DEPARTMENT OF TEXTILE TECHNOLOGY

Vision:

The Vision of the Department of Textile Technology, Anna University is to be recognized as a leader in textile and apparel technology education, research and application of knowledge and skills to benefit the society.

Mission:

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

- To deliver the highest quality textile and apparel technologists with societal values.
- To carryout cutting-edge research and develop innovative technology for the benefit of society at national and international level.
- To inculcate a sense of highest ethical and professional standards among the students.

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

ANNA UNIVERSITY, CHENNAI: 600 025

UNIVERSITY DEPARTMENTS

M.TECH. TEXTILE TECHNOLOGY

REGULATIONS – 2019

CHOICE BASED CREDIT SYSTEM

1. PROGRAM EDUCATIONAL OBJECTIVES(PEOs):

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

1. Have attitude and knowledge for the successful professional and technical career
2. Design and conduct experiments and interpret the results, Design new process and product for textile industry
3. Manage research and development activities in textile industry and research organizations and
4. Enhance their skills for managing textile manufacturing industry

2. PROGRAM OUTCOMES(POs):

The Textile Technology Post Graduates will have the ability to

1. Apply the knowledge gained through the post graduate programme to effectively teach the students at the undergraduate level
2. Effectively carryout fundamental and applied research
3. Develop new process or product at the textile industry
4. Develop new process or product at the textile research organizations
5. Apply the knowledge of textile technology to effectively manage textile industry
6. Effectively function as individual or as a part of a team to accomplish a stated goal.
7. Understand the professional and ethical responsibility
8. Communicate effectively with a wide range of audience
9. Learn independently and engage in life-long learning
10. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

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3. Mapping of Programme Educational Objective with Programme Outcomes

PEO	PO											
	1	2	3	4	5	6	7	8	9	10		
1.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
2.		✓	✓	✓	✓		✓			✓		
3.		✓	✓	✓			✓			✓		
4.		✓	✓	✓	✓	✓	✓	✓		✓		

4. Mapping of Programme Outcomes with Course Outcomes

CO	PO									
	1	2	3	4	5	6	7	8	9	10
Theory of short staple spinning	✓	✓		✓	✓	✓		✓		
Advances in fabric formation	✓	✓	✓	✓	✓			✓	✓	
Polymer and fibre physics	✓	✓	✓	✓	✓	✓		✓		✓
Statistics in textile engineering	✓	✓	✓	✓	✓	✓	✓	✓		✓
Advanced textile testing lab	✓	✓	✓	✓	✓	✓				
Wetting and wicking of textile materials	✓	✓		✓	✓	✓				✓
Yarn quality analysis	✓	✓	✓	✓	✓	✓	✓	✓		✓
Fabric quality analysis	✓	✓	✓	✓	✓	✓	✓	✓		✓
Professional Electives										
Alternative Spinning System	✓	✓	✓	✓					✓	✓
Process Control and Optimization in Yarn Spinning	✓	✓	✓		✓	✓				✓
Shuttleless Weaving Technology	✓	✓	✓		✓				✓	✓
Structural mechanics of yarn	✓	✓		✓	✓	✓				✓
Theory of Drafting	✓	✓	✓	✓	✓					✓
Theory of twisting	✓	✓	✓	✓	✓					✓
Structure and properties of Nonwovens	✓	✓	✓	✓					✓	✓
Structural mechanics of fabrics	✓	✓	✓	✓					✓	✓

Characterization of Textile Polymers	✓	✓	✓	✓		✓				✓
Colour Science and its Applications	✓	✓		✓	✓					✓
Enzyme Technology for Textile Processing	✓	✓	✓	✓	✓					
High Performance Textiles	✓	✓	✓	✓	✓				✓	
Pollution abatement in Textile industry	✓	✓	✓		✓		✓			
Coated and laminated textiles	✓	✓		✓		✓	✓			✓
Sustainability in textile industry	✓		✓	✓	✓		✓		✓	
Medical Textiles	✓	✓		✓		✓	✓			✓
Protective Clothing	✓	✓		✓		✓	✓			✓
Textile Reinforced Composites	✓	✓		✓		✓	✓			✓
Textiles in Civil Construction and Transportation	✓	✓		✓		✓	✓			✓
Filtration textiles	✓	✓		✓		✓	✓			✓
Clothing science	✓	✓		✓		✓	✓			✓
Functional dyes	✓	✓		✓		✓	✓			✓
Colouration and functional finishes	✓	✓		✓		✓	✓			✓
RESEARCH METHODOLOGY AND IPR COURSES (RMC)										
Research Methodology and IPR										
AUDIT COURSES (AC)										
Audit Course I										
Audit Course II										
EMPLOYABILITY ENHANCEMENT COURSES (EEC)										
Textile product engineering		✓	✓	✓			✓		✓	✓
Project Phase I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Project Phase II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

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ANNA UNIVERSITY, CHENNAI

UNIVERSITY DEPARTMENTS
M.TECH. TEXTILE TECHNOLOGY
REGULATIONS – 2019
CHOICE BASED CREDIT SYSTEM
CURRIULLA AND SYLLABI FOR I TO IV SEMESTER
SEMESTER I

S. NO.	CODE NO.	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	TX5101	Theory of short staple spinning	PCC	4	0	0	4	4
2.	TX5102	Advances in fabric formation	PCC	4	0	0	4	4
3.	TX5103	Polymer and Fibre Physics	PCC	3	0	0	3	3
4.	TX5104	Statistics in Textile Engineering	PCC	3	0	2	5	4
5.		Professional Elective I	PEC	3	0	0	3	3
6.	RM5151	Research Methodology and IPR	RMC	2	0	0	2	2
7.		Audit Course – I *	AC	2	0	0	2	0
PRACTICALS								
8.	TX5111	Advanced textile testing Lab	PCC	0	0	6	6	3
			TOTAL	**21**	**0**	**8**	**29**	**23**

*Audit Course is Optional

SEMESTER II

S. NO.	CODE NO.	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	TX5201	Wetting and wicking of textile materials	PCC	3	0	0	3	3
2.	TX5202	Yarn quality analysis	PCC	2	0	2	3	3
3.	TX5203	Fabric quality analysis	PCC	2	0	2	3	3
4.		Professional Elective II	PEC	3	0	0	3	3
5.		Professional Elective III	PEC	3	0	0	3	3
6.		Professional Elective IV	PEC	3	0	0	3	3
7.		Audit Course –II	AC	2	0	0	2	0
PRACTICALS								
8.	TX5211	Textile product engineering	EEC	0	0	8	8	4
			TOTAL	**18**	**0**	**12**	**28**	**22**

*Audit Course is Optional

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SEMESTER III

S. NO.	CODE NO.	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.		Professional Elective V	PEC	3	0	0	3	3
2.		Professional Elective VI	PEC	3	0	0	3	3
3.		Open Elective	OEC	3	0	0	3	3
PRACTICALS								
4.	TX5311	Project Phase I	EEC	0	0	12	12	6
			TOTAL	**9**	**0**	**12**	**21**	**15**

SEMESTER IV

S. NO.	CODE NO.	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
PRACTICALS								
1.	TX5411	Project Phase II	EEC	0	0	24	24	12
			TOTAL	**0**	**0**	**24**	**24**	**12**

Total credits: 72

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Professional Elective Courses (PEC)

S. NO	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1	TX5001	Alternative Spinning System	PEC	3	3	0	0	3
2	TX5002	Process Control and Optimization in Yarn Spinning	PEC	3	3	0	0	3
3	TX5003	Shuttleless Weaving Technology	PEC	3	3	0	0	3
4	TX5004	Structural mechanics of yarn	PEC	3	3	0	0	3
5	TX5005	Theory of Drafting	PEC	3	3	0	0	3
6	TX5006	Theory of twisting	PEC	3	3	0	0	3
7	TX5007	Structure and properties of Nonwovens	PEC	3	3	0	0	3
8	TX5008	Structural mechanics of fabrics	PEC	3	3	0	0	3
9	TX5009	Characterization of Textile Polymers	PEC	3	3	0	0	3
10	TX5010	Colour Science and its Applications	PEC	3	3	0	0	3
11	TX5011	Enzyme Technology for Textile Processing	PEC	3	3	0	0	3
12	TX5012	High Performance Textiles	PEC	3	3	0	0	3
13	TX5013	Pollution abatement in Textile industry	PEC	3	3	0	0	3
14	TX5014	Coated and laminated textiles	PEC	3	3	0	0	3
15	TX5015	Sustainability in textile industry	PEC	3	3	0	0	3
16	TX5016	Medical Textiles	PEC	3	3	0	0	3
17	TX5017	Protective Clothing	PEC	3	3	0	0	3
18	TX5018	Textile Reinforced Composites	PEC	3	3	0	0	3
19	TX5019	Textiles in Civil Construction and Transportation	PEC	3	3	0	0	3
20	TX5020	Filtration textiles	PEC	3	3	0	0	3
21	TX5021	Clothing science	PEC	3	3	0	0	3
22	TX5022	Functional dyes	PEC	3	3	0	0	3
23	TX5023	Colouration and functional finishes	PEC	3	3	0	0	3

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PROGRAM CORE COURSES (PCC)

S. NO.	CODE NO.	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			LECTURE	TUTORIAL	PRACTICAL		
1.	TX5101	Theory of short staple spinning	4	0	0	4	1
2.	TX5102	Advances in fabric formation	4	0	0	4	1
3.	TX5103	Polymer and fibre physics	3	0	0	3	1
4.	TX5104	Statistics in textile engineering	3	0	2	4	1
5.	TX5111	Advanced textile testing lab	0	0	6	3	1
6.	TX5201	Wetting and wicking of textile	3	0	0	3	2
7.	TX5202	Yarn quality analysis	2	1	0	3	2
8.	TX5203	Fabric quality analysis	2	1	0	3	2
					TOTAL CREDITS	27	

RESEARCH METHODOLOGY AND IPR COURSES (RMC)

S. No.	Code No.	Course Title	Periods per week			Credits	Semester
			Lecture	Tutorial	Practical		
1	RM5151	Research Methodology and IPR	2	0	0	2	1
					Total Credits:	**2**	

OPEN ELECTIVE COURSES [OEC]

*(Out of 6 Courses one Course must be selected)

S.NO.	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			Lecture	Tutorial	Practical		
1.	OE5091	Business Data Analytics	3	0	0	3	3
2.	OE5092	Industrial Safety	3	0	0	3	3
3.	OE5093	Operations Research	3	0	0	3	3
4.	OE5094	Cost Management of Engineering Projects	3	0	0	3	3
5.	OE5095	Composite Materials	3	0	0	3	3
6.	OE5096	Waste to Energy	3	0	0	3	3

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AUDIT COURSES (AC)

Registration for any of these courses is optional to students

S. NO.	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			Lectur	Tutorial	Practical		
1.	AX5091	English for Research Paper Writing	2	0	0	0	1/2
2.	AX5092	Disaster Management	2	0	0	0	
3.	AX5093	Sanskrit for Technical Knowledge	2	0	0	0	
4.	AX5094	Value Education	2	0	0	0	
5.	AX5095	Constitution of India	2	0	0	0	
6.	AX5096	Pedagogy Studies	2	0	0	0	
7.	AX5097	Stress Management by Yoga	2	0	0	0	
8.	AX5098	Personality Development Through Life Enlightenment Skills	2	0	0	0	
9.	AX5099	Unnat Bharat Abhiyan	2	0	0	0	

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S. NO.	CODE NO.	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			Lecture	Tutorial	Practical		
1	TX5211	Textile product engineering	0	0	8	4	2
2	TX5311	Project Phase I	0	0	12	6	3
3	TX5411	Project Phase II	0	0	24	12	4
Total Credits:						**22**	

SUMMARY

S.NO.	Subject Area	Credits per Semester				Credits Total
		I	II	III	IV	
1	PCC	18	9	-	-	27
2	PEC	3	9	6	-	18
3	OEC	-	-	3	-	3
4	EEC	-	4	6	12	22
5	RMC	2	-	-	-	2
	Total	23	22	15	12	**72**
	Audit courses (Non Credit)	*	*			

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SYLLABI
SEMESTER I

TX5101 THEORY OF SHORT STAPLE YARN SPINNING L T P C
4 0 0 4

OBJECTIVE

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

UNIT I FIBRE DISPERSION AND CLEANING 12

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 12

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 12

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

UNIT IV TWISTING 12

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

UNIT V FIBRE BLENDING AND LEVELLING 12

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

TOTAL: 60 PERIODS

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OUTCOMES:

Upon completion of this course, the student shall have the knowledge on

CO1: Theory of opening and cleaning in spinning preparatory machinery

CO2: Theory of generation of hooks, neps and rectification

CO3: Wire and roller drafting, technology involved, their limitations and scope for improvement

CO4: Theory of twisting in different systems of yarn spinning

CO5: Fibre blending and leveling carried out at different stages of yarn production process

TEXT BOOKS

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

REFERENCES

1. 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.
2. 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.
3. 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.
4. Lord P.R., “Yarn Production: Science, Technology and Economics”, The Textile Institute, Manchester, 1999.
5. Iredale John A., “Yarn Preparation: A Handbook”, Intermediate Technology, London, 1992, ISBN:1853390429.
6. Salhotra K.R. and Chattopadhyay R., "Book of papers on Blow room, Card", Indian Institute of Technology, Delhi, 1998.
7. Shaw J., "Short-staple Ring Spinning", Textile Progress, The Textile Institute, Manchester, 1982
8. Grosberg P. and Iype C, "Yarn Production: Theoretical Aspects", Textile Institute, 1999, ISBN: 1870372034.

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome									
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	Theory of opening and cleaning in spinning preparatory machinery	3	3	-	2	3	3	-	3	-	1
CO2	Theory of generation of hooks, neps and rectification	3	3	-	2	3	3	-	3	-	1
CO3	Wire and roller drafting, technology involved, their limitations and scope for improvement	3	3	-	2	3	3	-	3	-	1
CO4	Theory of twisting in different systems of yarn spinning	3	3	-	2	3	3	-	3	-	1
CO5	Fibre blending and leveling carried out at different stages of yarn production process	3	3	-	2	3	3	-	3	-	1
Overall CO		3	3	-	2	3	3	-	3	-	1

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

Attested

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TX5102	ADVANCES IN FABRIC FORMATION	L T P C 4 0 0 4

OBJECTIVE

To enable the students to learn about

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

UNIT I WOVEN FABRICS 12

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 12

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 12

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 12

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 12

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

TOTAL: 60 PERIODS

OUTCOMES

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

CO1: advancement in weaving and 3D weaving techniques
CO2: advanced knit structures and techniques
CO3: advancements in braiding techniques
CO4: auxetic structures and their production methods
CO5: smart fabric and their production methods

TEXT BOOKS

1. Xiaogang Chen, " Advances in 3 D Textiles" Woodhead Publishing Limited, 2015
2. K. F. Au, "Advances in knitting technology" Woodhead Publishing Limited, 2011

REFERENCES:

1. John McLoughlin and TasneemSabir, "High-Performance Apparel" Woodhead Publishing Limite, 2018
2. George Kellie, Advances in Technical Nonwovens, Woodhead Publishing Limited, 2016
3. SavvasVassiliadis, Advances in Modern Woven Fabrics Technology, InTech publications, 2011
   YordanKyosev, Recent Developments in Braiding and Narrow Weaving, Springer, 2016

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Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome									
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	Advancement in weaving and 3D weaving techniques	3	3	3	3	2	1	-	3	3	1
CO2	Advanced knit structures and techniques	3	3	3	3	2	1	-	3	3	1
CO3	Advancements in braiding techniques	3	3	3	3	2	2	-	3	3	1
CO4	Auxetic structures and their production methods	3	3	3	3	2	1	-	3	3	1
CO5	Smart fabric and their production methods	3	3	3	3	2	1	-	3	3	1
Overall CO		3	3	3	3	2	1	-	3	3	1

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

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TX5103 **POLYMER AND FIBRE PHYSICS** **LT P C**
3 0 0 3

OBJECTIVES

To enable the students to learn about

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

UNIT I **9**

Synthetic fibre forming polymers, definition, terms and fundamental concepts of polymerization; molecular architecture in polymers-configuration and conformation, molecular weight and its influence on fibre formation

UNIT II **9**

Glass transition temperature (Tg), factors affecting Tg, WLF equation; rubber elasticity; melting and crystallization, polymer solutions- solubility parameter and its significance to fibre spinning.

UNIT III **9**

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

UNIT IV **9**

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

UNIT V **9**

Mechanical properties of natural and synthetic fibres; moisture sorption behaviour of natural and synthetic fibres; Thermal, Frictional an optical properties of fibres

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course, the student shall

CO1: Be able to understand the synthesis of polymers
CO2: Beable to correlate the properties of polymers
CO3: Beable to understand rheological characteristics
CO4: Know about viscoelastic behavior of polymers
CO5: Beable to correlate the properties of fiber

TEXT BOOKS

1. Billmeyer, "Textbooks of Polymer Science", 3rd ed., Wiley, 1984.
2. Sperling, "Introduction to Physical Polymer Science", Wiley, 1986.

REFERENCES

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

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Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome									
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	Understand the synthesis of polymers	3	3	3	3	3	2	-	3	-	2
CO2	Correlate the properties of polymers	3	3	3	3	3	2	-	3	-	2
CO3	Understand rheological characteristics	3	3	3	3	3	2	-	3	-	2
CO4	Know about viscoelastic behaviour of polymer	3	3	3	3	3	2	-	3	-	2
CO5	Able to correlate the properties of fibre	3	3	3	3	3	2	-	3	-	2
Overall CO		3	3	3	3	3	2	-	3	-	2

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

Attested

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TX5104 STATISTICS IN TEXTILE ENGINEERING L T P C
3 0 2 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 textile applications and
·Modeling the probabilistic phenomena

UNIT I PROBABILITY DISTRIBUTION AND ESTIMATIONS 12

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

UNIT II HYPOTHESIS TESTING 12

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

UNIT III ANALYSIS OF VARIANCE AND NON-PARAMETRIC TESTS 12

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

UNIT IV PROCESS CONTROL AND CAPABILITY ANALYSIS 12

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

UNIT V DESIGN AND ANALYSIS OF EXPERIMENTS 12

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

TOTAL: 60 PERIODS

OUTCOMES

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

CO1: Understand the probability distribution
CO2: Carryout hypothesis testing
CO3: CarryoutANOVA and nonparametric tests
CO4: Construct control charts for understandthe process
CO5: Design the experiment, conduct statistical tests and analyse the results to arrive at the conclusion

TEXT BOOKS

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.

REFERENCES

1. Douglas C. Montgomery, “Design and analysis of experiments”, John Wiley & Sons, Inc., Singapore, 2000, ISBN 9971 51 329 3
2. Ronald D. Moen, Thomas W. Nolan, Lloyd P. Provost, “Quality improvement through planned experimentation’, McGraw-Hill, 1998, ISBN 0-07-913781-4

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome									
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	Understand the probability distribution	3	3	3	3	3	3	2	3	-	3
CO2	Carryout hypothesis testing	3	3	3	3	3	3	2	3	-	3
CO3	Carryout ANOVA and nonparametric tests	3	3	3	3	3	3	2	3	-	3
CO4	Construct control charts for understand the process	3	3	3	3	3	3	2	3	-	3
CO5	Design the experiment, conduct statistical tests and analyse the results to arrive at the conclusion	3	3	3	3	3	3	2	3	-	3
Overall CO		3	3	3	3	3	3	2	3	-	3

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

RM5151 **RESEARCH METHODOLOGY AND IPR** **LT P C**
2 0 0 2

COURSE OBJECTIVES:

To impart knowledge and skills required for research and IPR:

- Problem formulation, analysis and solutions.
- Technical paper writing / presentation without violating professional ethics
- Patent drafting and filing patents.

UNIT I RESEARCH PROBLEM FORMULATION **6**

Meaning of research problem- Sources of research problem, criteria characteristics of a good research problem, errors in selecting a research problem, scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, necessary instrumentations

UNIT II LITERATURE REVIEW **6**

Effective literature studies approaches, analysis, plagiarism, and research ethics.

UNIT III TECHNICALWRITING /PRESENTATION **6**

Effective technical writing, how to write report, paper, developing a research proposal, format of research proposal, a presentation and assessment by a review committee.

UNIT IV INTRODUCTION TO INTELLECTUAL PROPERTY RIGHTS (IPR) **6**

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT V INTELLECTUAL PROPERTY RIGHTS (IPR) **6**

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System, IPR of Biological Systems, Computer Software etc.

Traditional knowledge Case Studies, IPR and IITs.

TOTAL: 30 PERIODS

COURCE OUTCOMES:

1. Ability to formulate research problem
2. Ability to carry out research analysis
3. Ability to follow research ethics
4. Ability to understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity
5. Ability to understand about IPR and filing patents in R & D.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓										
CO2	✓											
CO3	✓							✓				
CO4	✓				✓							
CO5	✓					✓						✓

REFERENCES:

1. Asimov, “Introduction to Design”, Prentice Hall, 1962.
2. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd ,2007.
3. Mayall, “Industrial Design”, McGraw Hill, 1992.
4. Niebel, “Product Design”, McGraw Hill, 1974.
5. Ranjit Kumar, 2nd Edition, “Research Methodology: A Step by Step Guide for beginners” 2010

TX5111	ADVANCED TEXTILE TESTING LAB	LT P C
		0 0 6 3

OBJECTIVES:

To enable the students to learn about

- Characteristics of textile materials and their related models to describe their properties .
- Conducting of experiments to characterize the polymers and fibres

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. Thermal stability studies on fibres
8. Analysis - FTIR and NMR graphs
9. Determination of crystallinity by XRD
10. Determination of residual formaldehyde in fabrics
11. Evaluation of Flame retardant finish
12. Evaluation of Water repellant finish
13. Evaluation of conductivity of fabrics
14. Determination of surface tension of liquids
15. Determination of contact angle for porous substrates

TOTAL: 90 PERIODS

OUTCOMES:

Upon the completion of this course the student will be able to

CO1: Understand and analyze the characteristics of textile materials using advanced characterizing techniques
CO2: Analyze the graphs, charts of TGA, FTIR spectrometer and X-ray Diffractometer
CO3: Evaluate fabric finishes and nature of fabrics
CO4:Determine the property of liquids
CO5: Characterize the porous substrates

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome									
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	Understand and analyze the characteristics of textile materials using advanced techniques	3	3	2	3	2	2	-	-	-	-
CO2	Analyze the graphs, charts of TGA, FTIR spectrometer and X-ray Diffractometer	3	3	2	3	2	2	-	-	-	-
CO3	Evaluate fabric finishes and nature of fabrics	3	3	2	3	2	2	-	-	-	-
CO4	Determine the property of liquids	3	3	2	3	2	2	-	-	-	-
CO5	Characterize the porous substrate	3	3	2	3	2	2	-	-	-	-
Overall CO		3	3	2	3	2	2		-	-	-

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

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SEMESTER II

TX5201 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 FUNDAMENTALSON WETTING 9

Surfacetension of liquids and theories on its measurements;equilibrium state of a liquid on a solid; solid-liquidinteraction in immersion, penetration, adhesion andspreading

UNIT II CHARACTERIZATION OF WETTING 9

Determination of wetting force and work of adhesion; measurement ofcontact angle using Goniometry and tensiometry; criticalassessment of the above techniques

UNIT III WETTING OF FIBRES AND FABRICS 9

Wettabilityassessment of fibres and filaments using goniometry andtensiometry; importance of wetting of fabrics and itsassessment

UNIT IV WICKING INYARNS AND FABRICS 9

Fundamentalsof wicking; wicking in yarns and its measurement; wicking in fabrics from an infinite and finite reservoirs; studies onfactors affecting wetting and wicking in fibres and fibrousassemblies; mathematical models of wetting and wicking

UNIT V APPLICATION 9

Areas of wetting and wicking of fibrous materials; role ofwetting and wicking on comfort behaviour of textiles; significance of wetting and wicking in medical and hygieneproducts; usefulness of wetting and wicking in industrialand domestic products

TOTAL: 45 PERIODS

OUTCOMES

On completion of this course, the students shall have the knowledge on the

CO1: Fundamentals of wetting and wicking
CO2: Characterization of wetting
CO3: Liquid-fibre interaction during of fiber and fabrics
CO4: Surface energy of the fabric
CO5: Application of wetting and wicking

TEXTBOOKS

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. Ningtao, “Liquid transport and wicking in nonwoven materials”, VDM Verlag Dr. Müller, 2009, ISBN 3639114213/978-3639114218.

REFERENCES

1. PatnaikA , 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.

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome									
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	Fundamentals of Wetting and wicking	3	3	-	3	2	3	-	1	-	3
CO2	Characterization of wetting	3	3	-	3	2	3	-	1	-	3
CO3	Liquid-fibre interaction during of fiber and fabrics	3	3	-	3	2	3	-	1	-	3
CO4	Surface energy of the fabric	3	3	-	3	2	3	-	1	-	3
CO5	Application of wetting and wicking	3	3	-	3	2	3	-	1	-	3
Overall CO		3	3	-	3	2	3	-	1	-	3

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

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TX5202 **YARN QUALITY ANALYSIS** **LT P C**
2 1 0 3

OBJECTIVES

To make the students to

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

UNIT I MASS VARIATION OF TEXTILE STRANDS 6

Depiction of mass variation of textile strands in time and frequency domain; interpretation and significance of U% and CV% for textile strands; irregularity index

UNIT II VARIANCE LENGTH CURVE 6

Effect of specimen length and total length on mass variation measurements of textile strands; theory of construction of VL curve; analysis of variance length curves to understand and avoid the introduction of mass variation during the spinning operation

UNIT III SPECTGROGRAM 6

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 IV TENSILE PROPERTIES 6

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

UNIT V YARN DEFECTS 6

Classification and analysis of yarn faults created by mass variation, their causes and remedies; yarn faults in fabrics - causes and remedies

TOTAL: 30 PERIODS

LABORATORY:

Measurement and analysis of

1. U% of sliver, roving and yarn
2. Imperfections and hairiness of yarn
3. Tensile properties
4. Creep and stress relaxation
5. Yarn fatigue

Analysis of

6. Variance-length curve
7. Spectrogram
8. Yarn faults

TOTAL: 30 PERIODS

OUTCOME:

On completion of this course, the students can

CO1: Understand different methods of depicting mass variation of strand

CO2: Analyze and interpret VL curve

CO3: Analyze and interpret spectrogram in finding faulty machine elements

CO4: Analyze the tensile values of strand

CO5: Analyze classified faults and other faults present in the yarn and apply knowledge in reducing yarn faults

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TEXT BOOKS

1. Kothari V.K., “Progress in Textiles: Science & Technology Vol. 1, Testing and Quality Management”, IAFL Publications, New Delhi, 1999, ISBN: 81-s901033-0-X.
2. Furter R., “Strength and elongation testing of single and ply yarns”, The Textile Institute, Manchester, 1985.

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1. Furter R., “Evenness testing in yarn production: Part I”, The Textile Institute, Manchester, 1982.
2. Furter R., “Evenness testing in yarn production: Part II”, The Textile Institute, Manchester, 1982.
3. Steadman R.G., “Cotton testing”, Textile Progress, Vol. 27, No.1.Text.Inst., 1997, ISBN:1870812859.
4. “Instrumentation in the textile industry”, Vol. 1; 1996, Instrument Society of America,1997, ISBN:1556175973.
5. Lord P.R. and Grover G., “Roller drafting”, Textile Progress, Vol. 23 No.4, Textile Institute, 1993, ISBN:1870812468.

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Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome									
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	Understand different methods of depicting mass variation of strand	3	3	3	3	2	2	2	2	-	2
CO2	Analyze and interpret VL curve	3	3	3	3	2	2	2	2	-	2
CO3	Analyze and interpret spectrogram in finding faulty machine elements	3	3	3	3	2	2	2	2	-	2
CO4	Analyze the tensile values of strand	3	3	3	3	2	2	2	2	-	2
CO5	Analyze classified faults and other faults present in the yarn and apply knowledge in reducing yarn faults	3	3	3	3	2	2	2	2	-	2
Overall CO		3	3	3	3	2	2	2	2	-	2

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

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TX5203 **FABRIC QUALITY ANALYSIS** **LT P C**
2 1 0 3

OBJECTIVES

To make the students understand

- Nature of fabric failure
- Aanalyzing low stress mechanical and comfort properties
- Fabric appearance and their properties

UNIT I MECHANICS OF FABRIC FAILURE 6

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

UNIT II LOW STRESS MECHANICAL PROPERTIES 6

Analysis and interpretation of low stress mechanical properties measured using Kawabata Evaluation System - tensile, compression, bending, shear and buckling deformation; influence of low stress mechanical properties of fabrics on fabric handle, tailorability and sewability

UNIT III COMFORT PROPERTIES 6

Influence of fibre and yarn characteristics, and fabric structure on air permeability, water vapour permeability, resistance to penetration of liquid water, resistance to flow of heat; static electricity measurement and control; influence on comfort properties

UNIT IV FABRIC APPEARANCE AND OTHER PROPERTIES 6

Role of drape, formability, crease recovery, wrinkle recovery, pilling resistance, dimensional stability on fabric appearance; influence of fibre and yarn characteristics, and fabric structure on the above fabric properties

UNIT V PROPERTIES OF TECHNICAL TEXTILES 6

Selection of fibre, yarn and fabric for achieving flame resistance, impact resistance, absorbency, water resistance, filtration efficiency

TOTAL: 30 PERIODS

LABORATORY

1. Analysis of KES data
2. Measurement and analysis of air permeability, filtration efficiency of fabrics
3. Measurement and analysis of tensile and flexural properties of textile materials
4. Measurement and analysis of water vapour permeability and thermal conductivity characteristics

TOTAL: 30 PERIODS

OUTCOMES

Upon completion of this course, the student shall have the knowledge on the

CO1: Mode offailure of fabrics and influencing parameters
CO2: Kawabata evaluation system
CO3: Fabric role on comfort
CO4: Fabric properties and appearance
CO5: Technical textile properties

TEXT BOOKS

1. Ukponmwan J., Mukhopadhuau A. and Chatterjee K., “Pilling”, Textile Progress, Vol.8/3, 1996. ISBN: 1870372153.
2. Li, “The Science of Clothing Comfort”, Textile Progress, Vol., 29/3, 1997, ISBN:1870372247.

REFERENCES:

1. Slater K., Charles C., Thomas Springfield I.L., “Human Comfort”, 1985.
2. Bishop D.L., “Fabrics: Sensory and Mechanical Properties”, Textile Progress Vol. 26/3, 1994. ISBN: 1870812751.
3. Seyam, “Structural Design of Woven Fabric: Theory and Practice”, Textile Progress, Vol., 31/3, 1999.
4. Laing and Sleivert, “Clothing Textiles and Human Performance”, Textile Progress, Vol. 32/4, 2000.
5. Ponmwan, J.O, “The Thermal Insulation Properties on fabrics”, Textile Progress, Vol. 24, No.4, Textile Institute, 1993, ISBN: 1870812654.

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome									
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	Mode of failure of fabrics and influencing parameters	3	3	3	3	2	2	2	2	-	2
CO2	Kawabata evaluation system	3	3	3	3	2	2	2	2	-	2
CO3	Fabric role on comfort	3	3	3	3	2	2	2	2	-	2
CO4	Fabric properties and appearance	3	3	3	3	2	2	2	2	-	2
CO5	Technical textile properties	3	3	3	3	2	2	2	2	-	2
Overall CO		3	3	3	3	2	3	2	2	-	2

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

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TX5211	TEXTILE PRODUCT ENGINEERING	LT P C
		0 0 8 4

OBJECTIVE:

To enable the students to test and analyze the given product that include identification of fibre, yarn and fabric specifications and method of production of same

LIST OF EXPERIMENTS

Reverse engineering of textile products with an emphasis on testing protocols – Four each for a student

TOTAL: 120 PERIODS

OUTCOMES:

Upon the completion of this course the student will be able to

CO1: Identify the materials used in the product
CO2: Carryout confirmative tests to identify specifications of materials used
CO3: Suggest the production process required to make the product

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome									
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	Identify the materials used in the product	-	3	3	3	-	-	2	-	2	2
CO2	Carryout confirmative tests to identify specifications of materials used	-	3	3	3	-	-	2	-	2	2
CO3	Suggest the production process required to make the product	-	3	3	3	-	-	2	-	2	2
Overall CO		-	3	3	3	-	-	2		2	2

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

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ELECTIVES

TX5001 ALTERNATIVE SPINNING SYSTEMS L T P C
3 0 0 3

OBJECTIVES

To enable the students to learn the

- Theory of yarn formation by rotor, friction, 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 property relationship

UNIT III FRICTION SPINNING 9

Principle of yarn formation - DREF-2, DREF-3 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 property relationship.

UNIT IV AIR-JET AND AIRVORTEX SPINNING 9

Description of yarn production in air-jet spinning machine; structure and quality of the air-jet spun yarn, raw materials requirement, process variables; theory of yarn formation by Air vortex system, raw material requirement and structure; structure 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 shall be able to understand the

CO1: Theory of yarn formation in open end spinning and production of yarn in rotor spinning system
CO2: Design of important elements of rotor spinning machine
CO3: Theory of yarn formation in friction spinning system and structure of yarn
CO4: Theory of yarn formation in air-jet and Air vortex spinning system and structure of yarns
CO5: Principle of yarn production by other spinning systems and double rove spinning

TEXT BOOKS

1. Oxtoby E., “Spun Yarn Technology”, Butterworths, London, 1987.
2. Klein W., "New Spinning Methods ", The Textile Institute, Manchester, 1993.

REFERENCES

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

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome									
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	Theory of yarn formation in open end spinning and production of yarn in rotor spinning system	3	3	3	3	-	-	-	-	2	2
CO2	Design of important elements of rotor spinning machine	3	3	3	3	-	-	-	-	2	2
CO3	Theory of yarn formation in friction spinning system and structure of yarn	3	3	3	3	-	-	-	-	2	2
CO4	Theory of yarn formation in air-jet and Air vortex spinning system and structure of yarns	3	3	3	3	-	-	-	-	2	2
CO5	Yarn production by other spinning systems and double rove spinning	3	3	3	3	-	-	-	-	2	2
Overall CO		3	3	3	3	-	-	-	-	2	2

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

TX5002 PROCESS CONTROL AND OPTIMIZATION IN YARN SPINNING L T P C
3 0 0 3

OBJECTIVE:

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 understand the

CO1: Quality control measures in terms of levelling of material
CO2: Control of neps and hooks
CO3: Factors influencing production rate and efficiency of spinning machines
CO4: Balancing of machinery, production and labour efficiency
CO5: Measures to be taken while processing manmade fibres, humidity control

TEXT BOOKS

1. Lord P.R., “Handbook of Yarn Production; Science, Technology and Economics”, WoodheadPublishing, 2003, ISBN: 1855736969 | ISBN-13: 9781855736962
2. MajumdarA., Das A., Alagirusamy. R., and Kothari V.K., “Process Control in TextileManufacturing”, Wood Head publishing, 2012, ISBN: 0857090275 | ISBN-13: 9780857090270

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1. 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
2. Garde A.R., and Subramaniam T.A., “Process Control in Spinning”, ATIRA Publications, Ahmedabad, 1989.
3. Van der Sluijs M., and Hunter L., “Neps in Cotton Lint, Textile Progress”,The Textile Institute, Manchester, 1999, ISBN: 1870372239 / ISBN: 978-1870372237
4. Slater K., “Yarn Evenness”, Textile Progress, The Textile Institute, Manchester, 1986.
5. Townend P.P., “Nep Formation in Carding”, Wira, U.K., 1986, ISBN: 0900739851 / ISBN: 978- 0900739859.

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Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome									
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	Quality control measures in terms of levelling of material	3	3	3	-	3	2	-	-	-	3
CO2	Control of neps and hooks	3	3	3	-	3	2	-	-	-	3
CO3	Factors influencing production rate and efficiency of spinning machines	3	3	3	-	3	2	-	-	-	3
CO4	Balancing of machinery, production and labour efficiency	3	3	3	-	3	2	-	-	-	3
CO5	Measures to be taken while processing manmade fibres	3	3	3	-	3	2	-	-	-	3
Overall CO		3	3	3	-	3	2	-	-	-	3

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

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TX5003 SHUTTLELESS WEAVING TECHNOLOGY L T P C

3 0 0 3

OBJECTIVE:

To enable the students to understand different mechanisms of weft insertion, their advantages and limitations

UNIT I INTRODUCTION 9

Introduction to shuttleless weaving; advantages of shuttleless weaving, comparison with shuttle weaving; features of unconventional weaving; different selvedges: tucked-in, leno, fused, stitched, their mechanism of formation, their characteristics and uses; weft accumulator.

UNIT II PROJECTILE WEAVING MACHINE 9

Basic principle of projectile weaving; feeding of yarn to projectile; sequence of weft insertion; cam driven shedding; dwelling sley beat-up; torsion bar picking; energy utilization during picking.

UNIT III RAPIER WEAVING MACHINE 9

Classification based on type of rapier; system of weft insertion and number of rapiers; Sequence of weft insertion for Gabler and Dewas systems, their comparison; driving of flexible and rigid rapiers; asynchronized rapier timing; rapier buckling.

UNIT IV AIR-JET AND WATER-JET WEAVING MACHINES 9

Principle of weft insertion in air-jet weaving, air requirements; path of the yarn on loom; sequence of weft insertion; control of air stream by relay nozzle, confuser profile reed and suction; design of air jet nozzle, air drag force, factors affecting drag force; principle of weft insertion in water-jet weaving machine, path of the yarn on loom, quality of water required, sequence of weft insertion; design of water jet nozzle, merits and demerits of water jet weaving; fabric drying on loom

UNIT V MULTIPHASE WEAVING 9

Technological developments – models & features; functional description of multi-linear shedweaving – shed formation, filling insertion, beat-up, let-off, take-up and selvedge motion; characteristics of multi-linear shed weaving machine; circular and narrow fabric weaving

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Overview of shuttless weaving technology
CO2: Principle, concepts and features of projectile weaving machine
CO3: Mechanisms of picking in rapier weaving machine
CO4: Mechanisms of picking and merits and demerits of air jet, water jet
CO5: Principle of fabric formation in multiphase weaving machine

TEXT BOOKS

1. Adanur.S, “Handbook of Weaving”, Textile Institute, 2000.
2. Ormerod A, “Modern Preparation and Weaving Machinery”, Butterworth’s & Co., London, 1983.

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REFERENCES:

1. Weaving Technology and Operations, AllaanOrmerod and Walter S. Sondhelm, The Textile Institute, 1995, ISBN 1 870812 76 X
2. Adanur.S, “Handbook of Weaving”, Textile Institute, 2000.
3. Ormerod A, “Modern Preparation and Weaving Machinery”, Butterworth’s & Co., London, 1983.
4. Talukdar M K, Sriramulu P K, Ajgaonkar D B, “Weaving Machines, Mechanisms, Management”. ISBN: 8185401160, Mahajan Publishers Pvt. Ltd., 2004.
5. Ormerod .A and Sondhelm.W.S, “Weaving Technology & Operations”, Textile Institute Publication, 1995.
6. Khatwani P A, "Weaving II: Shuttleless looms", NCUTE Publication, 1999.
7. Marks and Robinson, "Principles of Weaving", Textile Institute, Manchester, 1976.

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Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome									
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	Overview of shuttless weaving technology	3	3	3	-	2	-	-	-	3	3
CO2	Principle, Concepts and features of projectile weaving machine	3	3	3	-	2	-	-	-	3	3
CO3	mechanisms of picking in rapier weaving machine	3	3	3	-	2	-	-	-	3	3
CO4	mechanisms of picking and merits and demerits of air jet, water jet	3	3	3	-	2	-	-	-	3	3
CO5	Principle of fabric formation in multiphase weaving machine	3	3	3	-	2	-	-	-	3	3
Overall CO		3	3	3	-	2	-	-	-	3	3

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

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TX5004 **STRUCTURAL MECHANICS OF YARN** **L T P C**
3 0 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 9

Elements of yarn geometry; helix geometry of yarn; yarn diameter, twist relationship; ideal packing of fibres in yarn; packing coefficient, estimation of packing density and radial packing density of yarn

UNIT II MIGRATION OF FIBRES IN YARN 9

Twist contraction and retraction; geometry of folded yarns; 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 behavior and hairiness of the yarn

UNIT III YARN MECHANICS 9

Analysis of breakage of yarn; effect of twist on strength and elongation at break of filament yarn; relationship between elongation at break of filament and yarn; prediction of breakage - continuous filament yarn; model - breakage of spun yarn, effect of twist

UNIT IV BLENDED YARN MECHANICS 9

Blend irregularity; measurement of blending irregularity, effect on fabric properties; concept of elongation balance; effect of properties of constituent fibres and blend composition on behavior of blended yarns

UNIT V STRUCTURE - PROPERTIES RELATIONSHIP 9

Structure - property relationship of yarns produced from different spinning systems; effect of fibre properties and geometrical configuration of yarn on properties of ring yarn; comparison of ring and compact spun yarn based on structure

TOTAL: 45 PERIODS

OUTCOMES

On completion of this course, student would understand

CO1: Yarn geometry and packing density
CO2: Migration of fibres in yarn
CO3: Breaking mechanics of yarn
CO4: Mechanics of blended yarn
CO5: Structure and properties relationship of yarn

TEXT BOOKS

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

REFERENCES

1. Hearle J.W.S., Thwaitesand J.J. and Amikrbayhat A., “Mechanics of Flexible Fibre Assemblies”, Maryland, 1980.
2. Postle P., DejongS.andCarnaby G.A., “The Mechanics of Wool Structure”, Ellis Horwood, London, 1988.
3. Grosberg P. and Iype C., “Yarn production: Theoretical aspects”, Textile Institutepublication, 1999, ISBN-13: 978 1 87037 203 9.

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Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome									
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	Yarn geometry and its packing density	3	3	1	3	3	2	-	-	-	2
CO2	Migration of fibres in yarn	3	3	1	3	3	2	-	-	-	2
CO3	Breaking mechanics of yarn	3	3	1	3	3	2	-	-	-	2
CO4	Mechanics of blended yarn	3	3	1	3	3	2	-	-	-	2
CO5	Structure and properties relationship of yarn	3	3	1	3	3	2	-	-	-	2
Overall CO		3	3	1	1	3	2	-	-	-	2

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

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TX5005 **THEORY OF DRAFTING** **L T P C**
3 0 0 3

OBJECTIVE

To enable the students to learn about the theory of drafting process and drafting irregularities

UNIT I DRAFTING **9**

Definition of ideal drafting, model; conditions required to achieve ideal drafting in a roller drafting system; deviations from ideal draftingduring actual drafting; definition of drafting wave; condition for drafting wave formation during roller drafting; estimation of the magnitude of the irregularity caused by the occurrence of drafting wave.

UNIT II DRAFTING FORCE **9**

Roller drafting - forces acting on a fibre during drafting at different positions in drafting zone; measurement of drafting force; factors affecting drafting force; methods to avoid drafting wave formation; role of apron in controlling drafting wave formation; limitations of apron in roller drafting system

UNIT III OTHER DRAFTING IRREGULARITIES **9**

Definition of roller slip; conditions for the formation of forward and backward slips in the roller drafting systems; measures to avoid roller slip occurrence, causes for roller nip movement, model; roller speed variation during drafting and their effect on irregularity formation; control of the irregularity formed due to these sources.

UNIT IV COMPARISON **9**

Comparison of roller drafting system with wire point drafting system; application of wire point drafting in card and rotor spinning machine; comparison of roller drafting in drawframe, comber preparatory, comber, speed frame, ring frame and air-jet spinning system

UNIT V COMPACT SPINNING **9**

Spinning triangle – formation, factors affecting dimensions, effect on yarn quality; condensed yam spinning – principle, different methods

TOTAL 45 PERIODS

OUTCOMES:

On completion of this course, student would understand

CO1: Theory of ideal drafting and formation of drafting wave
CO2: Drafting force its measurement and influence
CO3: Different causes for irregularities in textile strand
CO4: Comparison of wire and roller drafting system and the drafting systems used in different spinning machinery
CO5: Compact spinning, principle and different methods

TEXT BOOK:

1. Foster G.A.R. The Principles of Roller Drafting and the Irregularity of Drafted Materials, The Textile Institute, Manchester, 1958.
2. Klein W. A Practical Guide to Combing, Drawing and the Roving Frame, The Textile Institute, Manchester, 1999.

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REFERENCE:

1. Lord P.R. Roller Drafting, Textile Progress, The Textile Institute, Manchester, 1993.
2. Grosberg P and lype C. Yarn Production: Theoretical Aspects, The Textile Institute, Manchester, 1999.
3. Lord P.R., Yam Production: Science, Technology and Economics, The Textile Institute, Manchester, 1999.

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome									
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	Theory of ideal drafting and formation of drafting wave	3	3	2	3	3	-	-	-	-	2
CO2	Drafting force, its measurement and influence	3	3	2	3	3	-	-	-	-	2
CO3	Different causes for irregularities in textile strand	3	3	2	3	3	-	-	-	-	2
CO4	Comparison of wire and roller drafting system and the drafting systems used in different spinning machinery	3	3	2	3	3	-	-	-	-	2
CO5	Compact spinning, principle and different methods	3	3	2	3	3	-	-	-	-	2
Overall CO		3	3	2	2	3	-	-	-	-	2

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

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TX5006 **THEORY OF TWISTING** **L T P C**
3 0 0 3

OBJECTIVE

To enable the students to learn about the principle of twist insertion in different spinning systems

UNIT I FUNDAMENTALS OF TWISTING 9

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

UNIT II TWISTING IN RING SPINNING 9

Principle of twist insertion in ring spinning; limitations of ring twisting; mechanics of balloon formed during twisting, yarn tension; influence of twisting on spinning triangle size and the subsequent effect on yarn quality and spinning performance; design features of rings and travelers used for twisting different types of yams.

UNIT III TWISTING IN OPEN-END SPINNING 9

Principle of twist insertion in open-end spinning; application of this principle in rotor spinning and friction spinning machines; advantages of this method of twisting over ring twisting method; comparison of yam tension developed during twisting in these two machines.

UNIT IV TWISTING IN AIR-JET AND AIR-VORTEX SPINNING 9

Principle of twist formation in air-jet, air vortex spinning; the merits and demerits of these methods of twisting; factors influencing twist insertion

UNIT V TWO-FOR-ONE TWISTING 9

Principle of two-for-one twisting; twisting of yarns in double-rove fed spinning machines; operating principle involved in the twisting of core spun yarns, wrap-spun yarns; self-twist spinning; electrostatic spinning

TOTAL 45 PERIODS

OUTCOMES

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

CO1: Fundamentals of twisting

CO2: Theory of twisting at ring frame

CO3: Twisting principle of open end spinning and application in rotor and friction spinning systems

CO4: Twisting in air-jet and air-vortex spinning

CO5: Principle and method of twisting in two for one twisting system and other spinning systems

TEXT BOOKS:

1. 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.
2. Stalder H., “The Rieter Manual of Spinning, Vol.6”, Rieter Machine Works Ltd., Winterthur, 2014, ISBN: 10 3-9523173-6-5 / ISBN: 13 978-3-9523173-6-5

REFERENCE:

1. De Barr A.E. and Catling H., The Principle and Theory of Ring Spinning, The Textile Institute, Manchester, 1965.
2. Usenko V., Processing of Man-made Fibres, Mir Publishers, Moscow, 1979.
3. Grosbe,G . andlype C. Yarn Production: Theoretical Aspects, The Textile Institute, Manchester, 1999.
4. Lord P.R., Yarn Production: Science, Technology and Economics, The Textile Institute, Manchester, 1999

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome									
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	Fundamentals of twisting	3	3	2	3	3	-	-	-	-	2
CO2	Theory of twisting at ring frame	3	3	2	3	3	-	-	-	-	2
CO3	Twisting principle of open end spinning and application in rotor and friction spinning systems	3	3	2	3	3	-	-	-	-	2
CO4	Twisting in air jet and air-vortex spinning	3	3	2	3	3	-	-	-	-	2
CO5	Principle and method of twisting in two for one twisting system and other spinning systems	3	3	2	3	3	-	-	-	-	2
Overall CO		3	3	2	2	3	-	-	-	-	2

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

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TX5007 STRUCTURE AND PROPERTIES OF NON WOVENS L T P C
3 0 0 3

OBJECTIVE

To enable the students to learn about the manufacturing of nonwovens and their properties

UNIT I INTRODUCTION 9

Recapitulation of web preparation by dry and wet method and bonding by mechanical, thermal and chemical methods; brief outline of nonwoven manufacture by spun bonding and melt blown processes

UNIT II WEB QUALITY 9

Effect of web quality on nonwoven quality; mechanisms of web forming machines and processes to achieve uniformity in web; process control tools used for maintaining web quality

UNIT III NEEDLE PUNCHED NONWOVENS 9

Design of needles and its effect on needle punched fabric structure and quality; type of fibres and its characteristics which affect fabric quality; horizontal and vertical structure in needle punched fabrics, and their contribution to fabric properties; needle machine parameters that affect fabric structure and properties

UNIT IV HYDRO-ENTANGLED, THERMAL AND CHEMICAL BONDED NONWOVENS 9

Effect of water jets on fibres, effect of water pressure, number of manifolds and nozzles, and type of web support systems used in spun laced nonwoven production on fabric structure and properties; effect of type of heat transfer method on thermal bonded nonwoven structure and properties; effect of process and material variables on the structure and properties of thermal and chemical bonded nonwovens

UNIT V MELTBLOWN AND SPUN BONDED NONWOVENS 9

Effect of material and process variables like type of polymer, molecular weight, polymer and air temperature, collector distance, primary and secondary air pressure in melt-blown nonwoven production on fabric structure and quality; factors affecting the structure of spun bonded fabrics and properties

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course the student will be able to

CO1: Know overview of nonwovens
CO2: Understand the optimization of process in web preparation
CO3: Process variables in needle punched nonwoven manufacture
CO4: Process control inhydro entangling, thermal and chemical bonding
CO5: Process control inmelt blown and spun bonded fabrics

TEXT BOOKS

1. Lunenschloss J., Albrecht W. and David Sharp., “Nonwoven Bonded Fabrics”, Ellis Horwood Ltd., New York, 1985, ISBN: 0-85312-636-4.
2. Mrstina V. and Feigl F., “Needle Punching Textile Technology”, Elsevier, New York, 1990, ISBN: 0444988041 | ISBN-13: 9780444988041

REFERENCES

1. Dharmadhikary R. K., Gilmore T. F., Davis H. A. and Batra S. K., “Thermal Bonding of Nonwoven Fabrics”, Textile Progress, Vol.26, No.2, Textile Institute Manchester, 1995, ISBN: 1870812786.
2. Jirsak O. and Wadsworth L. C., “Nonwoven Textiles”, Textile Institute, Manchester, 1999, ISBN: 0 89089 9788.
3. Russell S., “Hand Book of Nonwovens”, Textile Institute, Manchester, 2004, ISBN: 1855736039.
4. Chapman R., “Applications of Nonwovens in Technical Textiles”, Textile Institute, Manchester, 2010, ISBN: 1845694376
5. AbhijitMajumdar, Apurba Das, R.Alagirusamy and V.K.Kothari., “Process Control in Textile Manufacturing”, Wood Head Publishing Limited, Oxford, 2013, ISBN: 978-0-85709-027-0

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome									
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	Overview of nonwovens	3	3	3	3	-	-	-	-	2	3
CO2	Understand the optimization of process in web preparation	3	3	3	3	-	-	-	-	2	3
CO3	Process variables in needle punched nonwoven manufacture	3	3	3	3	-	-	-	-	2	3
CO4	Process control in hydro entangling, thermal and chemical bonding	3	3	3	3	-	-	-	-	2	3
CO5	Process control in melt blown and spun bonded fabrics	3	3	3	3	-	-	-	-	2	3
Overall CO		3	3	3	3	-	-	-	-	2	2

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

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TX5008	STRUCTURAL MECHANICS OF FABRICS	L T P C 3 0 0 3

OBJECTIVE

To enable the students to learn about geometry of fabric, mechanics of fabric deformation fabrics

UNIT I GEOMETRY OF CLOTH STRUCTURE 13

Geometry of plain and non-plain weaves; Peirce and Olofsson models; crimp ratio and thread spacing; jamming of threads; crimp interchange,balance of crimp.

UNIT II FABRIC DEFORMATION 9

Fabric deformation under tensile stress; prediction of modulus; tensile properties in bias direction

UNIT III OTHER FABRIC DEFORMATION 9

Compression, shear, bending and buckling; fabric handle; spirality and skewness formation and control

UNIT IV KNITTED FABRIC STRUCTURES 9

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

UNIT V NONWOVEN STRUCTURES 5

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

TOTAL: 30 PERIODS

OUTCOMES:

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

CO1: Understand the geometry of woven cloth
CO2: Know fabric deformation under tensile stress
CO3: Understand the mechanics of other fabric deformations
CO4: Know the mechanics of knitted fabric structure
CO5: Understand the structure of nonwovens

TEXT BOOKS

1. Hearle J. W. S., “Structural Mechanics of Fibers, Yarns and Fabrics”, Wiley-Interscience, New York, 1969, ISBN: 0471366692
2. Hearle J. W. S., John J., Thwaites. andJafargholiAmirbayat., “Mechanics of Flexible Fibre Assemblies”, Sijthoff and Noordhoff, 1980, ISBN : 902860720X

REFERENCES

1. Jinlian Hu., “Structure and Mechanics of Woven Fabrics”, Woodhead Publishing Ltd.,2004, ISBN: 1855739046
2. Hassan M. Berery., “Effect of Mechanical and Physical Properties on Fabrics Hand”,Wood head publishing Ltd., 2005, ISBN : 13: 978 – 1- 85573 -9185

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome									
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	Understand the geometry of woven cloth	3	3	3	3	-	-	-	-	2	2
CO2	Know fabric deformation under tensile stress	3	3	3	3	-	-	-	-	2	2
CO3	Understand the mechanics of other fabric deformations	3	3	3	3	-	-	-	-	2	2
CO4	Know the mechanics of knitted fabric structure	3	3	3	3	-	-	-	-	2	2
CO5	Understand the structure of nonwovens	3	3	3	3	-	-	-	-	2	2
Overall CO		3	3	3	3	-	-	-	-	2	2

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

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TX5009 CHARACTERIZATION OF TEXTILE POLYMERS L T P C
3 0 0 3

OBJECTIVE

To enable the students to learn about characterization of polymers used in the production of textile fibres

UNIT I MOLECULAR WEIGHT 9

Polymer solution thermo dynamics; molecular weight and molecular dimensions by end group analysis, osmometry, light scattering, viscometry, gel permeation chromatography, high performance liquid chromatography

UNIT II MOLECULAR STRUCTURE CHARACTERISATION 9

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

UNIT III THERMAL PROPERTIES 9

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

UNIT IV MICROSCOPY 9

Optical and electron microscopy; TEM, SEM, AFM, X-ray scattering from polymers, birefringence

UNIT V OTHER PROPERTIES 9

Crystallinity by density measurements, surface area, pore volume measurements by B.E.T. method, porosimetry, surface energy measurements and particle size measurement.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Determine the molecular weight using various techniques
CO2: Interpret molecular structure obtained from various analytical instruments
CO3: Determine the thermal properties using various instruments
CO4: Understand microscopy
CO5: Understand the properties of textile polymers

TEXT BOOKS

1.Gupta V.B. and Kothari V.K., “Man Made Fibre production,” Chapman and Hall, 1985.
2.Billmayer, “Textbooks of Polymer Science,” 3rd ed., Wiley, 1984

REFERENCES

1. Sperling, “Introduction to Physical Polymer Science,” Wiley, 1986.
2. Campell D. and White J.R, “Polymer characterization, Physical Techniques”, McGraw – Hill, New York, 1969.
3. Stamm M., “Polymer surfaces and Interfaces”, Springer1st ed., 2008.

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome									
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	Determine the molecular weight using various techniques	3	3	2	3	-	2	-	-	-	2
CO2	Interpret molecular structure obtained from various analytical instruments	3	3	2	3	-	2	-	-	-	2
CO3	Determine the thermal properties using various instruments	3	3	2	3	-	2	-	-	-	2
CO4	Understand microscopy	3	3	2	3	-	2	-	-	-	2
CO5	Understand the properties of textile polymers	3	3	2	3	-	2	-	-	-	2
Overall CO		3	3	2	2	-	2	-	-	-	2

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

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TX5010 COLOUR SCIENCE AND ITS APPLICATION L T P C
3 0 0 3

OBJECTIVE:

To enable the students to understand the theory of colour and measurement of colour

UNIT I LIGHT-MATTER INTERACTION 9

Electromagnetic spectrum – the optical region, interaction of light with matter a) Transparent case–Beer's Law and Lambert's Law b) Opaque case – reflection absorption and scattering, the concept of "Radiative Transfer Theory" and its simplification into the Kubelka – Munk model

UNIT II HUMAN COLOUR VISION 9

Colour sensation – physiological and psychological mechanism of colour vision; colour vision theories; defects in colour vision; colour vision tests; additive and subtractive colour mixing and confusion in colour perception

UNIT III COLOUR ORDER SYSTEMS 9

Description of colour, various colour order systems, CIE numerical system for colour definition and its components – illuminants, the versions of the standard observer, the colour scales, chromaticity diagram.

UNIT IV METAMERISM AND COLOUR DIFFERENCE ASSESSMENT 9

Metamerism – types and its assessment, metamerism in textile materials; colour differences – visual assessment, standard conditions, methods and problems, assessment of colour difference, non-linearity of subjective perception of colour, need for specific colour difference systems, setting up of objective pass/fail standards.

UNIT V NUMERICAL COLOUR MATCHING 9

Reflectance and K/S value, relationship between dye concentrations and a) reflectance values and b) K/S values, reflectance and K/S curves of dyed samples; CIE model for computer colour matching and the calculation of colour recipes; non CIE models for colour matching, limitations of computer colour matching

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Light matter interaction using various theories and laws
CO2: Colour vision theories, tests and colour mixing
CO3: Concepts of colour and colour order system
CO4: Concepts of Metamerism, colour difference assessment
CO5: Numerical colour matching

TEXT BOOKS

1. Wright W.D., "The Measurement of Colour", Adam Hilger Ltd., 1969, ISBN: 0852741340 |ISBN-13: 9780852741344
2. Sule A.D., "Computer Colour Analysis", New Age International Publishers, 2005, ISBN: 8122410847 | ISBN-13: 9788122410846.

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1. Shah H.S., and Gandhi R. S., “Instrumental Colour Measurement and Computer Aided Colour Matching for Textiles”, Mahajan Book Publication, 1990.ISBN: 8185401004 / ISBN: 9788185401003.
2. Park J., “Instrumental Colour Formulation: A Practical Guide”, Wood head Publishing, 1993, ISBN: 0901956546 | ISBN-13: 9780901956545
3. Kuehni R.G., “Computer Colorant Formulation”, Lexington Books, 1976, ISBN: 0669033359 | ISBN-13: 9780669033359
4. ChoudhuryA. K. R., “Modern Concepts of Colour and Appearance”, Oxford and IBH Publishing Ltd., 2000,ISBN: 1578080797 | ISBN-13: 9781578080793
5. McLaren K., “The Colour Science of Dyes & Pigments”, Adam Hilger Ltd., 1983, ISBN: 0852744269 | ISBN-13: 9780852744260
6. Travis D., “Effective Colour Displays”, Academic Press, 1991,ISBN: 0126976902 | ISBN 13:9780126976908.
7. Gulrajani M. L. (Ed.), “Colour Measurement - Principles, advances and industrial applications”, Wood head publishing Ltd, 2010, ISBN: 1845695593 | ISBN-13:9781845695590

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Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome									
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	Light matter interaction using various theories and laws	3	3	-	2	2	-	-	-	-	2
CO2	Colour vision theories, tests and colour mixing	3	3	-	2	2	-	-	-	-	2
CO3	Concepts of colour and colour order system	3	3	-	2	2	-	-	-	-	2
CO4	Concepts of Metamerism, colour difference assessment	3	3	-	2	2	-	-	-	-	2
CO5	Numerical colour matching	3	3	-	2	2	-	-	-	-	2
Overall CO		3	3	-	2	2	-	-	-	-	2

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

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TX5011 ENZYME TECHNOLOGY FOR TEXTILE PROCESSING L T P C
3 0 0 3

OBJECTIVES

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

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 understand the

CO1: Classification, characteristics and activity of enzymes
CO2: Kineticsof single and multi-substrate enzyme
CO3: Activity of enzyme on cotton fibres
CO4: Activity of enzyme on protein and synthetic fibres
CO5: Application of enzymes for effluent treatment

TEXT BOOKS

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.

REFERENCES

1. Cavaco-Paulo A. and Gubitz G., “Textile processing with enzymes”, Woodhead Publishing Ltd, Cambridge, UK, 2003.

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome									
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	Classification, characteristics and activity of enzymes	3	3	3	3	2	-	-	-	-	-
CO2	Kinetics of single and multi-substrate enzyme	3	3	3	3	2	-	-	-	-	-
CO3	Activity of enzyme on cotton fibres	3	3	3	3	2	-	-	-	-	-
CO4	Activity of enzyme on protein and synthetic fibres	3	3	3	3	2	-	-	-	-	-
CO5	Application of enzymes for effluent treatment	3	3	3	3	2	-	-	-	-	-
Overall CO		3	3	3	3	2	-	-	-	-	-

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

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TX5012 **HIGH PERFORMANCE TEXTILES** **L T P C**
3 0 0 3

OBJECTIVE

To enable the students to learn about advanced spinning technology for manufacturing high performance fibres, their properties and applications

UNIT I **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 **9**

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

UNIT III **9**

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

UNIT IV **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 **9**

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

TOTAL: 45 PERIODS

OUTCOMES

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

CO1: Method of producing high performance fibres
CO2: High performance fibres for industrial applications
CO3: Manufacturing of biodegradable and protein fibres and their properties
CO4: Manufacturingof chemical resistant fibres and their properties
CO5:Manufacturing of specialty fibres and their properties

TEXT BOOKS

1. Hearle J. W. S., “High Performance Fibres”, Woodhead Publishing Ltd., Cambridge, England, 2001.
2. Hongu T. and Phillips G.O., “New Fibres”, Woodhead Publishing Ltd., England, 1997

REFERENCES

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

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome									
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	Method of producing high performance fibres	3	3	2	3	2	-	-	-	3	-
CO2	High performance fibres for industrial applications	3	3	2	3	2	-	-	-	3	-
CO3	Manufacturing of biodegradable and protein fibres and their properties	3	3	2	3	2	-	-	-	3	-
CO4	Manufacturing of chemical resistant fibres and their properties	3	3	2	3	2	-	-	-	3	-
CO5	Manufacturing of specialty fibres and their properties	3	3	2	3	2	-	-	-	3	-
Overall CO		3	3	2	3	2	-	-	-	3	-

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

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TX5013 POLLUTION ABATEMENT IN TEXTILE INDUSTRY L T P C

3 0 0 3

OBJECTIVE

To enable the students to learn about pollutants from textile chemical processing industry, treatment and Government regulations

UNIT I **9**

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

UNIT II **9**

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

UNIT III **9**

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

UNIT IV **9**

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

UNIT V **9**

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

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course, the student shall know about

CO1: Pollution control policies and Government regulations
CO2: Method of treatment of waste water from processing industry
CO3: Managing pollutants as per Government regulations
CO4: Eco labeling, eco friendly textile processes
CO5: Solid and hazardous waste management in textile industry

TEXT BOOKS

1. Trivedi R.K., “Handbook of Environmental laws, Acts, Guidelines, Compliances and Standards”, Vol. 1, Enviro Media, India, 1996.
2. George Thobanoglous and Franklin L. Burton., “Waste Water Engineering and Treatment, Disposal, Reuse (Metcalf & Eddy Inc., California)”, Tata McGraw-Hill Publishing co Ltd, New Delhi, 1995.

REFERENCES

1. Manivasakam N., “Treatment of Textile Processing Effluents (including analysis)”, Sakhi Publications, Coimbatore, 1995.
2. “Eco-Textiles: Regulations, Labels, Processing and Testing, A Special Report”, The Bombay Textile Research Association, Mumbai, 1996.
3. “Symposium Proceedings on Eco - Friendly Textile Processing”, Department of textile Technology, Indian Institute of Textile Technology, New Delhi, 1995.
4. Skelly J. K., “Water Recycling in Textile wet Processing”, Woodhead Publishing Ltd, 2003.
5. Cooper P., “ Colour in Dyehouse Effluent”, Woodhead Publishing Ltd, 1995.
6. Slater K., “Environmental impact of textiles: Production Processes and Protection”, Woodhead Publishing Ltd, 2003.
7. Chritie R., “Environmental aspects of textile dyeing”, Woodhead Publishing Ltd, 2007.

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Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome									
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	Pollution control policies and Government regulations	3	2	3	-	3	-	3	-	-	-
CO2	Method of treatment of waste water from processing industry	3	2	3	-	3	-	3	-	-	-
CO3	Managing pollutants as per Government regulations	3	2	3	-	3	-	3	-	-	-
CO4	Eco labeling, eco friendly textile processes	3	2	3	-	3	-	3	-	-	-
CO5	Solid and hazardous waste management in textile industry	3	2	3	-	3	-	3	-	-	-
Overall CO		3	2	3	-	3	-	3	-		-

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

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TX5014 COATED AND LAMINATED TEXTILES L T P C
3 0 0 3

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

UNIT I POLYMERS USED IN COATING 9
Natural Latex &synthetic rubbers, synthetic polymers: polyurethanes, poly (vinyl chloride), polyacrylate elastomers, silicone elastomers, poly (Tetrafluoroethylene), polyethylene, chlorinated and chlorosulponatedpolyethylenes, foams for laminates; textile substrate for coating

UNIT II METHODS OF COATING 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 END USES OF COATING 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 END USES OF COATING 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 TEXTILES 9
Tensile strength, elongation, adhesion, tear resistance, 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 laminating
CO2: Different methods of coating and laminating
CO3: Application of coated and laminated textiles in different industry
CO4: Characterization of coated textiles

TEXT BOOKS

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.

REFERENCES

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

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Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome									
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	Different kinds of polymers used for coating and laminating	3	2	-	3	-	3	2	-	-	2
CO2	Different methods of coating and laminating	3	2	-	3	-	3	2	-	-	2
CO3	Application of coated and laminated textiles in different industry	3	2	-	3	-	3	2	-	-	2
CO4	Characterization of coated textiles	3	2	-	3	-	3	2	-	-	2
Overall CO		3	2	-	3	-	3	2	-	-	2

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

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TX5015 SUSTAINABILITY IN TEXTILE INDUSTRY L T P C
3 0 0 3

OBJECTIVE

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

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 understand the

CO1: Concept of sustainability and importance
CO2: Sustainability in textile fibre production
CO3: Sustainability in in dyeing of textiles
CO4: Importance of recycling in textile industry
CO5: Eco-labelling and eco-designing

TEXT BOOKS

1. Peter P Rogers., “An Introduction to Sustainable Development”, Glen Educational Foundation, Inc, 2008, ISBN 978-1-84407-520-1.
2. Blackburn R S., “Sustainable Textiles”, Woodhead Publishing Limited, 2009, ISBN 978-1-84569-453-1.

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.
5. Cavaco-Paulo and Gübitz G M, “Textile Processing with Enzymes”, Woodhead Publishing Ltd., UK, 2003, ISBN 978-1-85573-610-8.
6. Manivasakam N, “Treatment of Textile Processing Effluents”, Chemical Publishing Company, U.S.A, 2013, ISBN 978-0-82060-175-5.

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Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome									
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	Concept of sustainability and importance	3	-	3	3	3	-	3	-	3	-
CO2	Sustainability in textile fibre production	3	-	3	3	3	-	3	-	3	-
CO3	Sustainability in in dyeing of textiles	3	-	3	3	3	-	3	-	3	-
CO4	Importance of recycling in textile industry	3	-	3	3	3	-	3	-	3	-
CO5	Eco-labelling and eco-designing	3	-	3	3	3	-	3	-	3	-
Overall CO		3	-	3	3	3	-	3	-	3	-

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

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TX5016 **MEDICAL TEXTILES** **L T P C**
3 0 0 3

OBJECTIVES

To enable the students to learn about

- Different types of biomaterials and
- Biomedical application of textile products

UNIT I **9**

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

UNIT II **9**

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

UNIT III **9**

Bandages and pressure garments - elastic and non-elastic compression bandages, support and retention bandages;evaluation of bandages; bandages for various end uses.

UNIT IV **9**

Wound – types, healing process; requirements of wound dressing; wound care materials – types, advantages and limitations; testing of wound dressings; advanced wound dressings

UNIT V **9**

Implantable products; sutures – requirements, classifications, specifications, materials and their applications; vascular grafts, artificial ligaments, artificial tendons; scaffolds for tissue engineering; intelligent textiles for medical applications; ethical issues, clearance; disposal of medical products

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course, the student shall know the

CO1: Types of materials used for biomedical applications
CO2: Health care and hygiene products
CO3: Different types of bandages
CO4: Wound dressing construction, testing
CO5: Implantable products, scaffolds for tissue engineering, ethical issues

TEXT BOOKS

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.

REFERENCES

1. Joon B. Park. and Joseph D. Bronzino., “Biomaterials – Principles and Applications”,CRC Press Boca Raton London, NewYork, Washington , D.C. 2002
2. Anand S., “ Medical Textiles”, Textile Institute, 1996, ISBN: 185573317X
3. Horrocks A.R. and Anand S.C, “Technical Textiles”, Textile Institute,1999, ISBN: 185573317X.
4. Adanur S., “ Wellington Sears Handbook of Industrial Textiles”’ Technomic Publishing Co., Inc., Lancaster Pennylvania 1995, ISBN 1-56676-340-1.
5. Michael Szycher and Steven James Lee, “Modern Wound Dressing: A Systematic Approach to Wound Healing”, Journal of Biomaterials Applications, 1992
6. Rajendran S., “Advanced Textiles for Wound Care”, Woodhead Publishing Ltd., 2009, ISBN 1 84569 2713.

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Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome									
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	Types of materials used for biomedical applications	3	3	-	3	-	3	2	-	-	2
CO2	Health care and hygiene products	3	3	-	3	-	3	2	-	-	2
CO3	Different types of bandages	3	3	-	3	-	3	2	-	-	2
CO4	Wound dressing construction, testing	3	3	-	3	-	3	2	-	-	2
CO5	Implantable products, scaffolds for tissue engineering, ethical issues	3	3	-	3	-	3	2	-	-	2
Overall CO		3	3	-	3	-	3	2	-	-	2

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

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TX5017 **PROTECTIVE CLOTHING** **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 developing protective clothing
- Evaluation of protective clothing

UNIT I FIBRE REQUIREMENTS 9

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

UNIT II YARN AND FABRIC REQUIREMENTS 9

Types of yarns, woven, knitted and nonwoven fabric structures used for protective garments, methods of production, effect of structure on their performance

UNIT III CLOTHING CONSTRUCTION 9

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

UNIT IV FINISHING OF PROTECTIVE CLOTHING 9

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

UNIT V QUALITY EVALUATION 9

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

OUTCOMES:

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

CO1: Properties of fibres required for protective clothing
CO2: Selection of fibre, yarn and fabric for developing protective clothing for different applications
CO3: Protective clothing construction
CO4: Different types of finishes given to develop protective clothing
CO5: Evaluation of protective clothing

TEXT BOOKS

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

REFERENCES

1. Chellamani K.P. and Chattopadhyyay D., “Yarns and Technical Textiles”, SITRA, 1999.
2. Mukhopadhyay S.K. and Partridge J.F., “Automotive Textiles”, Textile Progress, Vol29, No1/2, 1999, ISBN:1870372212
3. Horrocks A.R. and Anand S.C., “Handbook of Technical Textiles”, The Textile Institute, Manchester, 2000, ISBN: 1855733854.
4. Anand S.C., “Medical Textiles”, Textile Institute, Manchester, 2001, ISBN:185573494X.
5. Scott R.A., “Textiles for protection”, Woodhead Publishing Ltd., Cambridge, UK, 2005, ISBN 1-85573-921-6.
6. Saville B.P., “Physical testing of textiles”, Woodhead Publishing Ltd., Cambridge, UK, 1999, ISBN 1-85573-367-6.
7. Long A.C., “Design and manufacture of Textile Composities”, Woodhead Publishing Ltd., Cambridge, UK, 2005, ISBN 1-85573-744-2.
8. Fung W, “Coated and laminated textiles”, Woodhead Publishing Ltd, Cambridge, UK, 2002, ISBN 1-85573-576-8.
9. 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.
10. Fung W. and Hardcastle, “Textiles in automotive engineering”, Woodhead Publishing Ltd, Cambridge, UK, 2001, ISBN 1-85573-493-1.
11. John N.W.M., “Geo Textile”, Blackie and Sons Ltd, London, U.K. , 1987, ISBN 0-412-01351-7.
12. Allison Mathews. and Martin Hardingham, “Medical and Hygiene Textile Production – A hand book” Intermediate Technology Publications, 1994.

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome									
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	Properties of fibres required for protective clothing	3	3	-	3	-	3	2	-	-	2
CO2	Selection of fibre, yarn and fabric for developing protective clothing for different applications	3	3	-	3	-	3	2	-	-	2
CO3	Protective clothing construction	3	3	-	3	-	3	2	-	-	2
CO4	Different types of finishes given to develop protective clothing	3	3	-	3	-	3	2	-	-	2
CO5	Evaluation of protective clothing	3	3	-	3	-	3	2	-	-	2
Overall CO		3	3	-	3	-	3	2	-	-	2

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

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TX5018 **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 and application; reinforcements- fibres and its properties; preparation of reinforced materials and quality evaluation; preforms for various composites

UNIT II MATRICES 9

Preparation, chemistry, properties and applications of natural matrices, thermoplastic and thermoset resins; 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, prepregsand autoclave moulding, pultrusion, vacuum impregnation methods, compression moulding; post processing of composites and composite design requirements

UNIT IV TESTING 9

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

UNIT V MECHANICS 9

Micro mechanics, macro mechanics of single layer, macro mechanics of laminate, classical lamination theory, failure theories and prediction of inter laminar stresses using at ware

TOTAL: 45 PERIODS

OUTCOMES

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

CO1: Understand different types of textile reinforcements
CO2: Understand different types ofmatrices
CO3: Understand manufacturing of composites
CO4: Evaluate the properties of thermoset and thermoplastic composite
CO5: Mechanics of composites failure

TEXT BOOKS

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.

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1. George LubinandStanley T. Peters, “Handbook of Composites”, Springer Publications,1998.
2. Mel. M. Schwartz, “Composite Materials”, Vol. 1 &2, Prentice - Hall PTR, New Jersey,1997.
3. RichardM.Christensen,“Mechanics of compositematerials”,DoverPublications,2005.
4. Sanjay K. Mazumdar, “Composites Manufacturing: Materials, Product, and Process Engineering”,CRCPress,2001

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Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome									
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	Understand different types of textile reinforcements	3	3	-	3	-	3	2	-	-	3
CO2	Understand different types of matrices	3	3	-	3	-	3	2	-	-	3
CO3	Understand manufacturing of composites	3	3	-	3	-	3	2	-	-	3
CO4	Evaluate the properties of thermoset and thermoplastic composite	3	3	-	3	-	3	2	-	-	3
CO5	Mechanics of composites failure	3	3	-	3	-	3	2	-	-	3
Overall CO		3	3	-	3	-	3	2	-	-	3

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

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TX5019 TEXTILES IN CIVIL CONSTRUCTION AND TRANSPORTATION L T P C
3 0 0 3

OBJECTIVES

To enable the students to learn about

- Textiles used for civil construction and transportation applications and their functional requirements and
- Evaluation of textile materials used for civil construction and transportation applications.

UNIT I GEO TEXTILES I 9

Geo textile – definition, types, functions; types of fibers and fabrics used in geo textiles; applications of natural fibers in geo-textiles; joining of geo- textiles

UNIT II GEO TEXTILES II 9

Usage of geo-synthetics in civil engineering applications as filters, reinforcement, separation and drainage medium; material specifications and design criteria of geo-synthetics for specific applications

UNIT III ARCHITECTURE TEXTILES 9

Fiber and fabric property requirements for architecture textiles; coated textiles; Tents, Awnings and Canopies; Inflatable structures – high pressure and low pressure inflatable structures; textile for roofing applications; acoustic and heat insulation textiles; floor and wall covering, scaffolding nets

UNIT IV TRANSPORTATION TEXTILES 9

Quality and design of textile materials used in automobiles – tire cord, filter, air bag, belt, seat cover, noise insulation; design and development of textile reinforced composites in automobile and aeronautic industry.

UNIT V EVALUATION 9

Evaluation of textile material used in civil construction and transportation industry in terms of performance, construction survivability and durability

TOTAL: 45 PERIODS

OUTCOMES

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

CO1: Understand the requirements of textiles used for civil construction and transportation applications and

CO2: Understand geo synthetics in civil engineering applications

CO3: Design the textiles for the architectural applications

CO4:Design of textile materials for automobile industry

CO5: Evaluation of textiles to be used for civil construction and transportation industry

TEXT BOOKS

1. Horrocks A.R. and Anand S.C., “Handbook of Technical Textiles”, The Textile Institute, Manchester, 2000, ISBN: 1855733854.
2. R. W. Sarsby, “Geo Synthetics in Civil Engineering”, Woodhead Publishing, ISBN-13: 978-1-85573-607-8

REFERENCES

1. Mukhopadhyay S.K. and Partridge J.F., “Automotive Textiles”, Textile Progress, Vol.29, No1/2, 1999, ISBN:1870372212.
2. Adanur S., “Wellington sears handbook of Industrial textiles”, Technomic publishing co inc., 1995, ISBN : 1–56676–340–1.
3. Eugeniooñate and Bern kröplin “Textile Composites and Inflatable Structures”, Springer Dordrecht, Berlin, Heidelberg, New York, ISBN-10 1-4020-3316-8

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Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome									
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	Understand the requirements of textiles used for civil construction and transportation applications and	3	3	-	3	-	3	2	-	-	2
CO2	Understand geo synthetics in civil engineering applications	3	3	-	3	-	3	2	-	-	2
CO3	Design the textiles for the architectural applications	3	3	-	3	-	3	2	-	-	2
CO4	Design of textile materials for automobile industry	3	3	-	3	-	3	2	-	-	2
CO5	Evaluation of textiles to be used for civil construction and transportation industry	3	3	-	3	-	3	2	-	-	2
Overall CO		3	3	-	3	-	3	2	-	-	2

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

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TX5020 **FILTRATION TEXTILES** **L T P C**
3 0 0 3

OBJECTIVE

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

UNIT I BASIC PRINCIPLES 9

Filtration and separation, contaminants, surface and depth filtration; filter ratings and filter test, dust collection – theory and principles, practical implications, cleaning mechanisms; fabric design and selection considerations; filter media: introduction, absorbent, adsorbent and biological filter media, paper and fabrics, woven wire and screens, constructed filter cartridges, membranes, packed beds; types of filters.

UNIT II TEXTILE FILTERS & FINISHING TREATMENTS 9

Fabric construction -woven fabrics, needle felts, knitted fabrics; heat setting, singeing, raising, calendaring, chemical treatments, special surface treatments

UNIT III LIQUID AND OIL FILTRATION 9

Water filters, waste water treatments, surface treatment chemicals; oil and hydraulic systems; engine filters, oil-water separators, oil cleaning and hydraulic systems. gas filtration-introduction, engine filters, oil–waterseparators, oil cleaning, hydraulic systems

UNIT IV TEXTILE FILTER IN SOLID-LIQUID SEPARATION 9

Introduction, fabric design/selection consideration, filtration equipment, considerations; yarn types and fabric constructions - monofilaments, multi filaments, fibrillated tape (split film) yarns, staple-fibre yarns, yarn combinations; fabric constructions and properties - plain weave, twill weaves, satin weaves, duplex and semi duplex weaves, link fabrics, needle felts

UNIT V GAS FILTRATION 9

Introduction, indoor air quality, fume and vapour emissions, dust collectors, machine air intake filters, vehicle cabin filters, compressed air filtration, pneumatic systems, sterile air and gas filters, respiratory air filters

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Principles of filtration
CO2: Fabric construction and finishing treatments of filtration textiles
CO3: Concepts of liquid and oil filtration
CO4: Concepts of solid liquid separation
CO5: Types of Gas filters

TEXT BOOKS

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.

REFERENCES

1. Alagirusamy R and Das A, “Technical Textile Yarns”, Woodhead Publishers, Cambridge, England, 2010

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome									
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	Principles of filtration	3	3	-	3	-	2	2	-	-	2
CO2	Fabric construction and finishing treatments of filtration textiles	3	3	-	3	-	2	2	-	-	2
CO3	Concepts of liquid and oil filtration	3	3	-	3	-	2	2	-	-	2
CO4	Concepts of solid liquid separation	3	3	-	3	-	2	2	-	-	2
CO5	Types of Gas filters	3	3	-	3	-	2	2	-	-	2
Overall CO		3	3	-	3	-	2	2	-	-	2

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

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TX5021 **CLOTHING SCIENCE** **L T P C**
3 0 0 3

OBJECTIVES

To enable the students to learn about

- 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

Neurophysiological 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 understand

CO1: Fabric hand and its comfort parameters
CO2: Permeability and porous nature of fibrous assemblies
CO3: Moisture vapour transfer phenomenon
CO4: Heat transfer phenomenon
CO5: Fabric properties with respect to comfort and correlate the property of the fabric with comfort to the wearer.

TEXT BOOKS

1. Hassan M. Behery, “Effect of Mechanical and Physical Properties on Fabric Hand”, Wood head Publishing Ltd., ISBN 0-8493-3479-9.
2. Li Y., “The Science of Clothing Comfort”, Textile Progress 31:1

REFERENCES

1. Laing, R.M. and Sleivert G.G., “Clothing, Textile and Human Performance, Textile Progress, 32:2
2. Pan N. and Gibson P., Thermal and moisture transport in fibrous materials Wood head Publishing Limited ISBN-10: 1-84569-226-8.

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome									
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	Fabric hand and its comfort parameters	3	2	-	2	-	3	2	–	–	3
CO2	Permeability and porous nature of fibrous assemblies	3	3	-	1	-	3	2	–	–	2
CO3	Moisture vapour transfer phenomenon	3	1	-	3	-	3	2	–	–	3
CO4	Heat transfer phenomenon	3	2	-	2	-	3	2	–	–	2
CO5	Fabric properties with respect to comfort and correlate the property of the fabric with comfort to the wearer.	3	3	-	1	-	3	2	–	–	3
Overall CO		3	2	-	2	-	3	2	–	–	2

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

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TX5022 **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 understand

CO1: Chemical structure and properties of dyes
CO2: Dyesused in textiles
CO3: Functional dyes, their chemical structure and requirements
CO4: Applications of the functional dyes in different industries
CO5: Toxicity and health issues

TEXT BOOKS

1. McLaren K., “The Color Science of Dyes & Pigments”, Adam Hilger Ltd., 1983, ISBN 0-85274-426-9.
2. Venkataraman K., “The Chemistry of Synthetic Dyes”, Elsevier., 2012, ISBN 97801-271-70084

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, HeinfredOhleier 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

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Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome									
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	Chemical structure and properties of dyes	3	3	-	3	-	2	2	-	-	3
CO2	Dyes used in textiles	3	3	-	3	-	2	2	-	-	3
CO3	Functional dyes, their chemical structure and requirements	3	3	-	3	-	2	2	-	-	3
CO4	Applications of the functional dyes in different industries	3	3	-	3	-	2	2	-	-	3
CO5	Toxicity and health issues	3	3	-	3	-	2	2	-	-	3
Overall CO		3	3	-	3	-	2	2	-	-	3

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

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TX5023 COLOURATION AND FUNCTIONAL FINISHES L T P C

3 0 0 3

OBJECTIVE

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

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

OUTCOMES:

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

CO1: Theories and concepts of dyeing

CO2: Concepts of ink jet printing

CO3: Different coating techniques

CO4: Overview of enzymes and enzymes usage in chemical processing

TEXT BOOKS

1. Park J., “Instrumental Colour formulation: A Practical guide”, Woodhead Publishing, 1993, ISBN 0 901956 54 6.
2. Choudhury A. K. R., “Modern concepts of colour and appearance”, Oxford and IBH Publishing Ltd, 2000.

REFERENCES

1. Sule A. D., “Computer colour analysis”, New Age International Publishers, 2002.
2. McLaren K., “The color science of Dyes & Pigments”, Adam Hilger Ltd., 1983, ISBN 0-85274-4269.
3. Freifelder D., "Molecular Biology ", Jones and Bartlett Publishers Inc. 1987.
4. Nierstrasz V. and Cavaco- Paulo A., “Advances in textile biotechnology”, Woodhead Publishing Ltd, Cambridge, UK, 2010.
5. Cavaco -Paulo A. and Gubitz G., “Textile processing with enzymes”, Woodhead Publishing Ltd, Cambridge, UK, 2003.
6. UjiieH.,”Digital Printing of Textiles”, Woodhead Publishing Ltd, Cambridge, UK, 2006

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome									
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	Theories and concepts of dyeing	3	3	-	3	-	2	2	-	-	3
CO2	Concepts of ink jet printing	3	3	-	3	-	2	2	-	-	3
CO3	Different coating techniques	3	3	-	3	-	2	2	-	-	3
CO4	Overview of enzymes and Enzymes usage in chemical processing	3	3	-	3	-	2	2	-	-	3
Overall CO		3	3	-	3	-	2	2	-	-	3

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

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OPEN ELECTIVE COURSES (OEC)

OE5091 BUSINESS DATA ANALYTICS L T P C
3 0 0 3

OBJECTIVES:

- To understand the basics of business analytics and its life cycle.
- To gain knowledge about fundamental business analytics.
- To learn modeling for uncertainty and statistical inference.
- To understand analytics using Hadoop and Map Reduce frameworks.
- To acquire insight on other analytical frameworks.

UNIT I OVERVIEW OF BUSINESS ANALYTICS 9

Introduction – Drivers for Business Analytics – Applications of Business Analytics: Marketing and Sales, Human Resource, Healthcare, Product Design, Service Design, Customer Service and Support – Skills Required for a Business Analyst – Framework for Business Analytics Life Cycle for Business Analytics Process.

Suggested Activities:

- Case studies on applications involving business analytics.
- Converting real time decision making problems into hypothesis.
- Group discussion on entrepreneurial opportunities in Business Analytics.

Suggested Evaluation Methods:

- Assignment on business scenario and business analytical life cycle process.
- Group presentation on big data applications with societal need.
- Quiz on case studies.

UNIT II ESSENTIALS OF BUSINESS ANALYTICS 9

Descriptive Statistics – Using Data – Types of Data – Data Distribution Metrics: Frequency, Mean, Median, Mode, Range, Variance, Standard Deviation, Percentile, Quartile, z-Score, Covariance, Correlation – Data Visualization: Tables, Charts, Line Charts, Bar and Column Chart, Bubble Chart, Heat Map – Data Dashboards.

Suggested Activities:

- Solve numerical problems on basic statistics.
- Explore chart wizard in MS Excel Case using sample real time data for data visualization.
- Use R tool for data visualization.

Suggested Evaluation Methods:

- Assignment on descriptive analytics using benchmark data.
- Quiz on data visualization for univariate, bivariate data.

UNIT III MODELING UNCERTAINTY AND STATISTICAL INFERENCE 9

Modeling Uncertainty: Events and Probabilities – Conditional Probability – Random Variables – Discrete Probability Distributions – Continuous Probability Distribution – Statistical Inference: Data Sampling – Selecting a Sample – Point Estimation – Sampling Distributions – Interval Estimation – Hypothesis Testing.

Suggested Activities:

- Solving numerical problems in sampling, probability, probability distributions and hypothesis testing.
- Converting real time decision making problems into hypothesis.

Suggested Evaluation Methods:

- Assignments on hypothesis testing.
- Group presentation on real time applications involving data sampling and hypothesis testing.

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- Quizzes on topics like sampling and probability.

UNIT IV ANALYTICS USING HADOOP AND MAPREDUCE FRAMEWORK 9

Introducing Hadoop– RDBMS versus Hadoop–Hadoop Overview – HDFS (Hadoop Distributed File System) – Processing Data with Hadoop– Introduction to MapReduce – Features of MapReduce – Algorithms Using Map-Reduce: Matrix-Vector Multiplication, Relational Algebra Operations, Grouping and Aggregation – Extensions to MapReduce.

Suggested Activities:

- Practical – Install and configure Hadoop.
- Practical – Use web based tools to monitor Hadoop setup.
- Practical – Design and develop MapReduce tasks for word count, searching involving text corpus etc.

Suggested Evaluation Methods:

- Evaluation of the practical implementations.
- Quizzes on topics like HDFS and extensions to MapReduce.

UNIT V OTHER DATA ANALYTICAL FRAMEWORKS 9

Overview of Application development Languages for Hadoop – PigLatin – Hive – Hive Query Language (HQL) – Introduction to Pentaho, JAQL – Introduction to Apache: Sqoop, Drill and Spark, Cloudera Impala – Introduction to NoSQL Databases – Hbase and MongoDB.

Suggested Activities:

- Practical – Installation of NoSQL database like MongoDB.
- Practical – Demonstration on Sharding in MongoDB.
- Practical – Install and run Pig
- Practical – Write PigLatin scripts to sort, group, join, project, and filter data.
- Design and develop algorithms to be executed in MapReduce involving numerical methods for analytics.

Suggested Evaluation Methods:

- Mini Project (Group) – Real time data collection, saving in NoSQL, implement analytical techniques using Map-Reduce Tasks and Result Projection.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of the course, the student will be able to:

- Identify the real world business problems and model with analytical solutions.
- Solve analytical problem with relevant mathematics background knowledge.
- Convert any real world decision making problem to hypothesis and apply suitable statistical testing.
- Write and Demonstrate simple applications involving analytics using Hadoop and MapReduce
- Use open source frameworks for modeling and storing data.
- Apply suitable visualization technique using R for visualizing voluminous data.

REFERENCES:

1. VigneshPrajapati, “Big Data Analytics with R and Hadoop”, Packt Publishing, 2013.
2. Umesh R Hodeghatta, UmeshaNayak, “Business Analytics Using R – A Practical Approach”, Apress, 2017.
3. AnandRajaraman, Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
4. Jeffrey D. Camm, James J. Cochran, Michael J. Fry, Jeffrey W. Ohlmann, David R. Anderson, “Essentials of Business Analytics”, Cengage Learning, second Edition, 2016.
5. U. Dinesh Kumar, “Business Analytics: The Science of Data-Driven Decision Making”, Wiley, 2017.
6. A. Ohri, “R for Business Analytics”, Springer, 2012
7. Rui Miguel Forte, “Mastering Predictive Analytics with R”, Packt Publication, 2015.

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	1	1	2	3	1
CO2	2	1	1	2	1	1
CO3	1	1	2	3	3	1
CO4	2	2	1	2	1	1
CO5	1	1	2	2	1	1
CO6	1	1	1	3	2	1

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OE5092 **INDUSTRIAL SAFETY** **LT P C**
3 0 0 3

OBJECTIVES:

- Summarize basics of industrial safety
- Describe fundamentals of maintenance engineering
- Explain wear and corrosion
- Illustrate fault tracing
- Identify preventive and periodic maintenance

UNIT I INTRODUCTION 9

Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT II FUNDAMENTALS OF MAINTENANCE ENGINEERING 9

Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT III WEAR AND CORROSION AND THEIR PREVENTION 9

Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT IV FAULT TRACING 9

Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

UNIT V PERIODIC AND PREVENTIVE MAINTENANCE 9

Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

TOTAL: 45 PERIODS

OUTCOMES:

CO1: Ability to summarize basics of industrial safety
CO2: Ability to describe fundamentals of maintenance engineering
CO3: Ability to explain wear and corrosion
CO4: Ability to illustrate fault tracing
CO5: Ability to identify preventive and periodic maintenance

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓											
CO2	✓											
CO3	✓	✓	✓									
CO4	✓	✓	✓									
CO5	✓	✓	✓									

REFERENCES:

1. Audels, Pump-hydraulic Compressors, Mcgrew Hill Publication, 1978.
2. Garg H P,Maintenance Engineering, S. Chand and Company,1987.
3. Hans F. Winterkorn ,Foundation Engineering Handbook, Chapman & Hall London,2013.
4. Higgins & Morrow , Maintenance Engineering Handbook,Eighth Edition,2008

OE5093 OPERATIONS RESEARCH LT P C
3 0 0 3

OBJECTIVES:

- Solve linear programming problem and solve using graphical method.
- Solve LPP using simplex method
- Solve transportation , assignment problems
- Solve project management problems
- Solve scheduling problems

UNIT I LINEAR PROGRAMMING 9

Introduction to Operations Research – assumptions of linear programming problems - Formulations of linear programming problem – Graphical method

UNIT II ADVANCES IN LINEAR PROGRAMMING 9

Solutions to LPP using simplex algorithm- Revised simplex method - primal dual relationships – Dual simplex algorithm - Sensitivity analysis

UNIT III NETWORK ANALYSIS – I 9

Transportation problems -Northwest corner rule, least cost method,Voges's approximation method - Assignment problem -Hungarian algorithm

UNIT IV NETWORK ANALYSIS – II 9

Shortest path problem: Dijkstra's algorithms, Floyds algorithm, systematic method -CPM/PERT

UNIT V NETWORK ANALYSIS – III 9

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models

TOTAL: 45 PERIODS

OUTCOMES:

CO1: To formulate linear programming problem and solve using graphical method.
CO2: To solve LPP using simplex method
CO3: To formulate and solve transportation, assignment problems
CO4: To solve project management problems

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CO5: To solve scheduling problems

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓											
CO2	✓											
CO3	✓	✓	✓									
CO4	✓	✓	✓									
CO5	✓	✓	✓									

REFERENCES:

1. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010
2. Hitler Libermann, Operations Research: McGraw Hill Pub. 2009
3. Pant J C, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Pannerselvam, Operations Research: Prentice Hall of India 2010
5. Taha H A, Operations Research, An Introduction, PHI, 2008

OE5094 COST MANAGEMENTOF ENGINEERING PROJECTS L T P C
3 0 0 3

OBJECTIVES:

- Summarize the costing concepts and their role in decision making
- Infer the project management concepts and their various aspects in selection
- Interpret costing concepts with project execution
- Develop knowledge of costing techniques in service sector and various budgetary control techniques
- Illustrate with quantitative techniques in cost management

UNIT I INTRODUCTION TO COSTING CONCEPTS 9

Objectives of a Costing System; Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost; Creation of a Database for operational control.

UNIT II INTRODUCTION TO PROJECT MANAGEMENT 9

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities, Detailed Engineering activities, Pre project execution main clearances and documents, Project team: Role of each member,Importance Project site: Data required with significance, Project contracts.

UNIT III PROJECT EXECUTION AND COSTING CONCEPTS 9

Project execution Project cost control, Bar charts and Network diagram, Project commissioning: mechanical and process, Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis, Various decision-making problems, Pricing strategies: Pareto Analysis, Target costing, Life Cycle Costing.

UNIT IV COSTING OF SERVICE SECTOR AND BUDGETERY CONTROL 9

Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis, Budgetary Control: Flexible Budgets; Performance budgets; Zero-based budgets.

UNIT V QUANTITATIVE TECHNIQUES FOR COST MANAGEMENT 9

Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Learning Curve Theory.

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TOTAL: 45 PERIODS

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OUTCOMES

CO1 – Understand the costing concepts and their role in decision making
CO2–Understand the project management concepts and their various aspects in selection
CO3–Interpret costing concepts with project execution
CO4–Gain knowledge of costing techniques in service sector and various budgetary control techniques
CO5 - Become familiar with quantitative techniques in cost management

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓		✓			✓	✓		✓	✓
CO2	✓	✓	✓		✓				✓		✓	✓
CO3	✓	✓	✓		✓	✓					✓	✓
CO4	✓	✓	✓		✓		✓				✓	✓
CO5	✓	✓	✓		✓	✓	✓				✓	✓

REFERENCES:

1. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher, 1991
2. Charles T. Horngren and George Foster, Advanced Management Accounting, 1988
3. Charles T. Horngren et al Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi, 2011
4. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting, 2003
5. Vohra N.D., Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd, 2007

OE5095 COMPOSITE MATERIALS L T P C
3 0 0 3

OBJECTIVES:

- Summarize the characteristics of composite materials and effect of reinforcement in composite materials.
- Identifythe various reinforcements used in composite materials.
- Compare the manufacturing process of metal matrix composites.
- Understand the manufacturing processes of polymer matrix composites.
- Analyze the strength of composite materials.

UNIT I INTRODUCTION 9

Definition – Classification and characteristics of Composite materials - Advantages and application of composites - Functional requirements of reinforcement and matrix - Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT II REINFORCEMENTS 9

Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers - Properties and applications of whiskers, particle reinforcements - Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures - Isostrain and Isostress conditions.

UNIT III MANUFACTURING OF METAL MATRIX COMPOSITES 9

Casting – Solid State diffusion technique - Cladding – Hot isostatic pressing - Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving - Properties and applications.

UNIT IV MANUFACTURING OF POLYMER MATRIX COMPOSITES 9

Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method –Filament winding method – Compression moulding – Reaction injection moulding - Properties and applications.

UNIT V STRENGTH 9

Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

TOTAL: 45 PERIODS

OUTCOMES:

- CO1 - Know the characteristics of composite materials and effect of reinforcement in composite materials.
- CO2 – Know the various reinforcements used in composite materials.
- CO3 – Understand the manufacturing processes of metal matrix composites.
- CO4 – Understand the manufacturing processes of polymer matrix composites.
- CO5 – Analyze the strength of composite materials.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		✓	✓	✓								
CO2		✓✓	✓	✓	✓						✓	
CO3			✓	✓	✓		✓				✓	
CO4			✓	✓	✓		✓				✓	
CO5				✓	✓		✓					

REFERENCES:

1. Cahn R.W. - Material Science and Technology – Vol 13 – Composites, VCH, WestGermany.
2. Callister, W.D Jr., Adapted by Balasubramaniam R, Materials Science and Engineering, An introduction, John Wiley & Sons, NY, Indian edition, 2007.
3. Chawla K.K., Composite Materials, 2013.
4. Lubin.G, Hand Book of Composite Materials, 2013.

OE5096 **WASTE TO ENERGY** **L T P C**
3 0 0 3

OBJECTIVES:

- Interpret the various types of wastes from which energy can be generated
- Develop knowledge on biomass pyrolysis process and its applications
- Develop knowledge on various types of biomass gasifiers and their operations
- Invent knowledge on biomass combustors and its applications on generating energy
- Summarize the principles of bio-energy systems and their features

UNITI INTRODUCTION TO EXTRACTION OF ENERGY FROM WASTE 9

Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

UNITIIBIOMASS PYROLYSIS 9

Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNITIII BIOMASS GASIFICATION 9

Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

UNITIV BIOMASS COMBUSTION 9

Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNITV BIO ENERGY 9

Properties of biogas (Calorific value and composition), Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production -Urban waste to energy conversion - Biomass energy programme in India.

TOTAL: 45 PERIODS

OUTCOMES:

CO1 – Understand the various types of wastes from which energy can be generated
CO2 – Gain knowledge on biomass pyrolysis process and its applications
CO3 – Develop knowledge on various types of biomass gasifiers and their operations
CO4 – Gain knowledge on biomass combustors and its applications on generating energy
CO5 – Understand the principles of bio-energy systems and their features

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓		✓									✓
CO2	✓		✓									✓
CO3	✓	✓	✓		✓							✓
CO4	✓	✓	✓		✓		✓					✓
CO5	✓	✓	✓		✓							✓

REFERENCES:

1. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
2. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.

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AUDIT COURSES (AC)

AX5091 ENGLISHFOR RESEARCHPAPERWRITING L T P C
2 0 0 0

OBJECTIVES

- Teach how to improve writing skills and level of readability
- Tell about what to write in each section
- Summarize the skills needed when writing a Title
- Infer the skills needed when writing the Conclusion
- Ensure the quality of paper at very first-time submission

UNITI INTRODUCTION TO RESEARCH PAPER WRITING 6

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT II PRESENTATION SKILLS 6

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction

UNIT III TITLE WRITING SKILLS 6

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check

UNIT IV RESULT WRITING SKILLS 6

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNIT V VERIFICATION SKILLS 6

Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first-time submission

TOTAL: 30 PERIODS

OUTCOMES

CO1 –Understand that how to improve your writing skills and level of readability
CO2 –Learn about what to write in each section
CO3 –Understand the skills needed when writing a Title
CO4 – Understand the skills needed when writing the Conclusion
CO5 – Ensure the good quality of paper at very first-time submission

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1										✓		✓
CO2										✓		✓
CO3										✓		✓
CO4										✓		✓
CO5										✓		✓

REFERENCES

1. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011
2. Day R How to Write and Publish a Scientific Paper, Cambridge University Press 2006
3. Goldbort R Writing for Science, Yale University Press (available on Google Books) 2006
4. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book 1998.

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AX5092 **DISASTER MANAGEMENT** **L T P C**
2 0 0 0

OBJECTIVES

- Summarize basics of disaster
- Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Develop the strengths and weaknesses of disaster management approaches

UNIT I INTRODUCTION 6

Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT II REPERCUSSIONS OF DISASTERS AND HAZARDS 6

Economic Damage, Loss of Human and Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

UNIT III DISASTER PRONE AREAS IN INDIA 6

Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics

UNIT IV DISASTER PREPAREDNESS AND MANAGEMENT 6

Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT V RISK ASSESSMENT 6

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival

TOTAL : 30 PERIODS

OUTCOMES

CO1: Ability to summarize basics of disaster
CO2: Ability to explain critical understanding of key concepts in disaster risk reduction and humanitarian response.
CO3: Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
CO4: Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
CO5: Ability to develop the strengths and weaknesses of disaster management approaches

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓											
CO2	✓											
CO3	✓	✓	✓									
CO4	✓	✓	✓									
CO5	✓	✓	✓									

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REFERENCES

1. Goel S. L., Disaster Administration And Management Text And Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi,2009.
2. Nishitha Rai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company,2007.
3. Sahni, Pardeep Et.Al. ," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi,2001.

AX5093 SANSKRIT FOR TECHNICAL KNOWLEDGE L T P C
2 0 0 0

OBJECTIVES

- Illustrate the basic sanskrit language.
- Recognize sanskrit, the scientific language in the world.
- Appraise learning of sanskrit to improve brain functioning.
- Relate sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power.
- Extract huge knowledge from ancient literature.

UNIT I ALPHABETS 6

Alphabets in Sanskrit

UNIT II TENSES AND SENTENCES 6

Past/Present/Future Tense - Simple Sentences

UNIT III ORDER AND ROOTS 6

Order - Introduction of roots

UNIT IV SANSKRIT LITERATURE 6

Technical information about Sanskrit Literature

UNIT V TECHNICAL CONCEPTS OF ENGINEERING 6

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

TOTAL: 30 PERIODS

OUTCOMES

- CO1 - Understanding basic Sanskrit language.
- CO2 - Write sentences.
- CO3 - Know the order and roots of Sanskrit.
- CO4 - Know about technical information about Sanskrit literature.
- CO5 - Understand the technical concepts of Engineering.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1										✓		✓
CO2										✓		✓
CO3												✓
CO4												✓
CO5												✓

REFERENCES

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi, 2017.

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AX5094	VALUE EDUCATION	L T P C
		2 0 0 0

OBJECTIVES

Students will be able to

- Understand value of education and self-development
- Imbibe good values in students
- Let the should know about the importance of character

UNIT I

Values and self-development–Social values and individual attitudes. Workethics,Indianvisionofhumanism.Moralandnon-moralvaluation.Standards and principles. Value judgements

UNIT II

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love fornature, Discipline

UNIT III

Personality and Behavior Development-Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brother hood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature

UNIT IV

Character and Competence–Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively.

TOTAL: 30 PERIODS

OUTCOMES

Students will be able to

- Knowledge of self-development.
- Learn the importance of Human values.
- Developing the over all personality.

Suggested reading

1. Chakroborty, S.K."Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi

AX5095 **CONSTITUTION OF INDIA** **L T P C**
2 0 0 0

OBJECTIVES

Students will be able to:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional
- Role and entitlement to civil and economic rights as well as the emergence nation hood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolutionin1917and its impact on the initial drafting of the Indian Constitution.

UNIT I HISTORY OF MAKING OF THE INDIAN CONSTITUTION:

History, Drafting Committee, (Composition &Working)

UNIT II PHILOSOPHYOFTHE INDIANCONSTITUTION:

Preamble, Salient Features

UNIT III CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES:

Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT IV ORGANS OF GOVERNANCE:

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

UNIT V LOCAL ADMINISTRATION:

District's Administration head: Role and Importance, • Municipalities: Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy(Different departments), Village level:Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT VI ELECTION COMMISSION:

Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.

TOTAL: 30 PERIODS

OUTCOMES

Students will be able to:

- DiscussthegrowthofthedemandforcivilrightsinIndiaforthebulkofIndiansbeforethe arrival of Gandhi in Indian politics.
- Discusstheintellectualoriginsoftheframeworkofargumentthatinformedtheconceptualization
- of social reform sliding to revolution in India.
- DiscussthecircumstancessurroundingthefoundationoftheCongressSocialistParty[CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- DiscussthepassageoftheHinduCodeBillof1956.

Suggested reading

1. TheConstitutionofIndia,1950(BareAct), Government Publication.
2. Dr. S. N. Busi, Dr. B. R.AmbedkarframingofIndianConstitution,1st Edition,2015.
3. M.P. Jain,IndianConstitutionLaw,7th Edn.,Lexis Nexis,2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis,2015.

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AX5096	PEDAGOGY STUDIES	L T P C 2 0 0 0

OBJECTIVES

Students will be able to:

- Review existing evidence on there view topic to inform programme design and policy
- Making under taken by the DfID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

UNIT I INTRODUCTION AND METHODOLOGY:

Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions **-** Overview of methodology and Searching.

UNIT II THEMATIC OVERVIEW

Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.

UNIT III EVIDENCE ON THE EFFECTIVENESS OFPEDAGOGICALPRACTICES

Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT IV PROFESSIONAL DEVELOPMENT

Professional development: alignment with classroom practices and follow up support - Peer support - Support from the head teacher and the community - Curriculum and assessment - Barriers to learning: limited resources and large class sizes

UNIT V RESEARCH GAPS AND FUTURE DIRECTIONS

Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.

TOTAL: 30 PERIODS

OUTCOMES

Students will be able to understand:

- Whatpedagogicalpracticesarebeingusedbyteachersinformalandinformalclassrooms in developing countries?
- What is the evidence on the effectiveness soft he sepedagogical practices, in what conditions, and with what population of learners?
- How can teacher education(curriculum and practicum)and the school curriculum and guidance materials best support effective pedagogy?

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Suggested reading

1. Ackers, HardmanF(2001)ClassroominteractioninKenyanprimaryschools,Compare,31(2): 245-261.
2. AgrawalM (2004)Curricular reform in schools: The importance of evaluation, JournalofCurriculumStudies,36(3):361-379.
3. AkyeampongK(2003)TeachertraininginGhana-doesitcount?Multi-siteteachereducationresearchproject(MUSTER) country report 1.London:DFID.
4. Akyeampong K,LussierK, PryorJ, WestbrookJ (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33(3): 272–282.
5. Alexander RJ(2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. ChavanM (2003) Read India: Amass scale, rapid, 'learningtoread 'campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf

AX5097 **STRESS MANAGEMENT BY YOGA** **L T P C**
2 0 0 0

OBJECTIVES

- To achieve overall health of body and mind
- To overcome stress

UNIT I

Definitions of Eight parts of yoga.(Ashtanga)

UNIT II

Yam and Niyam - Do's and Don't'sin life - i) Ahinsa, satya, astheya, bramhacharya and aparigraha, ii) Ahinsa, satya, astheya, bramhacharya and aparigraha.

UNIT III

Asan and Pranayam - Various yog poses and their benefits for mind & body - Regularization of breathing techniques and its effects-Types of pranayam

TOTAL: 30 PERIODS

OUTCOMES

Students will be able to:

- Develop healthy mind in a healthy body thus improving social health also
- Improve efficiency

SUGGESTEDREADING

1. 'YogicAsanasforGroupTarining-Part-I":JanardanSwamiYogabhyasiMandal, Nagpur
2. "Rajayogaorconquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department),Kolkata

AX5098	PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS	L T P C 2 0 0 0

OBJECTIVES

- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To a waken wisdom in students

UNIT I

Neetishatakam-holistic development of personality - Verses- 19,20,21,22 (wisdom) - Verses- 29,31,32 (pride & heroism) – Verses- 26,28,63,65 (virtue) - Verses- 52,53,59 (dont's) - Verses- 71,73,75,78 (do's)

UNIT II

Approach to day to day work and duties - Shrimad BhagwadGeeta: Chapter 2-Verses 41, 47,48 - Chapter 3-Verses 13, 21, 27, 35 Chapter 6-Verses 5,13,17,23, 35 - Chapter 18-Verses 45, 46, 48.

UNIT III

Statements of basic knowledge - Shrimad BhagwadGeeta: Chapter2-Verses 56, 62, 68 Chapter 12 - Verses 13, 14, 15, 16,17, 18 -Personality of role model - shrimadbhagwadgeeta - Chapter2-Verses 17, Chapter 3-Verses 36,37,42 - Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63

TOTAL: 30 PERIODS

OUTCOMES

Students will be able to

- Study of Shrimad- Bhagwad- Geeta will help the student in developing his personality and achieve the highest goal in life
- The person who has studied Geeta will lead the nation and man kind to peace and prosperity
- Study of Neetishatakam will help in developing versatile personality of students.

Suggested reading

1. Gopinath, Rashtriya Sanskrit Sansthanam P, Bhartrihari's Three Satakam, Niti-sringar-vairagya, New Delhi,2010
2. Swami Swarupananda , Srimad Bhagavad Gita, Advaita Ashram, Publication Department, Kolkata, 2016.