES 9

Dyeing technology; standardization of textile dyes: dyes for cellulosic fibres, polyamides, polyesters and acrylic fibres; optical brightening agents: chemistry and evaluation of OBA

UNIT III FUNCTIONAL DYES 9

Functional dyes: dyes for leather; fur; paper; hair; food and inks – introduction, chemical structure and requirements

UNIT IV APPLICATION OF FUNCTIONAL DYES 9

Dyes used for imaging, invisible imaging, displays, electronic materials and biomedical applications; solar cells

UNIT V TOXICOLOGY AND HEALTH ASPECTS 9

Toxicity and environmental assessment; regulatory and legislative aspects

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course the student shall be able to

CO1: Comprehend the chemical structure and properties of dyes
CO2: Recognize about the various dyes used in processing house
CO3: Compare the role of functional dyes on textile and other substrates
CO4: Describe the applications of the functional dyes in different industries
CO5: Examine toxicity and health issues with functional dyes

REFERENCES

1. Choudhury A. K. R., “Modern Concepts of Colour and Appearance”, Oxford and IBH Publishing Ltd, 2000.
2. G. Buxbaum (Ed.) Industrial Inorganic Pigments, Second, Completely Revised Edition, 1998 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim.

3. Willy Herbst, Klaus Hunger, Industrial Organic Pigments- Production, Properties, Applications Third, Completely Revised Edition (With Contributions by Gerhard Wilker, Heinfred Ohleier and Rainer Winter) 2004 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim.
4. Advances in Color Chemistry – Vol I, Peters A. T.
5. Advances in Color Chemistry – Vol II, Peters A. T.
6. Non-Textile Dyes, Freeman H. S.
7. Robert A. Charvat ., "Coloring of Plastics: Fundamentals", John Wiley & Sons, 2005.
8. Mc Laren K., "The Color Science of Dyes & Pigments", Adam Hilger Ltd., 1983, ISBN 0-85274-426-9.
9. Venkataraman K., "The Chemistry of Synthetic Dyes", Elsevier., 2012, ISBN 97801-271-70084.

Course Articulation Matrix:

Course Outcomes	Program Outcomes					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	2	2	1	2	2
CO2	3	2	2	1	2	2
CO3	3	2	2	1	2	2
CO4	3	2	2	1	2	2
CO5	3	2	2	1	2	2
Overall CO	3	2	2	1	2	2

1, 2 and 3 are correlation levels with weightages as Slight (Low), Moderate (Medium) and Substantial (High) respectively

TX3011 SPORTS AND AGRO TEXTILES L T P C
3 0 0 3

OBJECTIVES

To enable the students to learn about

- Basic of sports textiles.
- Textiles in sports equipment.
- Applications of agro textile.

UNIT I SPORTS TEXTILE 9

Introduction to sports textile; high performance, high functional and smart fibers, yarns and fabrics – development, properties and applications

UNIT II MANUFACTURING OF SPORTS APPAREL 9

Design and development - aerobic clothing, athletic clothing, football clothing, cricket clothing, games shorts, gloves, jackets, pants, shirts, shorts, socks, sweatshirts, swimwear and tennis clothing

UNIT III TEXTILE IN SPORTS EQUIPMENTS 9

Raw materials and applications of textiles in sports footwear, protective gears, football, hockey equipment, tennis, baseball; textile material and structure for camping purpose; textile in sports surface; standards and test methods for sports textiles

UNIT IV AGRO APPARELS 9

Agro apparels - introduction and types; properties and design requirements for agro apparels - apron, gloves, head scarf, face mask and cap; standards and test methods for agro apparels

UNIT V AGRO NON APPARELS 9

Introduction to agro non apparels; design and development of sunscreen, fence, protection net, ropes, crop cover, weed barrier, wind shield, insect mesh, mulch mat, cold and frost control fabrics

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course the student shall be able to

CO1: Explain the requirements of sports textile
CO2: Demonstrate and outline the manufacturing of sports textile
CO3: Recognize the application of textile in sports equipments
CO4: Summarize and comprehend the application of textiles in agro apparels
CO5: Design and develop agro non apparels

REFERENCES

1. R.Shishoo, "Textiles for sportswear", Woodhead Publishing Series in Textiles, Cambridge, England, 2015.
2. Ghosh. S. K., "Functional Coatings", Wiley-VCH Verlag, GmbH & Co. KGaA, Weinheim, 2006, ISBN:3-527-31296-X.
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8. Schindler W.D and Hauser P., "Chemical Finishing of Textiles"., Woodhead Publications, ISBN: 1855739054.
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Course Articulation Matrix:

Course Outcomes	Program Outcomes					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	2	2	3	2	2
CO2	3	2	2	3	2	2
CO3	3	2	2	3	2	2
CO4	3	2	2	2	2	2
CO5	3	2	2	2	2	2
Overall CO	3	2	2	2.6	2	2

1, 2 and 3 are correlation levels with weightages as Slight (Low), Moderate (Medium) and Substantial (High) respectively

TX3012 SYNTHESIS AND APPLICATION OF NANOMATERIALS IN TEXTILE L T P C
3 0 0 3

OBJECTIVES

To enable the students to

- Acquire knowledge about the fundamentals of nanotechnology.
- Demonstrate the basic concepts in synthesis of nanomaterials.
- Know the manufacturing techniques and applications of nanotechnology in textile engineering.

UNIT I FUNDAMENTALS OF NANOSCIENCE AND NANOTECHNOLOGY 9

Fundamental concepts of nanoscience and nanotechnology; synthesis and fabrication of nanomaterials, basic approaches: bottom-up and top down; basic physical and chemical techniques of synthesis of nanomaterial; application in different fields of science and technology

UNIT II PROPERTIES OF NANOMATERIALS 9

Size, structure and surface dependence of physical and chemical properties; nanomaterials - conductivity, mechanical, optical and electrical properties; bonding and bond structure in nanoparticles, quantum confinement, surface plasmon resonance

UNIT III NANOFIBRES AND NANOCOMPOSITE 9

Electrospinning of nanofibres; factors influencing nanofibre morphology; polymer requirements, process parameters for various polymers, applications; basic concepts, definition, types, nano vs macrocomposites, synthesis routes: in situ, solution and melt; concept of hybrid nanocomposites; application of nanocomposite in textile

UNIT IV NANOTECHNOLOGY IN TEXTILES 9

Synthesis and applications of nanomaterials – fibres, yarn and fabric; functionalization of textile materials with nanomaterials-antimicrobial, UV, flame retardant, soil release, water repellency, conductivity, filtration, electromagnetic shielding and medical application

UNIT V EVALUATION OF NANOMATERIALS 9

Nanomaterials - particle size and its distribution, porosity, surface morphology- SEM, TEM, crystallinity; surface characteristics of nanomaterials coated fabrics

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course the student can

CO1: Outline the fundamental of nanotechnology
CO2: Illustrate the properties of nanomaterials
CO3: Demonstrate and summarize the concepts of nanofibre and nanocomposite
CO4: Explain the application of nanotechnology in textile
CO5: Analyse the properties of nanomaterials and coated fabric

REFERENCES

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11. Hari Singh Nalwa, Encyclopedia of Nanoscience and Nanotechnology, American Scientific Publishers, 10 Volumes Set (2004)

Course Articulation Matrix:

Course Outcomes	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	2	3	3	3
CO2	2	2	2	3	3	3
CO3	2	2	2	3	3	3
CO4	3	2	2	3	3	3
CO5	2	2	2	3	3	3
Overall CO	2.2	2	2	3	3	3

1, 2 and 3 are correlation levels with weightages as Slight (Low), Moderate (Medium) and Substantial (High) respectively

TX3013 ELECTRICALLY CONDUCTIVE AND ELECTRONIC WEARABLE TEXTILES L T P C
3 0 0 3

OBJECTIVES

To enable the students to

- Understand the fundamentals of electrically conductive textiles.
- Know the properties of conductive polymers.
- Analyze the properties of electronic textiles.

UNIT I ELECTRICAL PROPERTY OF TEXTILES 9

Introduction-conductor, semiconductor and insulator; dielectric property of fibres, electrical resistance, electrical surface resistance, volume resistivity, methods of measuring; factors influencing; types of electrical conductive textiles.

UNIT II METALLIC ELECTRICAL CONDUCTIVE TEXTILES 9

Introduction; metal fibres-types, applications, property; metal yarn-filament, spun yarn; spinning system, core yarn; weaving and knitting

UNIT III CONDUCTIVE POLYMER BASED TEXTILES 9

Introduction; conjugated polymers - chemical structure and electrical conduction; classification-polyaniline, polypyrrole, poly (3, 4-ethylenedioxythiophene) etc, conductive polymers- synthesis, properties and applications

UNIT IV CARBON BASED ELECTRICAL TEXTILES 9

Introduction, carbon-atomic structure and its electrical conduction; classification- carbon, fullerene, graphite, graphene, SWCT, MWCT; carbon nanofoams and its applications

UNIT V WEARABLE ELECTRONIC TEXTILES 9

Introduction, classification - active, passive and very smart; design and applications of smart wearable in military, sportswear, fashion, health care and medical

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course the student can

CO1: Explain the electrical property of textiles

CO2: Comprehend and Outline the characteristics of metallic conductive textiles

CO3: Summarize the available conductive polymer based textiles

CO4: Illustrate the overview of carbon based electrical textiles

CO5: Apply the concepts of wearable electronics in textile

REFERENCES

1. Sandra Varnaite-Zuravliova, “The types, properties and applications of conductive textiles, Cambridge scholar publishing, 2020, ISBN 9781527542822.
2. Prasanna Chandrasekhar, Conducting polymers, fundamentals and applications, Springer US, 2013, ISBN 9781461552451.
3. Tilak Dias,” Electronics textiles, smart fabrics and wearable technology”, wood head publishing series,2015, ISBN 9780081002230.
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6. Vladan koncar.”Smart textiles and its applications’, Wood head publishing, 2016, ISBN 9780081005835.

Course Articulation Matrix:

Course Outcomes	Program Outcomes					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	3	3	3	2	2
CO2	3	3	3	3	2	2
CO3	3	3	2	3	2	2
CO4	3	3	2	3	2	2
CO5	3	3	2	3	2	2
Overall CO	3	3	2.4	3	2	2

1, 2 and 3 are correlation levels with weightages as Slight (Low), Moderate (Medium) and Substantial (High) respectively

TX3014 MEDICAL AND HYGIENE 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 products.

UNIT I BIOMATERIALS 9

Biomaterials–introduction, types; natural, polymeric and biological materials; metals and metal oxides

UNIT II NON IMPLANTABLE MEDICAL TEXTILES 9

Bandages and pressure garments - elastic and non-elastic compression bandages, support and retention bandages, testing of bandages; wound – types, stages of healing; requirements of wound dressing; wound care materials – types, advantages and limitations; testing of wound dressings; advanced wound dressings; wound healing performance

UNIT III IMPLANTABLE TEXTILES 9

Implantable products – functional requirement, different applications; sutures – requirements, classifications, specifications, materials, production and their applications, testing; vascular grafts, artificial ligaments, artificial tendons- material and design; scaffolds for tissue engineering – material, design and testing of essential properties

UNIT IV HYGIENE TEXTILES 9

Textile based healthcare and hygiene products – bed spreads, gowns, gloves, respirators, functional requirement, engineering of product, evaluation-standards

UNIT V REGULARITY AND ETHICAL ISSUES 9

Application of nano technology in medical hygiene textiles, toxicity; advanced textile materials in healthcare; Ethical issues and regularities for conducting pre-clinical and clinical trials; regulations regarding disposal of medical wastes

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course, the student can

CO1: Discuss about biomaterials and biomedical applications

CO2: Design bandages and wound dressing and appraise their performance

CO3: Demonstrate the textiles for implantable applications

CO4: Explain the functional requirements of hygiene textiles and design the product

CO5: Explain the regularity and ethical issues in conducting *in-vivo* experiments and disposal of medical wastes

REFERENCES

1. Allison Mathews and Martin Hardingham., "Medical and Hygiene Textile Production - A hand book", Intermediate Technology Publications, 1994.
2. Anand S.C., Kennedy J.F. Miraftab M. and Rajendran S., "Medical Textiles and Biomaterials for Health care", Wood head Publishing Ltd. 2006.
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5. Horrocks A.R. and Anand S.C, "Technical Textiles", Textile Institute,1999, ISBN: 185573317X.
6. Adanur S., " Wellington Sears Handbook of Industrial Textiles"' Technomic Publishing Co., Inc., Lancaster Pennylvania 1995, ISBN 1-56676-340-1.
7. Michael Szycher and Steven James Lee, "Modern Wound Dressing: A Systematic Approach to Wound Healing", Journal of Biomaterials Applications, 1992.
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9. B J Mccarthy., "Textiles for hygiene and infection control" Elsevier Science,2011, ISBN 9780857093707.

Course Articulation Matrix:

Course Outcomes	Program Outcomes					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	2	1	3	3	2	3
CO2	2	1	3	3	3	3
CO3	2	1	3	3	2	3
CO4	2	1	3	3	3	3
CO5	2	1	3	2	2	3
Overall CO	2	1	3	2.8	2.4	3

1, 2 and 3 are correlation levels with weightages as Slight (Low), Moderate (Medium) and Substantial (High) respectively

TX3015 RECYCLING OF TEXTILES L T P C
3 0 0 3

OBJECTIVES

To enable the students to learn about the scope of recycling in textiles.

UNIT I OVERVIEW OF RECYCLING 9

Recycling -Introduction, importance and challenges in recycling of textiles; Recycling – Upcycling and downcycling; An approach to circular economy -Cradle to Cradle process in textiles; Importance of 3R principles - Reduce, Reuse and Recycle in textile waste management; market scenario of upcycled and downcycled textile, fashion garments; Pre consumer and post-consumer waste; textile waste collection models and sorting technologies

UNIT II RECYCLING OF FIBRES AND POLYMERS 9

Fibre recycling categories – reuse, product recycling, material recycling and thermal recycling methods; Fibre and polymer recycling routes-Primary, Secondary and tertiary recycling; Cotton waste separation and reclamation techniques; Mechanical recycling – shredding mechanism, factors influencing the quality of the shredded fibres; Chemical recycling - Solvolysis, Depolymerisation techniques for different polymers; PET Depolymerisation techniques- Glycolysis, methanolysis and hydrolysis, Total depolymerisation back to its monomers, partial depolymerisation back to its oligomers

UNIT III RECYCLING OF DYES AND CHEMICALS 9

Recycling and reuse of textile chemicals- Recovery of sizing compounds, thickeners, lubricants, waxes and enzymes; Recovery of chemicals from scouring, bleaching and mercerization liquors; Recovery of dyes and pigments from liquors; recycling waste water from textile production, waste water treatments and recycling using membrane technology

UNIT IV RECYCLED PRODUCT DEVELOPMENT 9

Manufacturing of woven, non-woven and Textile composites using recycled fibres; Waste minimization in technical design of clothing for facilitating recycling- recycle-friendly garment construction, technical aspects of garment design and automated disassembly of garments; Upcycling

UNIT V CHARACTERISATION 9

Sustainability performance indicators (SPIs); evaluation and characterization of recycled textiles based on its applications; Comparison of Mechanical and chemical behavior of recycled materials to that of virgin textile materials

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course the student can be able to

CO1: Comprehend the overview of recycling and its techniques

CO2: Execute and select right type of process for recycling of fibres and polymers

CO3: Execute and select right type of process for recovery of water, dyes and auxiliaries

CO4: Apply and design textile product using recycled fibre

CO5: Evaluate the performance of recycled materials to that of virgin materials

REFERENCES.

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4. Subramanian Senthilkannan Muthu, Miguel Angel Gardetti, "Sustainable Textiles, Clothing Design and Repurposing" Springer 2020.
5. Hanna De La motte and Asa Ostlund, "Sustainable fashion and recycling", MDPI, 2022. ISBN: 978-3-0365-5788-5.

Course Articulation Matrix:

Course Outcomes	Program Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	3	1	3	3
CO2	2	2	3	1	3	3
CO3	2	2	3	1	3	3
CO4	2	2	3	1	3	3
CO5	2	2	3	1	3	3
Overall CO	2	2	3	1	3	3

1, 2 and 3 are correlation levels with weightages as Slight (Low), Moderate (Medium) and Substantial (High) respectively

TX3016 SURFACE TREATMENTS FOR TEXTILES L T P C
3 0 0 3

OBJECTIVES

To enable the students to appreciate

- The methodology of various surface modification techniques.
- The basic concepts of coating.
- The physical and chemical aspects of coating, nano material and plasma treatment.
- The advancement in textiles by surface modifications.

UNIT I SURFACE MODIFICATION USING CHEMICALS 9

Mechanisms and chemistries of textile surface modifications- acid, alkali, oxidation agent, and reducing agent; merits and demerits of surface modification using chemicals; applications of surface modification of textiles by aqueous and ionic solutions

UNIT II GRAFTING 9

Techniques of surface grafting- chemical grafting, radiation, plasma and light induced grafting; properties and applications surface grafted textile; merits and demerits of surface grafting

UNIT III SURFACE MODIFICATION USING PLASMA 9

Nature of plasma, Plasma generation-low-pressure plasmas, atmospheric-pressure plasmas, corona discharge, dielectric barrier discharge, merits and demerits of plasma treatment, characterization of plasma-treated textile surfaces, modifications to natural and synthetic textile surfaces using plasma, applications of plasma treated textiles

UNIT IV ADVANCED COATING 9

Working principles of physical vapor deposition and its finishing process on textiles; working methods for chemical vapour deposition on textiles; electroless coating; electrophoretic deposition; nano coating- sol gel, layer by layer deposition technique; applications of advanced coated textiles

UNIT V APPLICATIONS OF SURFACE MODIFIED TEXTILES 9

Super absorbent; solar cells; filters; composites; thermochromic textile; thermal and electrically conductive textile; antimicrobial and anti-fouling; self-cleaning

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course the student shall be to

CO1: Explain and distinguish about surface modification of textile using various chemicals
CO2: Recognize about various surface grafting techniques
CO3: Analyze the effect of plasma and create desired effect on textile substrate
CO4: Explain about various advanced coating technique
CO5: Analyze about various applications of surface treated textiles

REFERENCES

1. Roshan Shishoo ., “Plasma Technology for Textiles”, Woodhead publishing in textiles, 2007, ISBN 9781845692575.
2. Norihiro Inagaki., “Plasma Surface Modification and Plasma Polymerization” CRC Press, 1996, ISBN 9780429156854.
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5. P.J. Brown & K. Stevens., “Nanofibres & Nanotechnology in Textiles”, Woodhead publishing of textiles, 2007, ISBN 9781845693732.

Course Articulation Matrix:

Course Outcomes	Program Outcomes					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	2	3	1	1	2
CO2	3	2	3	1	1	2
CO3	3	2	3	1	1	2
CO4	3	2	3	1	1	2
CO5	3	2	3	1	1	2
Overall CO	3	2	3	1	1	2

1, 2 and 3 are correlation levels with weightages as Slight (Low), Moderate (Medium) and Substantial (High) respectively