

## M.Text.(Technical Textiles) Implemented from July 2011

M.Text.(Technical Textiles)		SEMESTER I				JULY 2011			
SR.NO	SUBJECTS	TEACHING HOURS WEEK				EXAMINATION SCHEME			
		L	PR	A	TOTAL	TH	TW	OE	TOTAL
1	Manufacture of Fabrics for Technical Textiles	3	--	1	4	100	50	----	150
2	Industrial Application of Textiles	3	--	1	4	100	50	----	150
3	Advanced Computer Programming	3	--	1	4	100	50	----	150
4	Nanotechnology in Textiles	3	--	1	4	100	50	----	150
5	ELECTIVE-I	3		1	4	100	50	----	150
6	SEMINAR-I	---	1	---	1	----	50	----	50
	<b>TOTAL</b>	<b>15</b>	<b>1</b>	<b>5</b>	<b>21</b>	<b>500</b>	<b>300</b>	<b>0</b>	<b>800</b>

Elective-I= 1) Textiles for Protection  
2) Textiles for Sports Application

M.Text.(Technical Textiles)		SEMESTER II				JULY 2011			
SR. NO.	SUBJECTS	TEACHING HOURS/WEEK				EXAMINATION SCHEME			
		L	PR	A	TOTAL	TH	TW	OE	TOTAL
1	Plasma Technology for Textiles	3	----	1	4	100	50	----	150
2	Medical Textiles	3	----	1	4	100	50	----	150
3	Statistics for Textile Mill Management	3	----	1	4	100	50	----	150

4	Fibre Reinforced Composites	3	----	1	4	100	50	----	150
5	Elective-II	3	----	1	4	100	50	----	150
6	SEMINAR-II	---	1	---	1	---	50	----	50
	TOTAL	15	1	5	21	500	300	---	800

Elective II- 1)Textiles in Automobile Engineering  
2) Intelligent Textiles and Clothing

M.Text.(Technical Textiles)		SEMESTER III				JULY 2011			
SR.NO.	SUBJECTS	TEACHING HOURS/WEEK				EXAMINATION SCHEME			
		L	PR	A	TOTAL	TH	TW	OE	TOTAL
1	SEMINAR-III	---	1	---	1	----	50	----	50
2	DISSERTATION		4	---	4	----	100	---	100
	TOTAL	--	5	--	5	---	150	0	150

M.Text.(Technical Textiles)		SEMESTER IV				JULY 2011			
SR. NO.	SUBJECTS	TEACHING HOURS /WEEK				EXAMINATION SCHEME			
		L	PR	A	TOTAL	TH	TW	OE	TOTAL
1	SEMINAR-IV	---	1	---	1	----	50	----	50
2	DISSERTATION	---	4	---	4	----	50	200	250
	TOTAL	---	5	---	5	----	100	200	300

## M. TEXT. (TECHNICAL TEXTILES) SEMESTER - I

### 1. MANUFACTURE OF FABRICS FOR TECHNICAL TEXTILES

Lectures	:	3 Hrs / Week
Assignment	:	1 Hrs / Week
Theory Paper	:	100 Marks
Term Work	:	50 Marks
Subject Total	:	150 Marks

- 1. Review of conventional natural and manufactured fibers structure and properties.**
- 2. Technical Fibres:** Introduction to High Technology Fibres. Structure and properties of Aramid fibres, High performance polyethylene fibres, Carbon Fibres, Glass Fibres, Ceramic Fibres, Structure and properties other chemical and thermal resistant fibres.
- 3. Technical Yarns:** Introduction and classification of yarns on the basis of technical use, Manufacturing of spun yarn and filament yarn for technical applications.
- 4. Fabrics for technical textiles:** Introduction, classification of knitted and woven fabric production techniques. Modern weaving and knitting technologies for technical fabrics production.
- 5. Non-woven Fabrics:** Introduction – Review of non-woven fabric production techniques. Detail study of various methods of non woven fabrics production.

- 6. Finishing of Technical Fabrics:** Importance of finishing for technical textiles. Classification of various finishing processes. Process sequence and optimization of Mechanical finishes – Heat setting – Chemical processes. Importance of coatings for technical textiles. Classification of various coating techniques. Process sequence and optimization of fusible interlining – laminating.
- 7. Colouration of Technical Fabrics:** Introduction – objectives of coloration – colouration of technical textiles – dye classes and pigments – mass colouration of artificial fibres – conventional dyeing and printing of technical textiles – Total colour management system – colour fastness of technical textiles.

### **Term Work**

Assignments / Seminars / Mini Projects based on above topics.

### **Reference Books :-**

- 1) Wellington Sears Handbook of Industrial Textiles by Sabit Adanur.
- 2) Handbook of Technical Textiles by A.R. Horrocks.
- 3) Kevlar Aramid Fibre by H.H. Yang
- 4) High Performance Fibres by J.W.S. Hearle.
- 5) Carbon Fibres by L.H. Peebles.
- 6) Nonwoven Textiles by L.C. Wadsworth.
- 7) Coated & Laminated Fabrics : 2000 & Beyond by AATCC.
- 8) Coated Textiles, Principles & applications by A.K. Sen.
- 9) Carbon Fibres – Jean Baptiste Donnet & Roopchand Bansal.

10) Ullmann's Fibres Vol.1 & 2 by Wiley-VCH.

## M. TEXT. (TECHNICAL TEXTILES) SEMESTER - I

### 2. INDUSTRIAL APPLICATION OF TEXTILES

Lectures	:	3 Hrs / Week
Assignment	:	1 Hrs / Week
Theory Paper	:	100 Marks
Term Work	:	50 Marks
Subject Total	:	150 Marks

1. **Textiles for Construction:** Importance of buildtech with respect to technical textiles, Requirements of buildtech, study of structure and properties of high performance textile structures in relation to requirements of buildtech. Applications like Fabrics for Architecture and Construction, Applications of Coated Fabrics in Building Structures, Awnings and Canopies, Textiles as Roofing Materials, Storage Vessels, Fibre Reinforced Concrete and Cements, Textiles for Acoustic and heat Insulation
2. **Textiles for filtration:** Introduction, importance of filtration, Principles and mechanism of Filtration, requirements of filtration, Filtration Equipments, Textile in Dry Filtration, Textile in Liquid Filtration, Designing for Filtration, Testing and evaluation of performance. Application and developments in filtration fabrics.
3. **Textiles for military and defense:** Introduction, Applications of various textile structure in protective Clothing and Individual Equipment, Textiles Used in Defense Systems and Weapons, Testing and evaluation of various textile structures used in defense and military applications.

4. **Textiles in transportation:** Introduction, Manufacturing process, structure and properties of Tyre cord fabrics, Airbags, Seat Belts, Automotive Interior Trim, Automotive Exterior Trim ,Truck and Car Covers, Hoses and Filters in Cars. Textile for Aircrafts, Textiles as structural Elements in Transport Vehicles, Inflatable Products Used in Transportation. Testing and evaluation techniques of above products.
5. **Miscellaneous industrial applications of textiles:** Textiles in Agriculture, Electronics. Textiles for Banners and Flags. Textile Reinforced Products ,Transport Bags and Sheets, Fabrics to Control Oil Spills, Canvas Covers and Tarpaulins, Ropes and Nets, Home and Office Furnishings, Testing and evaluation techniques of all these products.

#### **Term Work**

Assignments / Seminars / Mini Projects based on above topics.

#### **Reference Books:-**

- 1) Wellington Sears Handbook of Industrial Textiles by Sabit Adanur.
- 2) Handbook of Technical Textiles by A.R. Horrocks.
- 3) Military Textiles by E. Wilusz.
- 4) Textiles in Automotive Engineering by W. Fung & M. Hardcastle.
- 5) Textiles for Protection by R.A. Scott.
- 6) Fibre-Reinforced Composites by P.K. Mallick.
- 7) 3-D Textile Reinforcements in composite materials by A. Miravate.





## **M. TEXT. (TECHNICAL TEXTILES) SEMESTER - I**

### **3. ADVANCED COMPUTER PROGRAMMING**

Lectures	:	3 Hrs / Week
Assignment	:	1 Hrs / Week
Theory Paper	:	100 Marks
Term Work	:	50 Marks
Subject Total	:	150 Marks

#### **1) Programming in C++ :-**

Introduction to object oriented programming, basic program construction, preprocessor directives, variable types, loops & decisions, structures, functions, objects & classes, arrays, operator overloading, inheritance, pointers, memory management.

#### **2) Artificial Neural Networks :-**

Biological Neuron & their artificial models, Models of artificial neural neuron, Neural processing, learning & adaptation, Neural Network learning rules, Multilayer feed forward networks, Generalised error back projection training algorithm, application of ANN in textiles : Yarn strength prediction using ANN. Case study.

#### **3) E-Commerce :-**

The scope of electronic commerce, definition of electronic commerce, E-commerce and the trade cycle, Electronic markets, Electronic data interchange, Internet Commerce, Business Strategy in E-commerce, The value chain, supply chain, Porter's value chain model. Inter organization value chains, Business to business E-commerce, Inter organizational transaction, The credit transaction trade cycle. Advantages & disadvantages of Electronic markets. Application of E-commerce in textile industries.



#### **4) Information Technology Applications in Textiles –**

Application of Information Technology in Textile Industries, such as spinning, weaving, knitting, processing & garment making. Study of different web portals for textile industries.

#### **Term Work**

Assignments / Seminars / Mini Projects based on above topics.

#### **Reference Books :-**

- 1) Object Oriented Programming in Turbo C++ - Robert Lafore, Galgotia Publications.
- 2) Introduction to Artificial Neural Systems – J.M Zurada, Jaico Book.
- 3) E-Commerce – David Whiteley, TmH.
- 4) Local Area Networks – Behrouz A. Forouzan, TmH.
- 5) I.T. in Textiles – NICUTE Report.
- 6) Object Oriented Programming with C++ - E. Balagurusamy.



## **M. TEXT. (TECHNICAL TEXTILES) SEMESTER - I**

### **4. NANOTECHNOLOGY IN TEXTILES**

Lectures	:	3 Hrs / Week
Assignment	:	1 Hrs / Week
Theory Paper	:	100 Marks
Term Work	:	50 Marks
Subject Total	:	150 Marks

#### **Chapter 1. Introduction to Nanotechnology**

Concept of nanoscale and Historical background of nanotechnology, Fundamental concepts of nanotechnology - Bottom-up approaches, Top-down approaches, Functional approaches.

#### **Chapter 2. Synthesis and Properties of Nanoparticles**

Synthesis of Fullerenes and various forms of carbon. Synthesis of nano metal particles by various chemical, physical and biological methods. Properties of nano particles like organic and inorganic materials in various chemical forms.

#### **Chapter 3. Characterization of Nanoparticles**

X-Ray Diffraction, Transmission Electron Microscopy and Spectroscopy; Scanning electron microscopy (SEM); Transmission electron microscopy (TEM); Energy-dispersive x-ray spectroscopy (EDS), Small-Angle X-Ray Scattering (SAXS), The Cone Calorimeter (CC), The Mass Loss Calorimeter (MLC).

#### **Chapter 4. Electrospinning of Nanofibers**

Principles of electrostatic atomization, Electrospaying and electrospinning by the capillary method, Electrospaying and Electrospinning by the charge injection method, Controlling fiber orientation, Producing non-continuous or short yarns, Producing continuous yarns. Various applications of nanofibres viz, tissue engineering, filter media

### **Chapter 5. Nanocomposites**

Carbon nanotube / nanofibre polymer composites, development of functional polymer nanocomposites, Nano filled polypropylene nanocomposites and Dyeable PP.

### **Chapter 6. Nanoengineered Textiles**

Nanolayer deposition/coating of polymer films through viz. grafting, plasma and self assembled for various applications like Conductive textiles, Antimicrobial textiles, Self cleaning textiles, Moisture absorbing textiles, Improved hydrophilicity, colourability and wear resistance, UV- blocking textiles, Controlled release of active agents.

### **Term Work**

Assignments / Seminars / Mini Projects based on above topics.

### **Reference Books :-**

- 1) Principles of Nanotechnology by Phani Kumar
- 2) Nanofibres & Nanotechnology in Textiles by P.J. Brown & K. Stevens.
- 3) New Millennium Fibres by G.O. Phillips & M.Takigami.
- 4) Analytical Electrochemistry in Textiels by P. Westbroek, G. Priniotakis & P. Kiekens.
- 5) Smart Textiles for Medicine & Healthcare by L. Van Langenhove.
- 6) The Nanoscope, Encyclopedia of Nano Science & nanotechnology Vol.-I to VI, Dr. Parag Diwan & Ashish Bharadwaj.
- 7) Nanotechnology in Fibres matures : A New Perspective, Textile Progress, The Textile Institute by Rajesh D. Anandiwala.



## M. TEXT. (TECHNICAL TEXTILES) SEMESTER - I (Elective-I)

### 5. TEXTILES FOR PROTECTION

Lectures	:	3 Hrs / Week
Assignment	:	1 Hrs / Week
Theory Paper	:	100 Marks
Term Work	:	50 Marks
Subject Total	:	150 Marks

**Overview of protective clothing:** Overview and various standards for protective clothing, Market prospects, Classification, Materials and technologies, Future of personal protection, Requirements, International standards, Certification, Future trends.

**Factors affecting the design and use of protective clothing:** Introduction, Factors influencing the design development process, Clothing systems and functionality, Reconciling fashion and function, Future trends, Recommended steps in the selection of textiles for protective clothing, Relevant standards, specifications or guidelines, Protection performance of materials, Biological protection performance, Flame and thermal protection performance, Mechanical protection performance, Selection of materials based on other major factors,

**Protection against hazard:** Introduction, Types of hazards, Mechanical hazards, Pressure hazards, Environmental and fire hazards, Chemical and biological hazards, Electrical and radiation hazards

**Intelligent textiles and surface treatments for textiles:** Smart textiles, Applications of smart textiles for protective purposes, Sensor function, Data processing, Actuators, Energy, Communication, Thermal protection, Electric actuation, Types of surface



treatments, Early treatments for protective textiles, Progression to modern treatments, Choice of treatments in relation to fibre and fabric types, Treatment process fundamentals, Treatment application systems, Brief overview of finishes for protection.

**Interactions between protection and thermal comfort** :Introduction, Definition of comfort, Test methods for heat and moisture transfer, Measurement of thermal comfort with practice-related tests, Interactions between heat and mass transfer, Moisture storage and influences on protection, Thermal manikins, Measuring the insulation of protective clothing systems, Measuring the evaporative resistance of protective clothing systems, Ensemble data, Moving manikins, Manikin tests vs fabric tests, Using manikins under transient conditions.

**General protection requirements and applications**: Civilian protection and protection of industrial workers from chemicals, Textiles for UV protection, Textiles for protection against cold, Thermal (heat and fire) protection, Microorganism protection, Textiles for respiratory protection. Electrostatic protection, Ballistic protection, Military protection, Fire fighters protective clothing, Protection against knives and other weapons, Flight suits for military aviators, Protection for workers in the oil and gas industry, Motorcyclists

### **Term Work**

Assignments / Seminars / Mini Projects based on above topics.

### **Reference Books :-**

1. Handbook of Fibre Science & Technology Vol-III Part –B.
2. New Fibres Second Edition by T. Hongu & Phillips.
3. Advanced Fibres Spinning Technology by T. Nakajima.
4. High Performance Fibres by J.W.S. Hearle.
5. Advances in Fibre Science by Dr. S.K. Mukhopadhyay.
6. Kevlar Aramid Fibres by H.Yang.
7. Textiles for Protection by R.A. Scott.

8. Fire Retardant Materials by A.R. Horrocks & D. Price.
9. Wellington Sears Handbook of Industrial Textiles by Sabit Adanur.
10. Intelligent Textiles & Clothing by H.R. Mattila.

### **M. TEXT. (TECHNICAL TEXTILES) SEMESTER - I ( Elective-I)**

#### **5. TEXTILE FOR SPORTS APPLICATION**

Lectures	:	3 Hrs / Week
Assignment	:	1 Hrs / Week
Theory Paper	:	100 Marks
Term Work	:	50 Marks
Subject Total	:	150 Marks

#### **Key trends in sportswear design**

Introduction, Market overview, Future market trends, the evolution of performance underwear; the rise of all-in-one suits; seamless garments; three-dimensional modeling; stitch less seams; the influence of advances made in laminating, The evolution of layering: the reorganization of the three-layer system; the soft shell; air: a key raw material, External influences: interactions between fashion and sportswear; wearable technology, Future trends: streamlining or stealth design.

#### **Material requirements for the design performance of sportswear**

Introduction: the link between textile technology and the demands of the end-user, Identifying the needs of the end-user: developments in sport specific clothing from post war to the present day: the layering system; from walking to mountaineering; point

of sale promotional material; synthetic fibres and fabrics; commercialization of sport; technical sportswear for women; trend; style; fashion; fibre branding; garment development. The design development process: the application of technical textiles in performance sportswear; functional needs of the end-user; the needs of the body; the demands of the sport, Form and style considerations, the demands of the culture; the demands of style and fashion, Emerging trends: commercial reality; smart clothes and wearable technology; biomimicry; environmental-issues

## **Functional sport footwear**

Introduction, Functional design of sport footwear, Functional fit of sport footwear: biomechanics of the foot; fitting areas of the shoe: flexing point; heel; toe and arch; heel-to-joint and shock absorbency; shape of the last; fastening systems; shoe size systems, Functional materials and components in sport footwear: properties of materials and components; materials for sport footwear of upper sole, Future trends in functional footwear, High-functional textiles: hydrophobic surface; dirt and oil repellence; hydrophilic finishing; UV-protection; flame retardance, antistatic finishing; antimicrobial finishing; reduction of shrinkage; softening; coating and membranes

## **Coated and laminated textiles in sportswear**

Introduction, Sports products from coated and laminated fabrics: protective sportswear and comfort; other sports products

## **Sportswear and comfort:** Physiological comfort of sportswear:

Introduction, Aspects of wear comfort, Measurement of physiological comfort, wear comfort as a measurable quantity; wearer trials; skin model; skin sensorial test apparatus; wear comfort vote applications

## **Elastic textiles**

Manufacturing of Elastic textiles for sports wear

## **Protection against impact using clothing and personal equipment**

Introduction, Analysis of injury sustained during sporting activities

Impact protection provided through protective clothing/equipment: general principles; effectiveness of impact protection in selected sporting codes

Effects of protective clothing/equipment on human performance; guidelines; codes of practice



### **Water resistance and water vapour transfer**

Introduction, Water resistance, Water vapor transfer: performance and protection under steady state conditions; performance and protection under windy conditions; performance and protection under rainy conditions; performance and protection under wind driven rainy conditions, The condensation problem in waterproof breathable fabrics for sportswear

### **Textile use in sports shoes**

Introduction: Current use of textiles in sport shoes: uppers; textiles in the sole

### **Term Work**

Assignments / Seminars / Mini Projects based on above topics.

### **Reference Books:-**

- 1) Wellington Sears Handbook of Industrial Textiles by Sabit Adanur.
- 2) High Performance Fibres J.W.S. Hearle.
- 3) Advances in Fibre Science by S.K. Mukhopadhyay
- 4) New Fibres by T. Hongu & G.O. Phillips.
- 5) Handbook of Technical Textiles by A.R. Hoorocks & S.C. Anand.
- 6) New Millennium Fibres by G.O. Phillips & T. Hongu.
- 7) Smart Textiles for Medicine & healthcare b L.Van Langenhove.
- 8) Synthetic Fibres, Nylon, Polyester, Acrylic & Polydefin by J.E. McIntyre.
- 9) Composite Materials: Engineering & Science by F.L. Matthews & R.D. Rawlings.
- 10) Textiles for Protection by R.A. Scott.
- 11) Coated Textiles by A.K. Sen

12) Materials in Sports Equipments by Subic.



## **M. TEXT. (TECHNICAL TEXTILES) SEMESTER - II**

### **1. PLASMA TECHNOLOGIES FOR TEXTILES**

Lectures	:	3 Hrs / Week
Assignment	:	1 Hrs / Week
Theory Paper	:	100 Marks
Term Work	:	50 Marks
Subject Total	:	150 Marks

#### **Chapter 1.**

##### **The Physics and Chemistry of Plasmas for Processing of Textiles**

Introduction, gases used, plasmas generated, plasma chemistry, plasma surface collisions.

#### **Chapter 2.**

##### **The Diagnosis of Plasmas used in the Processing of Textiles**

Discharge electrical characteristics, electrical plasma diagnostics, plasma mass spectrometry, optical emission spectrometry

#### **Chapter 3.**

##### **Low Pressure Cold Plasma Processing Technology**

Low pressure vacuum plasma technology, plasma activation in the technical textiles and nonwoven industries, plasma deposition on nonwoven materials, the economics of vacuum plasma treatment for fabrics and nonwovens.

#### **Chapter 4.**

## **Atmospheric Pressure Cold Plasma Processing Technology**

Basic manufacturing needs from plasma technology, Atmospheric pressure plasma types for textile processing, Atmosphere pressure plasma equipment for textile processing, Atmospheric pressure plasma surface properties for textile products.

## **Chapter 5.**

### **Corona and Dielectric Barrier Discharge Plasma Treatment for Technical Applications**

Special adoption of DBD technology for textiles, plasma induced surface activation of fibres, Deposition of nano layers by gas polymerization combination of DBD treatment and liquor deposition.

## **Chapter 6.**

### **Nano Scale Treatment of Textiles Using Plasma Technology**

Materials and methods, plasma cleaning, plasma metallization, plasma polymerization, plasma co-polymerization.

## **Chapter 7.**

### **Textile Application of Plasma Technology**

Plasma treatment of Textiles for water and soil repellency, Interfacial engineering of functional textiles for biomedical applications, plasma modification of wool, plasma modification of natural cellulosic fibres, plasma treatments of fibres and textiles.

## **Chapter 8.**

### **Characteristics of Plasma Treated Textiles**

Surface reaction in plasma treatment, techniques for characteristics of plasma treated textiles.

## **Term Work**

Assignments / Seminars / Mini Projects based on above topics.

## **Reference Books:-**

- 1) Plasma Technology for Textiles by Roshan Shishoo, CRC Publication.
- 2) Plasma Surface Modification and Plasma Polymerization – Norihiro Inagaki: CRC Press.
- 3) Plasma Kinetic Theory –Donald Gary – CRC Publication.

4) Proceedings 2 : The 5<sup>th</sup> Asian Textile Conference Kyoto Research Park, Kyoto Japan by Federation of Asian Professional Textile Association.

## M. TEXT. (TECHNICAL TEXTILES) SEMESTER - II

### 2. MEDICAL TEXTILES

Lectures	:	3 Hrs / Week
Assignment	:	1 Hrs / Week
Theory Paper	:	100 Marks
Term Work	:	50 Marks
Subject Total	:	150 Marks

#### 1. General introduction:

Definition and classification of medical textiles.

#### 2. Biomaterials utilized in medical textiles:

Natural carbohydrate polymers, Modified carbohydrate polymers, Natural and modified proteins, Commercial applications and products using carbohydrate polymers. Reformed collagen fibres, Novel Chitosan-alginate fibres for advanced wound dressings, Modification of alginic acid fibres with hydrolysed chitosans, Effect of degradation on the mechanical properties of biodegradable textiles.

#### 3. Healthcare and hygiene products

Market prospects, Current issues, Healthcare and hygiene products, Superabsorbent fibres, Antimicrobial fibres, Disposable products, Operating room garments

##### **Application of nonwovens in healthcare and hygiene sector**

Hygiene, Design issues, Absorbent hygiene products, Material used in nonwoven products available in the market

## **Role of advance textile materials in healthcare**

Fibres for medical and healthcare applications, advanced medical textiles

#### **4. Infection control and barrier materials**

Infection control and barrier materials, The use of dye-like interactions for developing novel infection-resistant materials, The impact of ageing on the properties of single use garments, The use of Amcor Pure technology in medical textiles for qualitative evaluation of the barrier effect of textiles, Reducing microbial contamination in hospital blankets.

#### **5. Bandaging and pressure garments**

Compression therapy for venous leg ulcers treatment, A comparison of elastic and non-elastic compression bandages for venous leg ulcer treatment, The theory of the Laplace Law, Laplace Law to predict pressures exerted by pressure garments, Evaluation of pressure profile of bandages using mannequin legs, Effect of fibre type and structure in designing orthopedics wadding for the treatment of venous leg ulcers.

#### **6. Wound care materials**

Wound care materials: The use of textiles in burns – from injury to recovery, Support surfaces - Initial management - Bandages - Splinting - Skin substitutes, Skin grafts and donor sites - Dressings' - Pressure garments - Silicone gels, Wound care dressings from chitin, Metronidazole loaded microspheres and membranes of dibutylchitin: preparation and drug release investigation

**Conducting clinical trials in wound care:** Phases of clinical trial, various designs of trial.

#### **7. Implantable devices:**

Vascular Prosthesis, Advantages of gelatin, Impregnated graft, Ligament prostheses, Mesh grafts. Repair of articular cartilage defects using 3-dimensional tissue engineering textile architectures, A spider silk supportive matrix used for cartilage regeneration, Third generation scaffolds for tissue engg.

**Term Work**

Assignments / Seminars / Mini Projects based on above topics.

**Reference Books :**

- 1) Medical Textiles & Biomaterial for Healthcare by S.C. Anand, M.M. Traftab, S. Rajendra – Woodhead Publication
- 2) Advance Textile for Wound Care – by S. Rajendra - Woodhead Publication
- 3) Medical Textiles 2007 : Proceedings of the fourth international conference on Health card & medical textile – by J.F. Kennedy, S.C. Anand & F. Miraftab.
- 4) Medical Textile : Proceeding of the Second International Conference & Exhibition by S.C. Anand : CRC Publication.



## M. TEXT. (TECHNICAL TEXTILES) SEMESTER - II

### 3 STATISTICS FOR TEXTILE MILL MANAGEMENT

Lectures	:	3 Hrs / Week
Assignment	:	1 Hrs / Week
Theory Paper	:	100 Marks
Term Work	:	50 Marks
Subject Total	:	150 Marks

#### 1. Multivariate Data & its Analysis:

Multiple and partial correlation, measures of Multiple and partial correlation, Examples for the data with three variables only.  
Multiple regression, planes of regression, Examples for the data with three variables only.

#### 2. Analysis of Variance:

One-way analysis of variance, mathematical model, ANOVA table & examples.

Two-way analysis of variance one observation per cell & with m observation per cell, Mathematical models, ANOVA tables & examples.

#### 3. Design of Experiments:

Basic Designs: CRD & examples as one-way, RBD & examples as two-way. LSD & examples of LSD.

#### 4. Factorial Experiments:

$2^n$  factorial experiments: Introduction, Analysis of  $2^n$  factorial experiments. Examples for  $2^n$  factorial experiments.

Introduction of  $3^n$  and higher order factorial experiments.( No examples)

Introduction of fractional factorial experiments.( No examples)

Introduction of response surface designs (No examples)

Taguchi techniques for reduction and optimization in design of experiments (No examples)

### **5. Linear programming Problem:**

Introduction, formulation of LPP, graphical and simplex methods for finding solutions of LPP. Examples.

### **6. Transportation Problem:**

Introduction, methods for finding initial and optimum solutions of transportation problem. Examples.

### **7. Assignment problem:**

Introduction, method for solving assignment problem. Examples.

### **8. Network Analysis:**

Programme Evaluation and Review Techniques(PERT): Introduction, Slack time critical path, Probability of completion of projects. Examples.

Critical path method (CPM): Introduction, Time estimates, Floats, Critical path. Examples.

**Note: Term work for this subject will be based on above syllabus.**

### **Reference Books:-**

- 1) Modern Elementary Statistics by J. Freund.
- 2) Mathematical Statistics by J. Freund.
- 3) Probability & Statistics for engineers by Johnson.
- 4) Applied Statistics & probability for engineers by Montgomery.
- 5) Experimental Designs by Cochran & Cox.
- 6) Design of Experiments by Montgomery.



## M. TEXT. (TECHNICAL TEXTILES) SEMESTER - II

### 4. FIBER REINFORCED COMPOSITES

Lectures	:	3 Hrs / Week
Assignment	:	1 Hrs / Week
Theory Paper	:	100 Marks
Term Work	:	50 Marks
Subject Total	:	150 Marks

#### Introduction

##### 1. General introduction

Meaning and types of composite materials, design of composite materials, the concept of load transfer.

##### 2. Fibers and matrices

Reinforcements: carbon fibers, glass fibers, organic fibers, silicon carbide, alumina and alumino silicates.

Strength of reinforcements: thermal stability, compressive strength, fiber fracture and flexibility, A statistical treatment of fiber strength.

Matrices: polymer matrices, metal matrices, ceramic matrices.

##### 3. Fiber architecture:

Volume fraction and weight fraction, fiber packing arrangements, clustering of fibers and particles.

Long fibers: laminates, woven, braided and knitted fabric arrays, characterisation of fiber orientations in a plane.

Short fibers: fiber orientation distributions in three dimensions, fiber length distributions.

##### 4. Fabrication:

Liquid resin impregnation routes, pressurized consolidation of resin prepregs, injection mouldings of thermoplastics, hot press mouldings of thermoplastics, powder blending and consolidation, physical vapour deposition diffusion bonding of foils, Layered ceramic composites, reactive processing, carbon/carbon composites, powder based routes.

**5. The interface region:**

Bonding mechanisms: absorption and wetting, inter diffusion and chemical reaction, electrostatic attraction, mechanical keying, residual stresses.

**6. Bond strength:**

Measurements of bond strength: single fiber pull out strength, single fiber push out and push down strength.

Control of bond strength: coupling agents and environmental effects, toughness reducing coatings, interfacial chemical reaction and diffusion barrier coatings.

**7. Strength of composites:**

Failure mode of long fibers like axial tensile failure, transverse tensile failure, shear failure, failure in compression.

Failure of laminae under off-axis loads. Strength of laminates like tensile cracking, interlaminar stresses and edge effects.

Basic concepts of fracture mechanics, interfacial fracture and crack deflection.

Contributions to work of fracture like Matrix deformation, fiber fracture, interfacial debonding and frictional sliding.

Subcritical crack growth like fatigue and stress corrosion cracking.

**8. Thermal behavior of composites:** Thermal stresses and strains, thermal expansivities, thermal cycling of unidirectional composites, thermal cycling of laminates, basics of matrix and fiber in relation to creep, axial creep of long fiber composites, transverse creep and discontinuously reinforced composites.

Thermal conduction mechanism like heat transfer, conductivity of composites and interfacial thermal resistance.

**9. Applications:** minesweeper hull, sheet processing rolls, helicopter rotor blade, and golf driving club, racing bicycle, diesel engine piston, microelectronics housing, aircraft brakes and gas turbine combustor can.

### **Term Work**

Assignments / Seminars / Mini Projects based on above topics.

### **Reference Books**

1. Physical Texting of Textiles by B. P. Saville.
2. Fabre reinforced composites by P. K. Mallick
3. Composite materials: Engineering & science by F. L. Mathew & R. D. Rawlings.
4. Microstructural Characterisation of fibre reinforced composites by John Summerscales.
5. New millennium fibres by T. Hongu & G. O. Phillips.
6. Effects of mechanical & Physical properties on fabric hand by H. M. Behery.
7. 3-D Textile reinforcements in composite materials by Prof. A. Miravete
8. Mechanics of Textile & Laminated composites by A. E. Bogdanovich & C. M. Pastore.
9. Textile Testing & Analysis by B. J. Collier.
10. Handbook of Technical Textiles by A. R. Horrocks & S. C. Anand.
11. Nanofibers & nanotechnology in textiles by P. J. Brown & K. Stevens.
12. Encyclopedia of Nanoscience & Nanotechnology by Dr. Parag Diwan & Ashish Bharadwaj

## **M. TEXT. (TECHNICAL TEXTILES) SEMESTER - II (Elective-II)**

### **5. TEXTILES IN AUTOMOBILE ENGINEERING**

Lectures	:	3 Hrs / Week
Assignment	:	1 Hrs / Week
Theory Paper	:	100 Marks
Term Work	:	50 Marks
Subject Total	:	150 Marks

1. Introductory survey : General survey, Material survey – fibres, Material survey – plastics, Material survey – natural and synthetic rubbers, Requirements from suppliers, Interior design
2. Fabric structures and production methods for Automobile textiles: Introduction, fibres and yarn types , Fabric structures – wovens Fabric structures – warp knitted Fabric structures – weft knitted Fabric structures – flat-bed knitting Fabric structures – non-wovens ,
3. Yarn and fabric processing: Introduction, dyeing and finishing, Printing, Coating and lamination,
4. Quality assurance and testing for Automotive textiles: Quality assurance, Test method details,
5. Product engineering – interior trim  
Introduction, Seats, Headliners, Door casings, Parcel shelves, other interior trim, complete modular interiors



6. Other textile applications

Introduction , Seat belts 228, Airbags, Carpets, Cabin air filters, Battery separators, Bonnet (hood) liners Wheel arch liners, Hood material for convertibles, Tyres, Hoses and belts – general considerations,

7. Automotive textiles and the environment

Introduction, The greenhouse effect and global warming, Environmental legislation, the effects of pollutants, Manufacturing concerns, Sustainable development,

8. Textiles in other forms of transportation

Introduction, Composite materials, Flame retardancy, Fabric coating, Textiles in other road vehicles, Railway applications, Marine applications, Textiles in aircraft.

**Term Work**

Assignments / Seminars / Mini Projects based on above topics.

**Reference Books:-**

1. Wellington Sears Handbook of Industrial Textiles by Sabit Adanur.
2. Hand book of Technical Textiles by A. R. Horrocks.
3. Textiles in automotive engineering by W. Fung.
4. Composite materials: Engineering & Science by F. L. Matthews & R. D. Rawlings.
5. Fire retardant materials by A. R. Horrocks & D. Price.
6. Textile advances in the automotive Industry by R. Shishoo.
7. Knitting Technology by Spencer.
8. Composite forming technologies by A. C. Long.
9. Textiles in automotive engineering by W. Fung.
10. Automotive textiles by Textile progress Vol. 29 by S. K. Mukhopadhyay.



## M. TEXT. (TECHNICAL TEXTILES) SEMESTER - II (Elective-II)

### 5. INTELLIGENT TEXTILES AND CLOTHING

Lectures	:	3 Hrs / Week
Assignment	:	1 Hrs / Week
Theory Paper	:	100 Marks
Term Work	:	50 Marks
Subject Total	:	150 Marks

#### **General introduction:**

Definition, classification, intelligent systems and general applications.

**Modeling of intelligent materials:** Background, underpinnings of interdisciplinary, scientific practices and research strategies for intelligent garments

**Phase change materials:** Heat balance and thermo-physiological comfort, Phase change technology, PCM in textiles, Future prospects of PCM in textiles and clothing

**Intelligent textiles with PCMs:** Basic information of phase change materials, Phase change properties of linear alkyl hydrocarbons, Textiles containing PCM, Measurement of thermo regulating properties of fabrics with micro PCMs

**Shape memory polymer:** Introduction to shape memory polymer, Shape memory alloys, Shape memory ceramics, Magnetic shape memory materials, Shape memory polymers and gels, Future prospects of shape memory materials

**Temperature sensitive shape memory polymers :** A concept of smart materials, Shape memory polymer and smart materials, Some examples of shape memory polymer for textile applications, Potential use of shape memory polymer in smart textile, General field of application, Challenges and opportunities

**Study of shape memory polymer films for breathable textiles:** Breathability and clothing comfort, Breathable fabrics, Water vapor permeability (WVP) through shape memory polyurethane

**Chromic and conductive materials:**Photo chromic materials, Thermochromic materials, Colour changing, Electro chromic materials

**Solar textiles:** production and distribution of electricity coming from solar radiation:

- Solar cells

- Textiles as substrates

- Technological specifications

- Challenges to be met

- Suitable textile constructions

- Conductive layers for PVs

### **Introduction to conductive materials**

- Electric conductivity

- Metal conductors

- Ionic conductors

- Inherently conducting polymers

- Application technologies for conducting fibre materials

### **Stability enhancement of polypyrrole coated textiles**

- Introduction

- Conductivity changes of polypyrrole films on textiles

Stabilisation of the Ppy

Experimental results of stability enhancement

### **Multipurpose textile based sensors**

Introduction

Conductive polymer textile sensors

Conductive polymer composites (CPCs) textile sensors

### **Textile micro system technology**

Textile micro system technology

Textiles are inherent microstructures

Goal of the application of compliant textile structures

First attempt: textile electronic circuit technology based on copper wires in a lattice structure with interconnections and interruptions

Galvanic modification of yarns

Light effects based on textiles with electrically conductive microstructure

Textile-based compliant mechanisms in micro-engineering and mechatronics

### **Applications:**

#### **Intelligent textiles for medical and monitoring applications**

Introduction

Importance of intelligent textiles for healthcare

Potential applications of intelligent textiles

From medical needs to technological solutions

### **Context aware textiles for wearable health assistants**

Introduction

Vision of wearable health assistant

Electronic textile technology

Context recognition technology

Wearable components

### **Intelligent garments in prehospital emergency care**

Introduction

Different cases and situations

Ambience

Vital functions

Monitoring of vital functions

Telemedicine

Negative effects of transportation on vital parameters

Patient chart

Data security

Day surgery

Protective covering

Optimal smart solution for prehospital emergency care

## **Intelligent textiles for children**

Introduction

State of the art

The intellitex suit

## **Wearable biofeedback systems**

Introduction

Is there a need for biofeedback technology?

Are there problems with current biofeedback devices?

Can we provide biofeedback for joint motion?

The development of a functioning wearable textile sensor

Functional electronics

Interconnections

The intelligent knee sleeve: A wearable biofeedback device in action

Why is the intelligent knee sleeve needed?

Other applications of wearable biofeedback technology

## **Applications for woven electrical fabrics**

Smart fabric technologies

Active and passive smart fabrics

Electrical smart fabrics

Products and applications

## **Term Work**



Assignments / Seminars / Mini Projects based on above topics.

### **Reference Books**

1. Smart fibres, fabrics and clothing edited by Xiaoming Tao, Wood head publishing Ltd., England.
2. Intelligent Textile and clothing edited by H. R. Mattila, Wood head Publishing, England.
3. Clothing bisensory Engineering edited by Y. L. and A. S. W Wang, Wood head publishing ltd. England.
4. Analytical electro chemistry in textiles P. Westbrook, G. Priniotakis and P.Kienkens, wood head publishing Ltd, England

**D.K.T.E.SOCIETY'S TEXTILE & ENGINEERING INSTITUTE, ICHALKARANJI.**

**Equivalence of subject at M.Text. to Revised M.Text. Course.**

**M.TEXT.- (TECHNICAL TEXTILES) SEMESTER-I**

<b>SR. NO.</b>	<b>COURSE</b>	<b>PRE-REVISED SUBJECTS</b>	<b>SEM-ESTER</b>	<b>REVISED SUBJECTS</b>	<b>SEMESTER</b>
1.	M.Text.(Tech. Textiles)	Manufacture of Fabrics for Technical Textiles	I	Manufacture of Fabrics for Technical Textiles	I
2.	M.Text.(Tech. Textiles)	Industrial Application of Textiles	I	Industrial Application of Textiles	I
3.	M.Text.(Tech. Textiles)	Advanced Computer Programming	I	Advanced Computer Programming	I
4.	M.Text.(Tech. Textiles)	Nanotechnology in Textiles	I	Nanotechnology in Textiles	I
5.	M.Text.(Tech. Textiles)	<b>ELECTIVE-I</b> 1) Textiles for Protection 2) Textiles for Sports Application	<b>I</b>	<b>ELECTIVE-I</b> 1) Textiles for Protection 2) Textiles for Sports Application	<b>I</b>
6	M.Text.(Tech. Textiles)	SEMINAR-I	I	SEMINAR-I	I

**M.TEXT.- (TECHNICAL TEXTILES) SEMESTER-II**

<b>SR. NO.</b>	<b>COURSE</b>	<b>PRE-REVISED SUBJECTS</b>	<b>SEM-ESTER</b>	<b>REVISED SUBJECTS</b>	<b>SEMESTER</b>
1.	M.Text.(Tech. Textiles)	Plasma Technology for Textiles	II	Plasma Technology for Textiles	II
2.	M.Text.(Tech. Textiles)	Medical Textiles	II	Medical Textiles	II
3.	M.Text.(Tech. Textiles)	Statistics & Design of Experiment	II	<b>Statistics for Textile Mill Management</b>	<b>II</b>
4.	M.Text.(Tech. Textiles)	Fibre Reinforced Composites	II	Fibre Reinforced Composites	II
5.	M.Text.(Tech. Textiles)	<b>Elective-II</b> 1)Textiles In Automobile Engineering 2) Intelligent Textiles And Clothing	II	<b>Elective-II</b> 1)Textiles In Automobile Engineering 2) Intelligent Textiles And Clothing	II
6.	M.Text.(Tech. Textiles)	SEMINAR-II	II	SEMINAR-II	II

**M.TEXT.- (TECHNICAL TEXTILES) SEMESTER-III**

<b>SR. NO.</b>	<b>COURSE</b>	<b>PRE-REVISED SUBJECTS</b>	<b>SEM-ESTER</b>	<b>REVISED SUBJECTS</b>	<b>SEMESTER</b>
1.	M.Text.(Tech. Textiles)	Seminar-III	III	Seminar-III	III
2.	M.Text.(Tech. Textiles)	Dissertation	III	Dissertation	III

**M.TEXT.- (TECHNICAL TEXTILES) SEMESTER-IV**

<b>SR. NO.</b>	<b>COURSE</b>	<b>PRE-REVISED SUBJECTS</b>	<b>SEM-ESTER</b>	<b>REVISED SUBJECTS</b>	<b>SEMESTER</b>
1.	M.Text.(Tech. Textiles)	Seminar-IV	IV	Seminar-IV	IV
2.	M.Text.(Tech. Textiles)	Dissertation	IV	Dissertation	IV