

VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE
(VJTI)
MATUNGA, MUMBAI 400 019

(Autonomous Institute affiliated to University of Mumbai)



Curriculum
(Scheme of Instruction & Evaluation and Course contents)

For
Two Year Postgraduate Programme Leading to
Master of Technology (M.Tech.) Degree in
Textile Technology

Implemented from the batch admitted in Academic Year 2014-15

VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

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For

Two Year Postgraduate Programme Leading to
Master of Technology (M.Tech.)

In

Textile Technology

DEPARTMENT OF TEXTILE MANUFACTURE

PROPOSED SCHEME M. TECH. TEXTILE TECHNOLOGY

Draft Scheme For M Tech Textile to be implemented from AY 2014-15

Semester-I

Scheme of Instruction				Scheme of Evaluation				
S.No	Course code	Course Title	L-T-P (Hours/week)	Credits	TA	IS T	ES E	ESE hours
1.	PE5201S	Generic Core - Computational Methods	3-1-0=4	4	20	20	60	3
2.	TT5001S	High Tech Fibres	3-1-0=4	4	20	20	60	3
3.	TT5002T	Characterization & Properties of Textile Materials	3-0-0=3	3	20	20	60	3
	TT5002P	Characterization & Properties of Textile Materials	0-0-2=2	1	100 % CIE			
4.	TT5003T	Advances in Textile Technology	3-0-0=3	3	20	20	60	3
	TT5003P	Advances in Textile Technology Lab	0-0-2=2	1	100 % CIE			
5.		Program Elective Course -1	3-1-0=4	4	20	20	60	3
6.		Program Elective Course -2	3-0-0=3	3	20	20	60	3
		Program Elective Course -2 Lab	0-0-2=2	1	100 % CIE			
Total			27	24				

Abbreviations: **L**: Lecture, **T**: Tutorial, **P**: Practical, **TA**: Teacher Assessment / Term work Assessment, **IST**: In Semester Tests (comprise of average of two In Semester Tests), **ESE**: End Semester Written Examination, **CIE**: Continuous In-semester Evaluation

Semester – II

Scheme of Instruction				Scheme of Evaluation				
S. No	Course code	Course Title	L-T-P (Hours/week)	Credits	TA	IST	ESE	ESE hours
1.	PE5205S	Generic Core – Research Methodologies	3-1-0=4	4	20	20	60	3
2.	TT5004S	Management of Textile Industry	3-1-0=4	4	20	20	60	3
3.	TT5005T	Technical Textiles	3-0-0=3	3	20	20	60	3
	TT5005P	Technical Textiles Lab	0-0-2=2	1	100 %CIE			
4.	TT5006T	Advanced Textile Composites	3-0-0=3	3	20	20	60	3
	TT5006P	Advanced Textile Composites Lab	0-0-2=2	1	100 %CIE			
5.		Program Elective Course –3	3-0-0=3	3	20	20	60	3
6.		Program Elective Course –4	3-0-0=3	3	20	20	60	3
		Program Elective Course -4 Lab	0-0-2=2	1	100 %CIE			
	TT5801D	Technical Seminar	0-0-4=4	2	100 % CIE			
Total			30	25				

Abbreviations: **L**: Lecture, **T**: Tutorial, **P**: Practical, **TA**: Teacher Assessment / Term work Assessment, **IST**: In Semester Tests (comprise of average of two In Semester Tests), **ESE**: End Semester Written Examination, **CIE**: Continuous In-semester Evaluation

SEMESTER III & IV – Projectwork

S. No	Course Category	Course Title	Credits	Evaluation pattern	Semester
1.	Project TT6901D	Stage – I Presentation	4	Graded evaluation by a committee of at least two examiners including supervisor (guide) and an external examiner	III (As per Academic calendar)
2.	Project TT6902D	Stage – II Presentation	4	Graded evaluation by a committee of at least two examiners including supervisor (guide) and an external examiner	III (As per Academic calendar)
3	Project TT6903D	Stage – III Presentation	4	Graded evaluation by a committee of at least two examiners including supervisor (guide) and an external examiner	IV (As per Academic calendar)
4.	Project TT6904D	Presentation and Final Viva Voce	12	Graded evaluation by a committee of at least two examiners including supervisor (guide) and an external examiner	IV (As per Academic calendar)

List of Electives - I

Sr. No.	Course Code	Course Title
1	TT5101S	Advanced Textile Materials
2	TT5102S	Costing, Project Formulation and Appraisal

List of Electives - II

Sr. No.	Course Code	Course Title
1	TT5103T	Apparel Engineering and Quality Control
2	TT5103P	Apparel Engineering and Quality Control Lab
3	TT5104T	Coated and Laminated Textiles
4	TT5104P	Coated and Laminated Textiles Lab

List of Electives - III

Sr. No.	Course Code	Course Title
1	TT5105S	Apparel Marketing and Merchandizing
2	TT5106S	Sustainable Textiles

List of Electives - IV

Sr. No.	Course Code	Course Title
1	TT5107T	Advances in Manmade Fibre production
2	TT5107P	Advances in Manmade Fibre production Lab
3	TT5108T	Surface Modification of Textiles
4	TT5108P	Surface Modification of Textiles Lab

Programme Educational Objectives (PEOs)

1. The post graduates of our textile technology program will be taking a leading role in managing the operations, process and Quality Assurance (QA) in textile manufacturing and allied industries.
2. To develop an ability to understand the complex textile problems and carry out independent research over the emerging technology.
3. To develop an ability to carry out continuous learning of new products and processes in textile manufacturing.
4. To undertake research about innovative products, processes and sustainability and promote the development in those technologies.

Program Outcomes (POs)

PO 1 Ability to apply knowledge of textile technology to solve complex problems in manufacturing and design of textile products and processes.

PO 2 Ability to apply statistical, analytical and computational skills to carry out experiments in research and development in textile and allied industries such as composites, eco friendly textiles and sustainability in textile industry.

PO 3 Ability to apply management skills and take independent decisions to ensure that the products and processes confirms to the specifications and the profitability is maintained in the textile and clothing industry.

PO 4 Ability to understand the technological advancements and apply the knowledge for the profitability of textile manufacturing operations.

PO 5 Ability to apply the knowledge of new technologies such as Composite Technology and Technical Textiles for the industrial and research purpose.

Programme Name:		M. Tech. Textile				SEMESTER –I	
Course Code:		PE5201S					
Course Title:		Computational Methods					
L	T	P	Credits	TA	IST	ESE	Total
3	1	0	4	20	20	60	100
Objectives		Develop the ability to <ul style="list-style-type: none"> Analyze problems to identify the potential of computational methods and Choose appropriate computational methods to solve numerical problems Design and develop software relevant to scientific simulation and modeling processes and Translate physical systems into computational models Plan, design and implement software projects for the optimization & automation of the processes Decompose a problem into smaller tasks that can be solved in computational method Explore the knowledge of Computational method in industrial application 					
Outcomes		The students should be able to <ul style="list-style-type: none"> Formulate and solve Factorial Design problems Model and analyze data Apply Multi criteria decision making (MCDM) methods for problem solving. Apply optimization, numerical methods , statistical methods to solve engineering problem 					

Course Contents

1. Overview to Optimization Techniques and Design of Experiment:
 Brief history of Design of Experiments (DOE), Overview of basic statistical concepts, Basic principles of DOE and Types and purposes of DOE methods
 Introduction to Decision Making in the Manufacturing Environment
 Decision-making Methods Used for optimization

2. Full Factorial Design

Fundamentals of "full factorials", ANOVA, Factorial effects and plots, and Model evaluation.

Fractional Factorial Design

The one-half fraction and one-quarter of the 2^k design, The general 2^{k-p} fractional factorial design and Resolution III, IV and V designs

The Robust Design:

The basics of robust designs, Taguchi designs and Robust design example.

Introduction to Response Surface Methodology.

3. Multi Criterion Decision-making (MCDM) Methods

Introduction to multi criterion optimization

Simple Additive Weighting (SAW) Method

Weighted Product Method (WPM)

Analytic Network Process (ANP)

Analytic Hierarchy Process (AHP) Method

TOPSIS Method

PROMETHEE

4. Multi- objective Decision making (MODM) Methods

Introduction to Multi objective optimization, Traditional Techniques such as quadratic programming, geometric programming, goal programming, dynamic programming.

Glimpses of Non-traditional optimization Techniques such as particle swarm, genetic algorithms, simulated annealing and Techniques based on Neural network & Fuzziness. Data envelopment analysis

Text Books

- 1 Douglas C. Montgomery: Design and analysis of experiments, John Wiley & Sons Inc., 8th Edition, 2012.
- 2 Ranjit Roy :A Primer on Taguchi Method ,Competitive Manufacturing Series, 2nd Edition, May 2010
- 3 R V Rao: Decision Making in the Manufacturing Environment Using Graph Theory and Fuzzy Multiple Attribute Decision Making, Springer Publication, 2010
- 4 Laurene Fausett: Fundamentals of Neural Networks, Architectures, Algorithms and Applications ,Pearson,1993
- 5 Xin-She Yang: Nature Inspired Metaheuristics Algorithm, Luniver Press, 2nd edition, 2008

Programme Name:		M. Tech. Textile				SEMESTER –I	
Course Code:		TT5001S					
Course Title:		High Tech Fibres					
L	T	P	Credits	TA	IST	ESE	Total
3	1	0	4	20	20	60	100
Objectives		<ul style="list-style-type: none"> • To enable the students to learn about new fibres, their properties and uses. • To make the students learn about innovative fibres, their structures and developments. 					
Outcomes		<p>The students should be able to</p> <ul style="list-style-type: none"> • analyze the structure and explain the properties of new fibres. • explain the manufacturing and uses of innovative fibres. • explore the structure of innovative fibres and possibility of their use in different applications. 					

Course Contents

Birth of new fibres – background, transition to new fibres.

Super fibres with new performance – two streams of super fibres, polyacetal fibres, strong vinyl RM, new liquid crystalline polymers, vectran-fully aromatic polyester, high tech. Boats of carbon fibre, future of super fibres. Glass fibres.

High Touch fibres – Silk like fibres, challenge of ultra-fine fibres, skin-like fibres (Exceltech), Chameleonic fibres, Photochromism-controlled fibres, Perfumed fibres, Power fibres storing solar energy, Protein plastics with feel of human skin, Iridescent textiles.
Biomimetic chemistry and fibres, applications, morphology/structure, Hybridization technology.
Biopolymer frontiers – functions of enzymes & co-enzymes, polysaccharides in semi-conductors and medicines, new applications of silk, fibres produced by bacteria, utilization of protein functionality.

Progression of hi-tech fibres. Unused sources.

Fibres and – biotechnology, electronics, cars, space, nuclear power, sports, geo- textiles

Various types of high tech fibres, development of shin-gosen, specialist fibres, fabrics for relation.

Cellulosic fibres – new solvent systems, new fibre derivatives, new environmental & cost saving developments

Fibres in next millennium – high tenacity-high modulus, micro-denier (ultra fine) - biomimetics, super functional fibre material and super-biomimetic fibre material, fibres for health.

Text Books

1. Hongu Tatsuya & Philips G.O. – ‘New Fibres’. Woodhead pub.Ltd., Cambridge, U.K. 1997
2. Lawrence C. A., Advances in Yarn Spinning Technology, Woodhead Publishing, 2010
3. High Performance Fibres, J. Hearle, Woodhead Publishing.
4. New millennium fibres, Tatsuya Hongu, Glyn O. Phillips and Machigo Takigami.

Programme Name:		M. Tech. Textile				SEMESTER –I	
Course Code:		TT5002T					
Course Title:		Characterization and Properties of Textile Materials					
L	T	P	Credits	TA	IST	ESE	Total
3	0	0	3	20	20	60	100
Objectives		<ul style="list-style-type: none"> • To enable the students to learn about the fibre, yarn and fabric structure and relationship between structure and properties of textile materials. • To enable the students to learn about the Geometrical attributes of fabrics and their influence on the mechanical properties of fabric • To enable the students to learn about structural characteristics of textile substrates and the evaluation of the same using analytical tools. 					
Outcomes		<p>The students should be able to</p> <ul style="list-style-type: none"> • gather detailed information about the influence of fibre, yarn and fabric structure on the performance of textile materials. • use sophisticated analytical tools to investigate textile problems. • have the ability of evaluating new products and processes 					

Course Contents

Engineering approach to textile structures- Interrelation between fibres, yarns and fabrics,

Chemical nature, fine structure; mechanical, electrical, thermal properties and viscoelastic properties of fibrous assembly

The physical and mechanical testing of fibers, yarns and fabrics - use of instrumentation with computer-controlled data acquisition system in textile testing;

Use of microscopy in analyzing textile structures- Principle and application of optical and UV microscope in textile field

Use of spectroscopy in studying textile structures- IR, Raman, ICP-AES/ MS analysis of spectra to identify fibres, identification of chemicals in finishes. Latest developments,

X-ray diffraction – Principle and application in evaluation of textile materials, fibre fine structure, crystal forms, dimensions, degree of order, size of ordered regions, orientation factor.

Thermal analysis-DSC, TGA –Principle and application in textiles

SEM /TEM- general information, principle sample preparation technique, use in textiles

Tensile behavior of ideal Yarn, analysis of tensile forces, study for small and large extension, lateral compression, Filament and spun yarns- tension built-up and breaking models etc.

Structure and mechanics of woven fabrics – tensile, bending, shear properties, characterization of mechanical behavior of woven fabrics based on image analysis, modeling drape deformation

Geometry & mechanics of knitted fabrics – Characterization of structure, tensile behavior, bending and shear properties, shear- bending comparison

Geometry of non-woven & composite structures – Fibre assemblies as reinforcement of composite structures, bonding and failure mechanism, structure property relationships.

Text Books

1. Campbell, D., White, J.R. – Polymer characterization: Physical Techniques. 1989. Chapman and Hall Ltd. (ISBN 0412 27160 5)
2. Hearle J.W.S., Grosberg P., Backer, S., – Structural mechanics of fibres, Yarns & fabrics. Willey Interscience Pub. 1969 (SBN 471 36669 2)
3. Robert T. Conner – Instrumental analysis of cotton cellulose and modified cotton cellulose'. Marcel Dakkar Inc. N.Y., 1972
4. Morton W.E. & Hearle J.W.S. – 'Physical properties of textile fibres', Butterworth & Co. & Textile Institute, 1962
5. Meredith R & Hearle J.W.S. – 'Physical methods of investigating textiles', textile book publishing Inc. Division of interscience Inc. N.Y. 1959
6. Structure and mechanics of textile fibre assemblies – Edited by P.Schwartz, 2008, Woodhead Publishing Limited and CRC Press LLC, (ISBN 978-1-84569-135-6)

Programme Name:		M. Tech. Textile				SEMESTER –I	
Course Code:		TT5002P					
Course Title:		Characterization and Properties of Textile Materials Lab					
L	T	P	Credits	TA	IST	ESE	Total
0	0	2	1	100 % CIE			
Objectives		<ul style="list-style-type: none"> • To enable the students to learn about the fibre, yarn and fabric structure and relationship between structure and properties of textile materials. • To enable the students to learn about the Geometrical attributes of fabrics and their influence on the mechanical properties of fabric • To enable the students to learn about structural characteristics of textile substrates and the evaluation of the same using analytical tools. 					
Outcomes		<p>The students should be able to</p> <ul style="list-style-type: none"> • gather detailed information about the influence of fibre, yarn and fabric structure on the performance of textile materials. • use sophisticated analytical tools to investigate textile problems. • have the ability of evaluating new products and processes 					

Course Contents

Experiments on chemical nature, fine structure; mechanical, electrical, thermal properties and viscoelastic properties of fibrous assembly, Use of microscopy in analyzing textile structures - application of optical and UV microscope in textile field

Experiments on spectroscopy in studying textile structures- IR, Raman, ICP-AES/ MS analysis of spectra to identify fibres, identification of chemicals in finishes, characterization of mechanical behavior of woven fabrics based on image analysis, modeling drape deformation.

Tensile behavior, bending and shear properties, shear bending comparison of knitted fabrics.

Properties of non-woven & composite structures.

Programme Name:		M. Tech. Textile				SEMESTER –I	
Course Code:		TT5003T					
Course Title:		Advances in Textile Technology					
L	T	P	Credits	TA	IST	ESE	Total
3	1	-	4	20	20	60	100
Objectives		<ul style="list-style-type: none"> • To enable the students to learn the modern developments in various processes of yarn spinning. • To enable students to learn about the unconventional spinning technologies and their development. • To enrich the students understanding of recent developments in the weaving preparatory and weaving machines. 					
Outcomes		<p>The students should be able to</p> <ul style="list-style-type: none"> • Student will be able to evaluate the new techniques of opening and cleaning and explain blending, intimacy of blending, its importance • The content of the syllabus of the course will enrich the students with modern yarn forming techniques, its machines and latest development in the field of new yarn forming techniques. This will help the students to be competent as per the requirement of textile Industries • Ability to explain the theory behind the technology in the design and development of weaving and preparatory machines. 					

Course Code:

Course Objectives

Course Outcomes

Course Contents

Modern developments in continuous preparatory lines feeding to automated spinning systems, Intimacy of mixing and blend variation, measures of blend variation, Forces on fibres during opening and cleaning processes and its effect.

Technological advancements in carding and drawframes. Technological considerations in the design of high production card. Fibre fractionation in comber. Combing performance.

Open End Spinning, Machine & process parameters. DREF spinning, Air-Jet spinning. Comfor/Compact and other state of art systems.

Fibrillated yarns, metallic yarns & applications, Metal yarns, glass fibre/yarns, Elastomeric yarns – (Lycra, Spandex) – structures, properties, applications & uses, Natural rubber elastic yarns. Self-Twist & Twist-less Yarns, Evaluation of spin finishes of modern fibres. Effect of processing parameters on textured yarns.

Development trends in winding, warping and sizing machines for improving quality of preparation and cost reduction with specific reference to shuttleless weaving machines. Tension control and automation in sizing.

Loom development trends and objectives. Multiphase looms. Kinematics of sley and heald motion with reference to shuttleless looms. Theoretical analysis of weft insertion in shuttleless looms. Mechanism of warp breakage; Cloth fell position, beat up force and pick spacing, Control of pick spacing and its effect on geometry of fabric. Analysis of let off mechanism, electronic let off and take up. Electronic jacquards. Developments with reference to energy saving, noise reduction and waste control. Electronic data acquisition in a loom shed.

Text Books:

1. Adanur S , “Handbook of Weaving”, Technomic Publishing Co, 2001.
2. Allan Ormerod, W S Sondhelm, “Weaving - Technology & Operation”, The Textile Institute, 1998.
3. Talukdar M K.,Sriramulu P K and Ajaonkar D B, “Weaving Machines, Mechanisms and Management”, Mahajan Publishers Pvt. Ltd, 1998
4. Seyam A M, “Structural Design of Woven Fabrics”, Textile Progress Vol.31, No: 3. Wood Head Publishing Ltd, 2002.
5. Hearle J W S, Grosberg P and Backer S, “Structural Mechanics of Fibres Yarn and Fabrics”, Wiley Interscience Pub., 1999.
6. Indian Journal of Fibre and Textile Research, “Special issue on Recent Advance in Fabric forming”, Publications and Information Directorate (NISCOM) CSIR, Vol. 19, No.3, 1994.
7. Booth J.E. – ‘Textile Mathematics’, Textile Institute, Manchester (U.K.).
8. Oxtoby Eric –‘Spun Yarn Technology’ , Butterworth Pub., London, U.K., 1987
9. Goswami B.C. , Martindale J.G. & Scardino F.L. – ‘Textile yarn, Technology, Structure & Application’, Wiley Interscience, Pub., U.S.A., 1977
10. Grosberg P. & Iype C. – ‘Yarn Production’, Textile Institute Int., Manchester, U.K., 1999.
11. Mahendra Gowda R V, “New Spinning Systems”, NCUTE Publication, Coimbatore, 2006.
12. Carl A. Lawrence, “Fundamentals of spun yarn technology”, CRC Press, New York, 2003.

13. Grosberg P and Iype C, "Yarn Production – Theoretical Aspects", The Textile Institute, Manchester, 1999.

Programme Name:		M. Tech. Textile				SEMESTER –I	
Course Code:		TT5003P					
Course Title:		Advances in Textile Technology Lab					
L	T	P	Credits	TA	IST	ESE	Total
0	0	2	1	100 & CIE			
Objectives		<ul style="list-style-type: none"> To enable the students to learn the modern developments in various processes of yarn spinning. To enable students to learn about the unconventional spinning technologies and their development. To enrich the students understanding of recent developments in the weaving preparatory and weaving machines. 					
Outcomes		<p>The students should be able to</p> <ul style="list-style-type: none"> Student will be able to evaluate the new techniques of opening and cleaning and explain blending, intimacy of blending, its importance The content of the syllabus of the course will enrich the students with modern yarn forming techniques, its machines and latest development in the field of new yarn forming techniques. This will help the students to be competent as per the requirement of textile Industries Ability to explain the theory behind the technology in the design and development of weaving and preparatory machines. 					

Course Contents

Experiments on evaluation of intimacy of mixing and blend variation. Studies of modern opening and cleaning machines.

Studies on technological advancements in carding and drawframes, Fibre fractionation in comber, Combing performance.

Experiments on process parameters on Open End Spinning Machine, DREF spinning, Air-Jet spinning. Preparing samples of fibrillated yarns, metallic yarns, Metal yarns, glass fibre/yarns, Elastomeric yarns – (Lycra, Spandex) Studies on processing parameters in texturizing process.

Studies on modern winding, warping and sizing machines, tension control in sizing. Studies on Multiphase looms, Kinematics of sley and heald motion with reference to shuttleless looms, Analysis of let off mechanism, electronic let off and take up.

Programme Name:		M. Tech. Textile				SEMESTER –II	
Course Code:		: PE5205S					
Course Title:		Research Methodology					
L	T	P	Credits	TA	IST	ESE	Total
3	1	0	4	20	20	60	100
Objectives		<ul style="list-style-type: none"> • Impart fundamentals of concepts, construct, theory, research, research methodology-(methods ,techniques ,tools) • Develop capability to undertake empirical and quantitative research using scientific methods. • Impart knowledge of selecting and using relevant statistical methods in research. • Develop capability in using quantitative methods with software. • Provide knowledge and skill in writing technical reports in standard format. 					
Outcomes		<p>The students should be able to</p> <ul style="list-style-type: none"> • Undertake empirical and quantitative research using scientific methods. • Apply the knowledge of selecting and using relevant statistical methods in research. • Use quantitative methods with software and write technical reports in standard format. 					

Course Contents

1. Introduction of Research Methodology

Meaning and purpose of research, objectives of research, types of research, significance of research, research approaches, research methods v/s methodology, research process, criteria of good research. Research and scientific methods problems encountered by researchers in India.

2. Research Problem

Steps in Research: Identification, selection and formulation of research problem- Research questions-Research design- Formulation of hypothesis- Review of literature. Definition, necessity and techniques of defining research problem; Formulation of research problem; Objectives of research problem.

3. Research Design:
Meaning need and features of good research design. Types of research designs, basic principles of experimental designs, design of experiments.
4. Sampling Designs and Technique
Sampling theory-types of sampling-steps in sampling-Sampling and Non-sampling error-Sample size –Advantages and limitations of sampling. Census and Sample surveys, Different types of sample designs, characteristics of good sample design. Techniques of selecting a random sample.
5. Data Collection
Primary and secondary data. Primary data-Meaning, Collection methods-Observation – Interview-Questionnaire-Schedule-Pretest-Pilot study –Experimental and case studies-Secondary data- Meaning – Relevance, limitations and cautions.
6. Hypothesis
Definition, Fundamentals and procedure of hypothesis testing, flow diagram for hypothesis testing. Measurement in Research: Measurement scales – Tests of good measurement construction of Likert and Semantic Differential scales-Source of errors in measurement- Scale validation. Parametric and non-parametric tests of hypothesis testing-Important non-parametric tests: Sign, Run Kruskal-Wallis tests and Mann – Whitney test.
7. Parametric Tests:
Testing of significance mean, proportion, variance and correlation- Testing for significance of difference between means, proportions, variances and correlation coefficients. Limitations of tests of hypothesis
8. ANOVA and Chi-Square Tests
One-way and two-way ANOVA – Latin Square tests for association and goodness of fit.
9. Technical Paper and Report Writing
Basic concepts of paper writing and report writing, review of literature, Concepts of Bibliography and References, significance of report writing, steps of report writing, Types of Research reports, Methods of presentation of report.
10. Process and Structuring the Report
Types of reports, Contents, Styles of reporting, Steps in drafting reports, Chapter format, Pagination, Identification, Using quotations, Presenting footnotes – abbreviations, Presentation of tables and figures, Referencing, Documentation, Use and format of appendices- Indexing Editing and evaluating the final draft.

11. Research Ethics
Ethical Issues, Ethical Principles that govern Research, Ethically valid Information Sources, Regulatory Compliance.

Text Books

1. R. Panneerselvam: Research Methodology, Prentice Hall India.
2. C. R. Kothari: Research Methodology: Methods and Techniques by, New Age International Publishing.
3. Fisher R. A.: Statistical Methods for Research Workers , Macmillan Publishers

Programme Name:		M. Tech. Textile				SEMESTER –II	
Course Code:		TT 5004S					
Course Title:		Management of Textile Industry					
L	T	P	Credits	TA	IST	ESE	Total
3	1	0	4	20	20	60	100
Objectives		<ul style="list-style-type: none"> • To enable the students to gain an understanding and in-depth knowledge of the various management philosophies and practices related to production, finance and marketing management prevalent in textile industry. • To learn how to think about, approach, analyze, and solve production system problems using both technology and people skills. • Deepen the insights in the field of productivity improvement techniques, quality engineering. • To enable the students to learn the skills to apply techniques to enhance work environment, quality and productivity. 					
Outcomes		<ul style="list-style-type: none"> • The students will have deeper understanding of management philosophies and practices related to production, finance and marketing management prevalent in textile industry • The students will be able to apply the techniques of productivity improvement techniques, quality engineering • The students will be able to explain the techniques of managing various functions such as marketing, finance for the textile industry. 					

Course Contents

Management principles: Planning, Organizing, Staffing, Motivation, Directing and Control.

Project Management, scheduling, Project Management: Basic concept, Network principles-CPM, PERT, PV concept, pay-back period, DCF methods, make or buy decision.

Overview of Production Management: - Types of Production processes (Project/Job, Batch, Mass/Line, Continuous), Concept of FMS (Flexible Manufacturing System), Vertical integration.

Inventory Control: Relevant Costs, P & Q Systems of Inventory, Basic EOQ Model, and Model with Quantity discount, Economic Batch Quantity. Safety Stock, Reorder Point, ABC Analysis, Material Requirement Planning, Elementary concept on TQM (Total Quality Management) ,JIT(Just In Time)

Financial Management: Analysis & interpretation of Balance sheet, Ratio analysis, funds flow statement, Types of capacity, Economics and Diseconomies of scale, Developing capacity alternatives,

Marketing management, Marketing concepts, Selling & Marketing, Marketing Mix, New Product management, PLC(Product Life Cycle) and pricing strategies, Brand-management, Sales Force Management, Marketing research-demand forecasting, Advertising concepts.

Advanced techniques of Industrial Engineering: - Just in Time, Concurrent Engineering, SMED, Kaizen, Business Process Reengineering, Supply Chain Management, Value Engineering, Lean Thinking, Visual Workplace, Poka-Yoke, Strategic Human Resource Management, Applications of the techniques in textile industry.

References:

1. Ormerod A. – ‘Management of Textile Production’.
2. Principles of Management – Kuchal
3. Wheldon – ‘Cost Accounting & Costing Methods’
4. The Japanese way of doing business – E. Cliff, Boye, Prentice Hall Inc. 1981.
5. The Kaisen wave circle the Globe – Tokyo Burmen, Today, May 44- 8
6. Guide to Quality Control – White Plain, 1990.
7. Anatomy of Japanese business, Ed.satoKaz40 and Yas 40, 1984 – N4
8. The Japanese Management System – Hawey, N.40 1984
9. Deming Management Philosophy – Yoshida, Kosaku, 1989, Columbia Journal of World Business
10. ISO – 9000 Series of Standards – ISO Standard

Programme Name:		M. Tech. Textile				SEMESTER –II	
Course Code:		TT5005T					
Course Title:		Technical Textiles					
L	T	P	Credits	TA	IST	ESE	Total
3	0	0	3	20	20	60	100
Objectives		<ul style="list-style-type: none"> To enable the students learn about different raw materials for technical textiles and their properties. To enable the students learn about various application areas of technical textiles. To enable the students to learn about the manufacturing technologies of technical textiles. 					
Outcomes		<p>The students should be able to</p> <ul style="list-style-type: none"> Define Technical Textiles and contrast it with industrial textiles. understand the different application areas, manufacturing methods and, role of Textile materials in the field of various technical textile application areas such as medical textiles, geotextiles, filtration other conventional application areas. create samples of few technical textiles and get hand on experience. 					

Course Contents

Definition, classification, products, market overview and growth projections of technical textiles.

Fibres, yarns and fabric structures in technical textiles and their relevant properties.

Filtration: Textile and other filter media for dry and wet filtration. Mechanisms of separation. Requirements for good filter media and filtration. Fibre and fabric selection for filtration.

Geotextiles: Types and application of geosynthetics. Functions and application areas of geotextiles. Fibres and fabric selection criteria for geotextile applications. Mechanics of reinforcement, filtration and drainage by geotextiles. Soil characteristics. Methods of long term prediction of geotextile life and survivability in soil.

Automotive Textiles: Application of textiles in automobiles. Requirement and design for pneumatic tyres, airbags and belts. Methods of production and properties of textiles used in these applications. Sewing threads, cords and ropes: Types, method of production and applications. Functional requirements, structure and properties. Applications of Technical Textiles in Aircraft & Rail, Functional requirements and types of textiles used for paper making, agricultural, architectural, packaging and footwear

Medical Textiles: Fibres used for medical textiles, Non-Implantable materials, Extracorporeal devices, implantable materials & health & hygiene materials.

Other fields of Technical textiles: Protective and Defence Textiles, Agro Textiles, Textiles in packaging, Textiles in Sports, etc.

Manufacturing of Technical Textiles on shuttleless looms – Projectile, Rapier, Air jet and Water jet looms, Cloth beam handling, Machine Monitoring. Woven Fabrics - Multiphase Weaving, Triaxial Weaving, Weaving of Technical Textiles.

Knitting & Braiding: Dynamics of knitted loop formation. Design and performance of high speed knitting cams. Developments in knitting machines. Yarn feeding devices on circular knitting machines and design features of positive feeders, Classification of Braids, Flat braiding, Circular braiding and hollow braiding – production techniques. Knitted Fabrics- Automation in weft and warp knitting, Knitting of Technical Textile,

Warp Knitting: Tricot & Rachel Two, Three & Multibar Machines - Pattern Control Mechanisms - Pattern Wheels and Chain Links.

Nonwovens: Nonwoven manufacturing processes. Raw material - Fibrous material – natural fibres – synthetic fibers. Binders-Introduction - Binder fluids - Adhesive fibres – Soluble fibre and Hot melt adhesive fibres. Mechanism of bonding and properties. Fibre/filament arrangement in web and its effect on mechanical properties of nonwoven fabrics. Failure mechanism in different nonwoven fabrics. Effects of machine, fibre and process variables on properties of nonwoven fabrics. Production of spun bonded and melt blown fabrics., Nonwoven product development for garments, decorative fabrics, home textiles and technical textiles, Modeling of nonwoven fabrics- pore size distribution – tensile strength- bending rigidity-permeability-filtration properties. Processes for manufacturing of tapes and films

Text Books

1. Jones F.R. – ‘Hand Book of Polymer Fibre Composites, Polymer Science & Tech. Series Longman House, Harlow, 1994.
2. Sabit Adanur, “Wellington Sears Handbook of Industrial Textiles “, Technomic Publishing Co., Inc, 1995.
3. Horrocks A R and Anand S C, “Handbook of Technical Textiles”, Woodhead Publishers and Textile Institute, 2000
4. Spencer D J, “Knitting Technology”, Pergamon Press, 1998.
5. Ajgaonkar D.B., Knitting Technology.
6. Russel.S, “Handbook of Nonwovens”, The Textile Institute Publication, 2004.
7. Irsak O, “Nonwoven Textiles”, Textile Institute, 1999.
8. Mrstina.V and Feigl F, “Needle Punching Technology”, Elsevier Science Publishers, 1990.

Programme Name:		M. Tech. Textile				SEMESTER –II	
Course Code:		TT5005P					
Course Title:		Technical Textiles Lab					
L	T	P	Credits	TA	IST	ESE	Total
0	0	2	1	100 % CIE			
Objectives		<ul style="list-style-type: none"> • To enable the students learn about different raw materials for technical textiles and their properties. • To enable the students learn about various application areas of technical textiles. • To enable the students to learn about the manufacturing technologies of technical textiles. 					
Outcomes		<p>The students should be able to</p> <ul style="list-style-type: none"> • Define Technical Textiles and contrast it with industrial textiles. • understand the different application areas, manufacturing methods and, role of Textile materials in the field of various technical textile application areas such as medical textiles, geotextiles, filtration other conventional application areas. • create samples of few technical textiles and get hand on experience. 					

Course Contents

Practicals on preparation of samples for technical textiles applications such as Filtration, geotextiles, automobiles, medicals textiles, Protective and Defence Textiles, Agro Textiles, Textiles in packaging, Textiles in Sports, etc.

Experiments on properties of textile materials such as sewing threads, cords and ropes used for technical textiles, Functional requirements. Experiments on Functional requirements and types of textiles used for paper making, agricultural, architectural, packaging and footwear.

Experiments on manufacturing of Technical Textiles on shuttleless looms, nonwoven machines, warp knitting machines.

Programme Name:		M. Tech. Textile				SEMESTER –II	
Course Code:		TT5006T					
Course Title:		Advanced Textile Composites					
L	T	P	Credits	TA	IST	ESE	Total
3	0	0	3	20	20	60	100
Objectives		<ul style="list-style-type: none"> • To expose the student to the textile raw materials and processes used in composite applications. • To introduce methods of analyzing and predicting the behavior of the resultant products. • To enable the students to learn various application areas of textile composites. 					
Outcomes		<p>The students should be able to</p> <ul style="list-style-type: none"> • explain the Fiber architecture of textiles used for composites along with manufacturing processes. • use tools for predicting elastic properties along with the ability to explain the relationship of elastic properties and geometric considerations 					

Course Contents

INTRODUCTION: Types of composite - Fibre Particulate and Laminar Composites - Examples

FIBRE COMPOSITES: Constituents - functions of fibre and matrix - Properties of fibres-Critical fibre length - Aligned and random fibre composites - property prediction Rule of Mixtures - Simple problems

COMPOSITE MATERIALS: Types of high performance fibers properties - types of matrix materials - Thermoset and Thermo plastics properties - short fibre composites - Fibre matrix interface-coupling agents - Concept of interfaces and interfacial reaction in fibre composites - Tensile strength of continuous and discontinuous composites. Fracture mode in fibre composites

PREPREGS: Introduction - Manufacturing techniques - property requirements- In-plane shear, Biaxial In-plane tension, Compaction. Textile preforms - weaving, knitting and braiding. Multi-axial multiply non-crimp fabrics.

COMPOSITE MANUFACTURING TECHNOLOGY: Vacuum bagging - compression moulding - Injection moulding Pultrusion - Thermoforming -Filament winding - Resin Transfer Moulding.

Manufacturing with thermosets – pre-impregnated composites, liquid moulding of textile composites. Manufacturing-thermoplastics-Consolidation of thermoplastic composites, textile thermoplastic composite material forms, processing routes, novel thermoplastic composite manufacturing routes.

Modelling in Injection Molding : Liquid composite molding processes. Flow through porous media. Liquid injection molding simulation. Gate location optimization. Disturbances in the mold filling process. Active and passive control.

PROPERTIES OF COMPOSITES: Testing of Composites - Fibre volume fraction - Lamina Tensile Shear Compression and flexural properties - Interlaminar fracture Failure modes in composites. Applications of composites. Design of textile composite materials

APPLICATION OF TEXTILE COMPOSITES: Aerospace applications. Construction industry. Medicine. Sports.

Text Books:

1. Long A C, "Design and Manufacture of Textile Composites", Woodhead Publishing Ltd., UK, 2005.
2. Gupta L, "Advanced Composite Materials", Himalayam Books, 1998.
3. Mathews F L and Rawlings R D, "Composite Materials Engineering Science", 1994.
4. Bogdanovich A and Pastore C, "Mechanics of Textile and Laminated Composites", Chapman & Hall Due, 1997.
5. Hearle J W S , "High Performance Fibres Composites and Engineering Textile Structures", Journal of the Textile Institute, Special issues, The Textile Institute, 1990.
6. Kostikov V L, "Fibre Science and Technology (Soviet Advanced Composites Technology Series)", Chapman & Hall, 1995.
7. Composite nonwoven materials: Structure, properties and applications , Das, Pourdeyhimi, Woodhead Publishing 2014.

Programme Name:		M. Tech. Textile				SEMESTER –II	
Course Code:		TT5006P					
Course Title:		Advanced Textile Composites Lab					
L	T	P	Credits	TA	IST	ESE	Total
0	0	2	1	100 % CIE			
Objectives		<ul style="list-style-type: none"> • To expose the student to the textile raw materials and processes used in composite applications. • To introduce methods of analyzing and predicting the behavior of the resultant products. • To enable the students to learn various application areas of textile composites. 					
Outcomes		<p>The students should be able to</p> <ul style="list-style-type: none"> • explain the Fiber architecture of textiles used for composites along with manufacturing processes. • use tools for predicting elastic properties along with the ability to explain the relationship of elastic properties and geometric considerations 					

Course Contents

Experiments on Fibre Particulate and Laminar Composites, Aligned and random fibre composites, Tensile strength of continuous and discontinuous composites. Fracture mode in fibre composites , compression moulding

PROPERTIES OF COMPOSITES: Testing of Composites - Fibre volume fraction - Lamina Tensile Shear Compression and flexural properties, Design of textile composite materials

Programme Name:		M. Tech. Textile				SEMESTER –II	
Course Code:		TT5101S					
Course Title:		Advanced Textile Materials					
L	T	P	Credits	TA	IST	ESE	Total
3	1	0	4	20	20	60	100
Objectives		<ul style="list-style-type: none"> To enable the students to learn the needs of various advanced textile materials such as protective clothing, medical textiles, sportswear, composites and intelligent textiles. To enable the students to learn about the structure, properties, design and uses of various advanced textile materials such as protective clothing, medical textiles, sportswear, composites and intelligent textiles 					
Outcomes		<p>The students should be able to</p> <ul style="list-style-type: none"> Develop an ability to explain the requirements of protective clothing, medical textiles, sportswear, composites and intelligent textiles. Students will be able to evaluate the raw material, fabric properties and explain the uses of protective clothing, medical textiles, sportswear, composites and intelligent textiles. Ability to explain the theory behind the technology in the design and development of Advanced textile materials with fibres such as glass, ceramic and metallic fibres. 					

Course Contents

Protective clothing: Clothing requirements for thermal protection, ballistic protection, UV-protection, protection from electro-magnetic radiation and static hazards, protection against micro-organisms, chemicals and pesticides. Design principles and evaluation of protective clothing.

Medical Textiles: Textiles in various medical applications. Application oriented designing of typical medical textiles. Materials used and design procedures for protecting wounds, cardiovascular application, sutures etc.

Sportswear: Clothing requirements for different sports. Development of highly functional fibres, yarns and fabrics for temperature control and moisture management. Stretch, bulky and light weight fabrics.

Composites: Two and three dimensional fabrics and triaxially braided materials for composites. Production and properties of performs and composites. Properties and uses of rigid composites.

Stimuli sensitive intelligent textiles - their production, properties and applications. Smart textile incorporating functional devices.

Miscellaneous: Glass, ceramic and metallic fibres and their textile products.

Text Books

1. Richard A Scott, "Textiles For Protection Textiles Institute, CRC press & wood head publishing, England, 2005.
2. Adanur S. "Wellington Sears Handbook of Industrial Textiles", Technomic Publishing Co.,Ind.1995
3. Anand S, "Medical Textiles", Textile Institute, 1996.
4. Shishoo R, "Textiles in sport", Textile Institute, 2005.
5. Mattilla H.R. "Intelligent textiles and clothing", Textile Institute, 2006.
6. Tao X., "Smart Fibres, Fabric and Clothing", Textile Institute, 2001.
7. Horrocks A R and Anand S C, "Handbook of Technical Textiles", Woodhead Publishers and Textile Institute, 2000

Programme Name:		M. Tech. Textile				SEMESTER –II	
Course Code:		TT5102S					
Course Title:		Costing, Project Formulation and Appraisal					
L	T	P	Credits	TA	IST	ESE	Total
3	1	0	4	20	20	60	100
Objectives		<ul style="list-style-type: none"> • To enable the students to learn methods of costing used in textile industry. • To enable the students to learn the application of costing methods for textile industry. • To enable the students to learn fundamentals of project formulation and appraisal 					
Outcomes		<ul style="list-style-type: none"> • Students will be able to use the costing methods for textile applications. • Students will be able to efficiently utilize the project formulation and appraisal • Gain knowledge about concepts for profitability of textile industry. 					

Course Contents

Cost Concepts: Direct/indirect, Fixed/ variable, Total cost. Inventory costing: FIFO, LIFO, Weighted average methods. System of costing: Job, order, batch, process, unit & operating cost joint & byproduct.

Cost Standards in Textiles: Cost structure in textile industry, Cost of raw material/labour/utilities. Cost Control: Standard costs, variance analysis, determination of cost per kg of yarn, per kg (metre) of fabric, measures for cost reduction, selling price decision for yarn/ fabric. Profit planning: Cost volume - profit analysis, Break Even point. Budgeting, Definition, purpose, types.

Financial Statement & Investment Analysis : Profit & Loss account and Balance sheet analysis, Fund flow statement, Ratio analysis, Concept of cost of capital, IRR, DRC, DSCR, ERR, payback period and techniques for calculation.

Project Cycle: Phases of project cycle identification, preparation evaluation, documentation & Supervision. Various functions in project cycle - Technical, commercial, financial, economic, managerial. Project formulation and Appraisal: Appraisal concept, Need for appraisal,

Methodology, Various aspects - market, management, technical, financial and economic, Key financial indicators in appraisal, Investment decision from appraisal report, Post-project appraisal. Evaluation of Technological Content of Textile Projects: The choice of Technology and their assessment, operating constraint, appropriateness of technology, factors influencing selection, various aspects of technology transfer.

Project Utilities and Environmental Aspects for Textile projects: Power, Steam, Fuel, Water, Compressed air, and Air conditioning, Pollution (air, water, and ground noise).

Special Appraisals: For Modernization projects, balancing equipment, expansion and diversification projects (including backward & forward integration).

Text Books:

- 1) Jain S P, Narang K L and Dhingra T R, "Cost Accounting", 6th Ed., Kalyani publishers, N Delhi, 2000.
- 2) Kerzner H, "Project Management" 1st Ed., CBS Publishers and distributors, Delhi, 1987.
- 3) Prasana C, "Projects- Planning, Analysis, Selection, Implementation and Review", 6th Ed., Tata Mc Grawhill Publishing Co. Ltd., N. Delhi, 1996.
- 4) Charles T Horngren, George Foster and Srikant M Datar, "Cost Accounting, A Managerial Approach", 2003
- 5) Varma H K, "Costing in Textile Industry", Prentice Hall Inc, 1992.
- 6) Robin looper and Regine Salgmolder, "Target Costing & Value", 1997.
- 7) Dudeja.V.D, " Management of Textile Industry", Textile Trade Press, Ahmedabad, 1990
- 8) Ormerod.A, "Textile Project Management", The Textile Institute, Manchester, 1992

Programme Name:		M. Tech. Textile				SEMESTER –II	
Course Code:		TT5103T					
Course Title:		Apparel Engineering and Quality Control					
L	T	P	Credits	TA	IST	ESE	Total
3	1	-	4	20	20	60	100
Objectives		<ul style="list-style-type: none"> • To enable the students to learn the modern garment manufacturing process. • To enable the students to learn the mechanics of sewing operations. • To enable the students to learn the management of Quality in the apparel industry, 					
Outcomes		<p>The students should be able to</p> <ul style="list-style-type: none"> • manage production and quality in Garment mfg. industry. • work in fashion industry and successfully perform various roles. • formulate research on garment technology • explain the garment technology and its application as entrepreneur 					

Course Contents

Pattern drafting and marker planning, Cutting, Planning, Drawing, Reproduction of Marker, grading, use of computers, Spreading of the fabric to form a lay. Method of spreading .The cutting operation, method of cutting, the work room teams and definitions: pattern making tools, Lay out preparation, industrial forms, paper pattern, figure analysis, measuring techniques. Methods for drafting the basic pattern: principles, the bodice draft, the skirt draft, the selvedge draft, collar, fashioning, neck finish, selvedge insertion, hem lines, waist lines, contour of garments, Elements and principles of fashion designing, Role of fashion designer, individual figure analysis, pattern industry standards. Principle of proportions, balance, unity and rhythm, source of inspiration.

Sewing: the properties of seam-seam types, stitch types,

Mechanics of sewing operation: Feeding mechanism, mechanism of generation of needle thread tension, feed dog setting mechanism, stresses and heat generated during sewing, interaction of feed and pressure, sewing dynamics. Measurement and controls in sewing operation: Pressure, sewing speed, thread tension, needle temperature, needle penetration force. Automation in sewing operation.

Fabric quality assessment for clothing industry: Fabric quality requirement for high quality garments, low stress fabric mechanical properties and their effect on sewing operation. Use of FAST and KES system. Fabric mechanical properties and sewing operation interaction: Tailorability and formability. Lindberg theory, optimization of sewing parameters by using fabric mechanical property, optimization of finishing parameters such as steam, pressure, vacuum, for getting desired effect. Fabric defect analysis for clothing industry: Defect identification, bow and skewness, correlating defect with back process, value loss.

Quality control in apparel manufacturing: Determination of sewability, seam pucker, seam slippage and needle cutting index, evaluation of cutting defect, fusing defect, sewing defect, inspection of dimension, appearance, drape, change in color, shape and spots. Measurement and selection of sewing thread properties for different fabrics: Optimization of sewing parameters such as ticket number, needle number, yarn tension, stitch density and stitch type for desired sewability. Selection of lining and interlining fabrics for various shell fabric: Evaluation of lining and interlining fabric, determination of compatibility. Packaging of finished garment, final random inspection of finished garments, packaging method, safety norms. Accessories: Buttons, hook and eye, jips, velcro.

Text Books

1. Winks J M, "Clothing Sizes International Standardization", The Textile Institute, Due Summer 1997.
2. Ruth E Glock , Grace I Kunz, "Apparel Manufacturing – Sewn Product Analysis – 3rd Edition", Prentice Hall Inc.,2000.
3. Cooklin G, "Introduction to Clothing Manufacture", Blackwell Science, 1991.
4. Managing Quality in Apparel Industry, Mehta and Bhardwaj, New Age Publishing.

Programme Name:		M. Tech. Textile				SEMESTER –II	
Course Code:		TT5103P					
Course Title:		Apparel Engineering and Quality Control Lab					
L	T	P	Credits	TA	IST	ESE	Total
0	0	2	1	100 % CIE			
Objectives		<ul style="list-style-type: none"> • To enable the students to learn the modern garment manufacturing process. • To enable the students to learn the mechanics of sewing operations. • To enable the students to learn the management of Quality in the apparel industry, 					
Outcomes		<p>The students should be able to</p> <ul style="list-style-type: none"> • manage production and quality in Garment mfg. industry. • work in fashion industry and successfully perform various roles. • formulate research on garment technology • explain the garment technology and its application as entrepreneur 					

Course Content

1. Study of various stitches and seams .
2. Calculation of seam strength, Resistance to slippage of seams and seam efficiency with various stitches and Stitch destiny.
3. Study and construction of some patterns for Kids wear, Men's wear and Women's wear.
4. Design and optimization of sewing parameters.
5. Study and assessment of seam puckering.
6. Study of various lay plans.
7. Study of various cutting tools and its applications.
8. Designing of T-shirts, Skirts, Pant and Shirt.

Programme Name:		M. Tech. Textile				SEMESTER –II	
Course Code:		TT5104T					
Course Title:		Coated and Laminated Textiles					
L	T	P	Credits	TA	IST	ESE	Total
3	1	-	4	20	20	60	100
Objectives		To enable students to <ul style="list-style-type: none"> • Learn various technique of coating and laminating of textile substrate • Production value added product based on coating and laminating • Adopt innovative and potential area in technical textile product development 					
Outcomes		Upon completion of course, the students shall be able to apply the knowledge gained <ul style="list-style-type: none"> • In selection of substrate and polymer material for coating and laminating operation • To develop innovative design of coated and laminated product for various end use application • To minimize environmental impact of developed product 					

Course Contents

UNIT-I

Fundamental of coating and laminating, Basic principle of coating and laminating process, Commercial and technical scope of coated and laminated textiles

UNIT-II

Material and their properties:

Basic textile substrate and their interaction in coated and laminated fabric, preparation of fabric, materials for coating and laminating, compounding of polymers (Resin) such as water based and solvent based, PVC, Plastisols, rubber compound, Adhesive and their mechanism of application on substrate, various types used, study of modification of surface properties

UNIT-III

Processes and technique for coating and laminating on textile substrate

Chemistry and technology of coating polymers, coating and laminating methods; Transfer coating and Direct coating, Dry laminating, Wet Laminating and Flame laminating, Paste preparation technique, Application system, Control parameter in coating, Study of method of

characterization of treated fabric, Experimental setup for parameter study, Effect of weave pattern, fill yarn size, effect of coating thickness and penetration on shear behaviour study

UNIT-IV

Product from Coated and Laminated fabric

Protective clothing-sports and industrial, functional clothing, automotive application, Marine application, Building , construction and Architecture application, Household product, Medical use, Defense textiles, Speciality product based on smart and intelligent textiles coating and laminating, Conductive coating for textiles, Breathable textiles from coated and laminated process, Shape memory polymer and phase change material application in coating and laminating textiles, Nanotechnology based advanced coating and functional finishing for textiles

UNIT-V

Testing, Product evaluation, quality study and environmental issues of coated and laminated textiles

General Test Consideration principle used, Texting of coated and Laminated fabric 9 Coating mass per unit area, Degree of adhesion, Accelerated ageing, Flexibility, abrasion resistance, Cone test, Resistance to water pretreatment, Water vapour permeability, Electrical resistance of fabric. Study of coating and laminating effect on environment, environmental legislation, manufacturing concerns and sustainable development

Text Books :

1. Walter Fung; Coated and Laminated Textiles, Woodhead Publication Ltd, 2002,
2. Smith W.C., Smart Textiles Coating and laminating Woodhead Publication, 2010
3. Carr C.M." Chemistry of Textile Industry, Chapt 07, Chapman and Hall India, 1995
4. Sen A.K., Coated Textiles: Principle and Application, 2nd Edition, CRC Press, 2007
5. Giesmann Andreas, Coating Substrate and Textiles: A Practical guide to coating and laminating Technologists, By Springer, 2012

Programme Name:		M. Tech. Textile				SEMESTER –II	
Course Code:		TT5104P					
Course Title:		Coated and Laminated Textiles Lab					
L	T	P	Credits	TA	IST	ESE	Total
0	0	2	1	100 % CIE			
Objectives		To enable students to <ul style="list-style-type: none"> • Learn various technique of coating and laminating of textile substrate • Production value added product based on coating and laminating • Adopt innovative and potential area in technical textile product development 					
Outcomes		Upon completion of course, the students shall be able to apply the knowledge gained <ul style="list-style-type: none"> • In selection of substrate and polymer material for coating and laminating operation • To develop innovative design of coated and laminated product for various end use application • To minimize environmental impact of developed product 					

Course Contents

1. Study of preparation of fabric used for coating and laminating
2. Preparation of polymer paste and study of various parameter
3. Study of various polymer characteristics used in coating and laminating
4. Product development using various polymer for industrial application such as automotive textile, Waterproof materials, Building, construction and Architecture application, Household product, Medical use, Defense textiles
5. Analysis of coated and laminated product
6. Case study related to environmental issues related to coated and laminated textiles
7. Market survey and product analysis

Programme Name:		M. Tech. Textile				SEMESTER –II	
Course Code:		TT5105S					
Course Title:		Apparel Marketing and Merchandising					
L	T	P	Credits	TA	IST	ESE	Total
3	0	0	3	20	20	60	100
Objectives		<ul style="list-style-type: none"> To enable the students to learn the selection of appropriate solutions utilizing a working knowledge of specific areas of domestic and international marketing, management related to the business operations of fashion and retail merchandising. To enable the students to learn about the concepts of supply chain management and logistics and its applications. 					
Outcomes		<p>The students should be able to</p> <ul style="list-style-type: none"> understand the concepts related to the management, marketing of textile and apparel products Analyze, develop, construct, and execute effective marketing strategies for a specific fashion or retail operation. Demonstrate a thorough understanding of consumer behavior and choose appropriate professional techniques in the display and sales of fashion and retail goods. 					

Course Contents

Marketing Management - Domestic marketing, international marketing, textile product development and marketing, product life cycle, pricing, marketing channels and promotion mix.

Marketing Research – Basic concepts, research process, identifying market segment, product research, advertising research, market and sales analysis.

Merchandising - Merchandise buying and handling process, resident buying offices, merchandise pricing, merchandising forecasting and budgeting.

Retail and Supply Chain Management-Types of retailers, Retail Formats, Retail Consumer Behavior, Retail Marketing Mix., Retail Market Strategy, Retail growth in India and abroad, Retail Theories, Retail Location Decisions, Merchandise Planning, Managing Assortments, Store Management, Layout, Design, Space Management.

Visual Merchandising- Retail Aesthetics, Customer Service, Retail Atmospherics, Retail Equity, Retail Purchase Planning. Retail Communication Mix, Retail Pricing: Price Setting, Pricing Strategies, Managing Retail Brands,

Retail Supply Chain- CRM, HRM Practices in Retail, Technology in Retailing, Future of Retailing, Basics of Supply Chain Management, Internet-Enabled SCM, E-Supply Chain Fusion, Management Issues in e-supply Chain Fusion, The continuing Evolution of e-Supply Chains.

Supply Chain as a network of entities- Role and interactions between the entities. Value Chain Focus of Supply Chain, Supply Chain Management strategy, Customer segmentation, Customer requirements analysis.

Procurement Logistics: Source Identification: Global Vs. Domestic Sourcing, Landed Cost Computation, Vendor Rating, Contract Negotiation, Consolidation, Self Certified Vendor Management, Individual component Vs. Module Purchases. Vendor Development and Vendor Relationship Management, Vendor Performance Monitoring.

Use of tools such as Lean and Agile Manufacturing, Virtual Manufacturing, Just-in-Time Manufacturing, Lead-time Components and their Compression, Lot Streaming in logistics management.

Distribution Management: Distribution Channels: Structure and Operation, Distribution Cost Components, Pipe line Inventory and Response Considerations, Hub and Spoke Models, Cross docking, Carrier Selection, Vendor Consolidation, Vehicle Loading and Vehicle Routing Methods.

Text Books:

1. Text Book of Logistics and Supply Chain Management – Agarwal – McMillan
2. Supply Chain Management: Strategy, Planning & Operations, Sunil Chopra, Pearson
3. Global Operations and Logistics – Dornier / Ernst / Fender / Kouvelis – Wiley
4. Introduction to Operations and Supply Chain Management – Bozarth / Handfield – Pearson
5. Supply Chain Management – Sahay – Mc Millan
6. Fundamentals of Supply Chain Management, J Mentzer, Sage
7. Retail Management – Bajaj, Tulsi & Srivastava – Oxford
8. Fundamentals of Retailing – Madaan – MC Graw Hill
9. e-Commerce: Business Technology & Society, Laudon and Traver, Pearson
10. E-Commerce An Indian Perspective, Joseph P.T., PHI
11. Fashion supply chain management using radio frequency identification (RFID) technologies ,ong, Guo, Woodhead Publishing 2014
12. Kotler P, “Marketing Management”, 9th Ed., Prentice Hall of India, N. Delhi, 1998.

Programme Name:		M. Tech. Textile				SEMESTER –II	
Course Code:		TT5106S					
Course Title:		Sustainable Textiles					
L	T	P	Credits	TA	IST	ESE	Total
3	0	0	3	20	20	60	100
Objectives		<ul style="list-style-type: none"> • To enable the students to learn about the sustainability and its importance • To teach the fundamental concepts related to sustainability in textile industry. 					
Outcomes		<p>The students should be able to</p> <ul style="list-style-type: none"> • Ability to explain the techniques in manufacturing by innovative designs of textile machines, • materials and processes from ecological point of view. • Ability to carry out research on the eco textiles and sustainability. • Ability to explain the importance of environmental protection at national and international • levels. 					

Course Contents

Structure and stability of ecosystem with reference to fibre and textile production, Alternative fibre sources, Microbiologically stable fibres and their impact on environment.

Toxicity of intermediates, dyes and other auxiliaries etc. Pollution load from different wet processing operations. Textile effluents and their characterization. Technology and principles of effluent treatment.

Environmental issue on cotton production and processing

The genetic modification of cotton and its impact on environment

Organic cotton: Production and its comparison with conventional cotton production and certification

Naturally coloured cotton production and its benefits

Ecological aspects in yarn, fabric production and fabric treatment processes, ecological considerations in textile machinery design, methodologies to impart ecofriendly nature in textile products.

Development of eco-textile products and its need. Functional finishes in textiles for ecological purpose, Applications of biotechnology in fibre production, protection and enhancement of environment fibre to fabric.

Eco friendly superabsorbant polymers; integrated approach, green technology in textiles, waste recycling, effluent treatments, filters.

Energy conservation in fibre production to processing, Development of ecofriendly preparatory processes,

Ecological and economical issue in Technical Textiles production, Coated and Laminated Textile, PLA fibre production, Tencel production

Environmental aspects in the use of textiles. Recycling and reuse of textile, Green composites.

Eco labeling, Eco norm, International standard with reference to banned products in textile production,

Environmental legislation (National and International)

Environmental issues in manmade fibre production.

Environmental protection , International and National policy regarding environmental protection, Protective applications ,Legislation ,Financial benefits, Costs, Drawbacks, Recycling , Pollution measurement problems ,Environmental auditing.

Magnitude of textile environmental damage contributions, Thermal exposure, Novel approaches in reduction of pollution, Protection of, or by textiles from environmental damage

Text Books

- (1) Indian Journal of fibre and textile research, Special issue on environmental issues:- Technology options for textile industry' 2001, June, edited by Prof. R.B.Chavan , IIT, Delhi.
- (2) Shastree N.K., 'Environmental resource management, noise pollution: standards and control', Anmol Publication Pvt. Ltd., New Delhi.(1997).
- (3) Environmental impact of textiles, Keith Slater, Woodhead Publishers, June 2003.
- (4) Textile Preparation and Dyeing, Asim Kumar Roy Chaudhary, Oxford IBHP Publishing house, New Delhi 2006.
- (5) Das S. & Ghosh A., National conference on environmentally conscious design and manufacturing –Issues and challenges, KCT, Coimbatore, (2004).
- (6) Wagle N.P., NCUTE programme on eco friendly textile wet processing, SSM College of Engg., Komarapalayam, T.N.(2001).
- (7) Y.S.Asolekar, (Co-ordinator) 2002, Environmental problems in the chemical processing of textiles, NCUTE, IIT Delhi.
- (8) 'Ecofriendly textile processing' symposium proceeding-IIT Delhi, Nov 1995.
- (9) E.Zippel, 1998, Oeko-tex labeling of textiles, In: Proceedings of ecotextile'98-Sustianable development, Bolton, UK, 1998,PP 197-210.
- (10) Handbook of Technical textiles, Edited by Subhash Chandra Anand, A. R. Harrocks and S. C. Anand. (2000)

Programme Name:		M. Tech. Textile				SEMESTER –II	
Course Code:		TT5107T					
Course Title:		Advances In Manmade Fibre Production					
L	T	P	Credits	TA	IST	ESE	Total
3	0	0	3	20	20	60	100
Objectives		<ul style="list-style-type: none"> • To enable the students to learn the process of drawing and related parameter for production of manmade fibres. • To enable the students to learn texturizing and related advancements and evaluation of fibres properties. • To enable the students to learn about the characteristics and applications of new fibres such as biodegradable fibres, chitosan fibres etc. 					
Outcomes		<p>The students should be able to</p> <ul style="list-style-type: none"> • Explain the advancements in the process of texturizing and related process parameters. • Explain the processes of drawing, texturizing, plasma processing of manmade fibres. • Explain the properties of new fibres and its innovative uses. 					

Course Contents

Drawing Process, neck drawing, initiation and propagation of neck, neck stabilization. natural draw ratio, effect of temperature and strain rate on neck drawing, prediction of neck formation, influence of drawing on structure and properties of filament, spin-draw process.

Texturing and warping process. Material and process variables in texturing and their influence on yarn quality. Recent advances in texturing, testing and evaluation of textured yarn. Properties of fabrics made from textured yarn. Heat Setting process, parameters for heat setting, equipment for heat setting and evaluation of degree of set. Post spinning operation on multifilament sewing threads.

Profile fibres, hollow & porous fibres, spandex fibres. Biodegradable fibres, polyglycolic acid fibres, polylactic acid fibres, chitosan fibres, their preparation properties and applications. Bicomponent fibres, blended fibres. Fibres in medicine and biotechnology. Aesthetic fibres, bio-mimicking fibres. Membranes. Smart fibres. Comfort fibres. Fibres for Ballistic protection. Microdenier fibre

Plasma processing of textiles.

Text Books

1. Gupta V B and Kothari V K, "Manufactured fibre technology", 1st Ed., Chapman and Hall, London, 1997
2. Mark H F, Atlas S M, Cernia E, "Man made fibre science and technology", 1st Ed., Vol. I, II, III, Willey Interscience Publishers, NewYork, 1967.
- 3Cook G. J., Handbook of Textile fibres Vol.1 & Vol.2, Woodhead Pulication, 1984
4. Macintyre J E, "Synthetic fibres", Woodhead Fibre Science Series, UK, 2003.
- 5.Fourne F, "Synthetic fibres: Machines and equipment, manufacture, properties", Hanser Publisher, Munich, 1999.

Programme Name:		M. Tech. Textile			SEMESTER –II		
Course Code:		TT5107P					
Course Title:		Advances In Manmade Fibre Production Lab					
L	T	P	Credits	TA	IST	ESE	Total
0	0	2	1	100 % CIE			-
Objectives		<ul style="list-style-type: none"> • To enable the students to learn the process of drawing and related parameter for production of manmade fibres. • To enable the students to learn texturizing and related advancements and evaluation of fibres properties. • To enable the students to learn about the characteristics and applications of new fibres such as biodegradable fibres, chintosan fibres etc. 					
Outcomes		<p>The students should be able to</p> <ul style="list-style-type: none"> • Explain the advancements in the process of texturizing and related process parameters. • Explain the processes of drawing, texturizing, plasma processing of manmade fibres. • Explain the properties of new fibres and its innovative uses. 					

Course Contents

Experiments related to fibres production processes. Effect of moisture and temperature on MFI of PET and PP. Melt spinning of PET, PP & nylon-6 filament yarns on laboratory spinning machines. Single and two stage drawing of the as spun yarns or industrial POY. Demonstration of high speed spinning machine. Wet and dry heat setting of PET and nylon drawn yarns. Effect of temperature and tension on heat setting. Determination of structure and mechanical properties of as spun, POY, drawn and heat set yarns using DSC, Xray, PTIR, density, sonic modulus. Effect of shear rate, temperature on polymer solution viscosity using Brookfield Rheometer and ball-fall method. Wet spinning or dry jet wet spinning of PAN copolymers. False twist and air jet texturing processes. Determination of structure of textured yarn under microscope.

Programme Name:		M. Tech. Textile				SEMESTER –II	
Course Code:		TT5108T					
Course Title:		Surface Modification of Textiles					
L	T	P	Credits	TA	IST	ESE	Total
3	0	0	3	20	20	60	100
Objectives		<ul style="list-style-type: none"> • To enable students to learn the basics of plasma science and technology. • To enable the students to understand the characterization of plasma textiles. • To teach the applications of enzyme treatment, high energy radiation and surface modification etc. 					
Outcomes		<p>The students should be able to</p> <ul style="list-style-type: none"> • apply the knowledge of plasma science and technology for the improvements in textile fibres including surface modifications. • explain the different techniques of surface modification. • explain the phenomenon associated with plasma technology. 					

Course Contents

INTRODUCTION: Importance of surface modification of textiles materials. Methods. Potential applications.

PLASMA SCIENCE: Concept of plasma. Corona discharge. Glow discharge. Plasma generation and its action. Interaction of plasma with substrate. plasma cleaning, plasma metallisation, plasma polymerization and plasma co-polymerization. Surface modification of fabrics under plasma treatment.

PLASMA TECHNOLOGY: Low pressure cold plasma processing, atmospheric - pressure cold plasma processing, corona and dielectric barrier discharge plasma treatment of textile materials. Plasma modification of wool. Plasma modification of natural cellulosic fibres. Plasma treatment

of textiles for water and oil repellency. Interfacial engineering of functional textiles for bio-medical applications.

CHARACTERISATION OF PLASMA TREATED TEXTILES : Surface reactions in plasma treatment. Brief study of techniques for characterization of plasma treated textiles. Surface characterization challenges.

HIGH ENERGY RADIATION: UV light irradiation, UV Laser abrasion, Electron Beam and other high energy beam irradiation of textile materials.

ENZYME TREATMENT: Introduction. Mechanism of enzyme action on cotton. Parameters governing the cellulase treatments. Changes in fibres by enzymatic hydrolysis.

OTHERS: Fiber surface modification by sol-gel finishes with inorganic oxide films. Surface modification by raising, shearing, calendaring and the application of phase-change materials.

Text Books

1. Christopher M. Pastore and Paul Kieken, "Surface characteristics of Fibers and Textiles," Marcel Dekker, Inc., New York, 2001, ISBN:0-8247-0002-3.
2. Perkins. W. S., "Textile Coloration and Finishing," Carolina Academic Press, London, 1996
3. Shishoo. R., "Plasma Technologies for Textiles," Woodhead Publishing Ltd., Cambridge, 2007
4. Xiaoming Tao, "Smart fibers, Fabrics and Clothing," Woodhead Publishing Ltd., Cambridge 2007

Programme Name:		M. Tech. Textile				SEMESTER –II	
Course Code:		TT5108P					
Course Title:		Surface Modification of Textiles Lab					
L	T	P	Credits	TA	IST	ESE	Total
0	0	2	1	100 % CIE			
Objectives		<ul style="list-style-type: none"> • To enable students to learn the basics of plasma science and technology. • To enable the students to understand the characterization of plasma textiles. • To teach the applications of enzyme treatment, high energy radiation and surface modification etc. 					
Outcomes		<p>The students should be able to</p> <ul style="list-style-type: none"> • apply the knowledge of plasma science and technology for the improvements in textile fibres including surface modifications. • explain the different techniques of surface modification. • explain the phenomenon associated with plasma technology. 					

Experiments

1. Various fabric studies with respect to surface characterization
2. Surface modification using various Plasma techniques
3. Study of high energy radiation technique for surface modification and their evaluation
5. Characterization study of Plasma Treated fabric
6. Surface modification of various textiles using enzymetic process
7. Surface modification of textile by mechanical processes
8. Analysis of market product based on international standard

