

VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE  
(VJTI)

MATUNGA, MUMBAI 400 019

(Autonomous Institute affiliated to University of Mumbai)



**Curriculum**

**(Scheme of Instruction & Evaluation and Course contents)**

(Revision 2014)

For

Second Year

of

Four Year Undergraduate Programmes Leading to  
Bachelor of Technology (B Tech) Degree in Textile Technology

**Implemented from the batch admitted in Academic Year 2014-15**

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Bachelor of Technology (B Tech) In Textile Technology

# **VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE**

## **Textile Manufactures Department**

### **VISION**

To develop competent professionals and leaders for the global textile community, through quality education, innovation and research.

### **MISSION**

- To provide comprehensive knowledge of textile technology through structured course delivery and active participation in innovative and collaborative research work.
- To foster stronger interface with industry, alumni and research organizations in India and abroad.
- To kindle a sense of social and environmental responsibility and inculcate the ability to perform well in team based projects in the professional sphere.

### **Bachelor of Technology in Textiles**

#### **Program Educational Objectives (PEOs)**

The undergraduate programme of textile technology is designed:

1. To impart in-depth knowledge in the field of textile products, processes and quality assurance aspects.
2. To impart leadership and problem solving skills to enable the graduates excel in challenging work environments in textile domain and assume positions of higher responsibility in their professional career.
3. To motivate the graduates towards continuous learning of new products and processes in the field of textile manufacturing.
4. To instil the spirit of professionalism, ethical conduct, effective communication and team work within the individual.

## Program Outcomes (POs)- As specified by NBA

On successful completion of the programme, graduates will be able to:

1. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems (**Engineering knowledge**).
2. Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences (**Problem analysis**).
3. Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations (**Design/development of solutions**).
4. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions (**Conduct investigations of complex problems**).
5. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations (**Modern tool usage**).
6. Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice (**The engineer and society**).
7. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development (**Environment and sustainability**).
8. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice (**Ethics**).
9. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings (**Individual and team work**).
10. Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions (**Communication**).
11. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments (**Project management and finance**).

12. Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change (**Life-long learning**).

### **Program Specific Outcomes (PSOs)**

On successful completion of the programme, graduates will be able to:

1. Apply knowledge of textile products and processes, statistical, analytical and computational skills to investigate technical problems in textile and allied industries.
2. Demonstrate knowledge in textiles and management principles effectively in the workplace and manage projects in multidisciplinary environments.
3. Understand the impact of the textile processes in societal and environmental contexts and demonstrate the knowledge and need for sustainable development.

<b>Programme Name</b>	<b>Bachelor of Technology in Textiles</b>	<b>Semester – III</b>
<b>Course Code</b>	<b>MA2005S</b>	
<b>Course Title</b>	<b>Mathematics For Textile Technology</b>	
<b>Course objective</b>	<b>To provide knowledge of mathematical tools useful in Textile Technology</b>	
<b>Course Outcomes</b>	<p>After completing this course students will be able to:</p> <ol style="list-style-type: none"> <li>1. Use matrix calculations in connection with the eigen values, eigen vectors, Cayley Hamilton Theorem, function of square matrix, quadratic form and find its rank, index, signature and class.</li> <li>2. Evaluate Laplace as well as Inverse Laplace Transform of function, solve ordinary differential equations and to linear time invariant system.</li> <li>3. Find approximate solution of a system of linear equations &amp; ordinary differential equations using numerical methods; also compare the approximate solution of ordinary differential equations with its exact solution.</li> <li>4. Develop basic knowledge of calculus involving limits, derivatives and integrations.</li> </ol>	
<b>Prerequisites</b>	Knowledge of basic high school level mathematics	

### **Course Contents**

<b>Module 1</b>	<p><b>Matrices:</b></p> <p>Eigen values Eigen vectors of square matrix. Cayley Hamilton's theorem and function of square matrix. Similarity Matrices, Modal Matrix. Function of Square a Matrix, Minimal Polynomial and Minimal Equation of a Matrix, Derogatory and Non-Derogatory Matrices. Quadratic forms : Linear Transformation, Linear Transformation of Quadratic forms , Congruence of a square Matrix , Reduction to Canonical form under Congruent and Orthogonal Transformation of Quadratic form , rank , index ,signature and class value of Quadratic form.</p>
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<b>Module 2</b>	<p><b>Laplace Transforms:</b></p> <p>Functions of bounded variation. Linear property of Laplace transforms. Laplace transforms of standard functions such as <math>1, t^n, e^{at}, \sin at, \cos at, \sinh at, \operatorname{erf}(t)</math>. Change of scale property, First shifting theorem, Second shifting theorem <math>L\{t^n f(t)\}, L\{f'(t)\}, L\left\{\frac{f(t)}{t}\right\}, L\left\{\int_0^t f(u)du\right\}, L\left\{\frac{d^n}{dt^n} f(t)\right\}</math> Inverse Laplace transform using linear property, theorems, partial fractions and convolution theorem. Unit step functions, Heaviside, Dirac delta functions, Periodic functions and their Laplace transforms. Application to solve ordinary differential equations with one dependent variable.</p>
<b>Module 3</b>	<p><b>Numerical Methods</b></p> <p>Solutions of systems of linear equations. Gauss elimination, Gauss Jordan, Crout's (LU) method. Gauss Seidal and Jacobi iteration. Differential equation, Taylor series method, Euler's Modified Formula, Runge-kutta Method.</p>
<b>Module 4</b>	<p><b>Basic skills in Calculus</b></p> <p>Concept of limit of a function, Limits of algebraic, trigonometric functions, Standard limits. Logarithmic Exponential Derivatives- Derivatives of standard function by first Principal, Rules of differentiation, derivatives of composite function, derivatives of implicit function and parametric function. Second order derivative and applications of derivatives. Integration-Integration of standard function, Method of integration, Definition of definite integral, Properties of definite integrals with simple problems, Application of definite integrals. Solving of quadratic equation, synthetic division, Indices rule, Finding equation of line, plane and circle. Basic curve fitting equations (Ellipse, Parabola, Hyperbola), 2D, 3D curve.</p>

### Text Books

1. Advanced Engineering Mathematics, H K Dass, S Chand & Co. Ltd, 3<sup>rd</sup> Edition, 2006
2. Higher Engineering Mathematics, Dr B S Grewal, Khanna Publications, 39<sup>th</sup> Edition, 2005
3. A Text Book of Engineering mathematics, N.P. Bali & Dr. Manish Goyal, Eight Edition, Laxmi Publication.
4. Mathematics for Polytechnic Students-II By S.P. Deshpande

<b>Programme Name</b>	<b>Bachelor of Technology in Textiles</b>	<b>Semester III</b>
<b>Course Code</b>	<b>ME2001S</b>	
<b>Course Title</b>	<b>Mechanics of Textile Machinery</b>	
<b>Course objective</b>	<b>To appraise students about the design aspect of various textile machinery</b>	
<b>Course Outcomes</b>	<p>After completing this course, students will be able to</p> <ol style="list-style-type: none"> <li>1. Identify the design aspects, construction and mechanics of textile machinery.</li> <li>2. Analyse and solve basic machine level technical problems.</li> <li>3. Co-relate the role and effect of machine elements in the processing of materials.</li> <li>4. Develop proper understanding of machine design, drives and various machine components.</li> <li>5. Decide machine parameters and settings for efficient processing of different materials</li> </ol>	
<b>Prerequisite</b>	Knowledge of engineering physics, mathematics and process flow of spinning and weaving.	

### Course Content

<b>Module</b>	<b>Description</b>
<b>Module 1</b>	<p><b>Machine Design : Elements &amp; Drives</b></p> <ul style="list-style-type: none"> <li>• Types of motors with a special emphasis on servo motors.</li> <li>• Nature &amp; types of drives</li> <li>• Factors to be considered in selecting the natures of drives especially gears, belts and chains for driving a specific machine element</li> <li>• Construction of flat-belt, v-belt, round belt, toothed belt, chain drives, tapes, variable speed drives and various types of gears, analysis of forces, torque and horse power, transmission characteristics, geometric relations, applications and comparison.</li> <li>• Gear trains - classification &amp; calculations</li> <li>• Brief study of clutches, brakes, pulleys, bearings and their applications in textile machinery.</li> <li>• Cam study - design of tappets and cams, classification and applications in textile machinery.</li> <li>• <b>Balancing of machines</b> - Imbalance, causes of imbalance, production and field balancing, measures of imbalance, dynamic and static balancing, practical aspects of balancing</li> </ul>



<b>Module 2</b>	<b>Friction in Textile machines</b> <ul style="list-style-type: none"> <li>• Machine elements responsible for friction and their effect</li> <li>• Derivation and calculation of frictional force – (exercise- Derivation showing frictional force is directly proportional to the distance of weight from the fulcrum in let-off motions)</li> </ul>
<b>Module 3</b>	<b>Mechanics of Spinning Machinery</b> <ul style="list-style-type: none"> <li>• The nomenclature used in spur gears and relationships between design parameters of spur gears, requirement of constant speed ratio (conjugate action), generation of involute teeth on spur gear, and effect of interference in gears on periodic drafting waves on fibre strands using roller drafting (drawing, roving and ring spinning machines)</li> <li>• Draft factor</li> <li>• Rack and pinion screw traversing mechanics</li> <li>• Design of cone drums-piano feed regulation, speed frame builder mechanics, balloon and traveller dynamics</li> <li>• Top arm loading in ring frames-principle of moment</li> <li>• Machine clothing and its effects of processing of materials</li> <li>• Ring and traveller- material and design study</li> </ul>
<b>Module 4</b>	<b>Mechanics of Weaving Machinery</b> <ul style="list-style-type: none"> <li>• Sley movement and mechanism</li> <li>• Kinetics and dynamics of shedding, picking, beat up, take up and let off mechanism</li> <li>• Design of winding drums and yarn packages</li> </ul>
<b>Module 5</b>	<b>Textile engineering Utilities and Services-</b> Air conditioning and Humidification systems, steam generation systems
<b>Module 6</b>	<b>Machine Maintenance-</b> Importance, common methods and practices in Textile Industry, Effect of Machine performance.

#### **Text Books:**

1. V. B. Bhandari, Design of machine Elements, Tata McGraw-Hill, New Delhi, 1994.
2. K. Slater, Textile Mechanics- Volume-1, Textile Institute Publications, 1977.
3. A. D. Deutschman, W. J. Michels and C. H. Wilson, Machine Design: Theory and Practice, Macmillan Publishing Co., Inc., New York, 1975.

#### **Recommended Readings:**

1. B Purushothama, Humidification and Ventilation Management in Textile Industry, Woodhead Publishing India, 2010
2. R. S. Rengasamy, Mechanics of Spinning Machines, NCUTE, New Delhi, 2002.
3. W. Klein, Manual of Textile Technology: A Practical Guide to Combing and Drawing Vol. 3., The Textile Institute, Manchester, 1987

<b>Programme Name</b>	<b>Bachelor of Technology in Textiles</b>	<b>Semester</b>	<b>III</b>
<b>Course Code</b>	<b>TT2001S</b>		
<b>Course Title</b>	<b>Textile Fibres</b>		
<b>Course objective</b>	<b>To appraise students about the classification and basic properties of textile fibres</b>		
<b>Course Outcomes</b>	After completing this course, students will be able to 1. Classify textile fibres and state structural properties of textile fibres. 2. Demonstrate the utility and technical applications of various textile fibres. 3. Relate selection of fibres as per end use. 4. Justify the applications of hi- tech fibres in textiles.		
<b>Prerequisite</b>	Applied Chemistry, Applied Physics.		

### Course Content

<b>Module</b>	<b>Description</b>
<b>Module 1</b>	Definition of terms – Fibre, textile fibre. Classification of textile fibre according to their origin and constitution, structural requirement of fibre forming polymer, concept of molecular weight, Degree of polymerization, orientation, crystallinity.
<b>Module 2</b>	Physical, Chemical and biological properties of Natural fibres- 1) cotton 2)wool 3) silk 4)Jute 4)Flax 5)Banana Fiber 6) Bamboo fiber 7)coir fiber. Various applications of above fibers.
<b>Module 3</b>	Introduction to methods of manmade fibre formation. Physical, Chemical and Biological properties of Manmade Fibres- 1)Polyester 2)Viscose rayon3)Acetate Rayon 4)Polynosic and High wet modulus rayon5)Nylon6)Acrylic & modarylic 7)polyoleifin fibres 8)Elastomeric fibres . Applications of above all fibres.
<b>Module 4</b>	Physical, Chemical and biological properties of high - tech fibres-1)Aromatic polyamides 2)super absorbent polymers 3)High density polyolefin 4)Polyvinyl fibres 5)Lyocell 6)Carbon fibre 6)PEEK fibres 6)PPS fibre 7)PBO fibre 8) Glass fibre and their applications

### Text Books :

1. E.P.G.Gohl, L.D.Vilinsky, Textile Science, an Explanation of Fibre Properties, Second Edition, CBS Publishers & Distributors Pvt. Ltd. ISBN 81-239-1038-X.
2. H.V.S. Murthy, Introduction to Textile Fibres (Revised edition- 2015) , Wood Head Publication, ISBN 9789385059094
3. Tatsuya Hongu, Glyn O. Phillips, Machiko Takigam, New Millennium Fibers, Woodhead Publishing Ltd., CRC Press LLC, 2005

<b>Programme Name</b>	<b>Bachelor of Technology in Textiles</b>	<b>Semester</b>	<b>III</b>
<b>Course Code</b>	<b>TT2002T</b>		
<b>Course Title</b>	<b>Spinning Preparatory</b>		
<b>Course objective</b>	<b>To provide knowledge on processes involved in preparation of raw materials for short staple spinning</b>		
<b>Course Outcomes</b>	<p>After completing this course, students will be able to</p> <ol style="list-style-type: none"> <li>1. Describe the techniques of cotton cultivation with suitable soil and environmental conditions.</li> <li>2. Illustrate opening and cleaning of raw cotton at various stages in blowroom</li> <li>3. Explain the concept of individualization of fibres, short fibre removal, neps removal and sliver formation as well as various settings and their effect on sliver quality at carding.</li> <li>4. Describe the draw frame process, different settings and the effect of various parameters on sliver evenness.</li> <li>5. Analyse the effect of various parameters on sliver quality.</li> </ol>		
<b>Prerequisite</b>	Student should have background of engineering Physics, Chemistry, Mathematics and Mechanics.		

### Course Content

<b>Modules</b>	<b>Description</b>
<b>Module 1</b>	<p>Cotton cultivation, Climatic and soil conditions, Methods of cultivation and picking of cotton. Hand picking and mechanical picking methods, their merits &amp; de-merits. Chief varieties of cotton.</p> <p>Market scenario of cotton growing in India, grading of cotton</p> <p><b>Ginning and baling</b>, Objects of ginning, Different methods and their limitations. Saw Gin &amp; roller gin method. Baling Process, Standard bale sizes and weights of bales from important cotton growing countries. Different impurities or trash packed with cottons in bales.</p>
<b>Module 2</b>	<p><b>Blowroom, Mixing:</b> opening, cleaning in blow room, Objects and methods of modern mixing – Concept of Blenders, Bale Pluckers etc. Modern openers and cleaners. Initial preparatory machinery in Blow room. Conventional and Automatic bale openers. Sequence of machinery and opening &amp; cleaning points for various cottons in blowroom according to trash content. Cleaning efficiency of blowroom. Synthetic openers and Tuft blending technologies, lap feed vs chute feed, chances of irregularity in chute feeding &amp; remedial measures. Conventional scutcher, cage condenser, beaters and lap forming process.</p>

<b>Module 3</b>	Transportation of material, dust removal, metal extractors and waste disposal in blowroom, seed traps, de-dusting units. Fibre contamination removal techniques in blow room. Use of CVT type of beaters. Modern developments in blowroom machinery. Aerodynamic Cleaning: Aerodynamic separation of lint & trash, methods used to avoid their recombination.
<b>Module 4</b>	<b>Carding</b> , Principle of carding, design and working of carding machine. Drive of carding machine - speeds, drafts and production calculations. Lap feeding and chute feeding, flock feed regulating mechanism. Action between feed rolls and licker-in. Licker-in zone details and various modifications. Integrated draw frame on card (IDF technology). Role of front and back plate, various types of flat-tops and their use in carding. Web doffing & coiling action, Transfer of fibres from cylinder-doffer region, factors affecting on fibre transfer and transfer-efficiency.
<b>Module 5</b>	Types of Card wires: On cylinder, doffer and licker-in, their maintenance, grinding and other operations like mounting of wires. Card Settings: Influence on the quality and waste extracted. Features of High production card, various developments in pre carding, main carding, post carding zones. Web transferring from doffer. Details of modern web stripping devices. Types of coiling, Coiling mechanism, off-setting and web crushing. Autolevellers at Card – Basic principles and concept. Types of autolevellers , working of autolevellers and Setting of autolevellers
<b>Module 6</b>	<b>Drawing</b> , Construction and working of a draw frame. Modern drafting: Various types of roller arrangement, weighting, new cots, and other accessories. Irregularity due to drafting wave. Introduction to Shirley drafting. Principle of roller drafting, concept of ideal drafting, draft and drafting force. Doubling, law of doubling, law of addition of irregularity, causes and control of irregularity of a drafted textile strand. Roller lapping- cause and remedies

#### **Text books :**

1. K.R. Salhotra, Spinning of Manmade & Blends on Cotton System, Textile Association (India), 2004.
2. Khare A.R, Elements of Raw cottons & Blow room, Sai book publication, 1999.
3. Khare A.R, Elements of Carding & Drawing, Sai book publication, 1999.
4. W. Klein, A practical guide to opening and carding, The Textile Institute Publication, 1987.

#### **Recommended Readings :**

1. W. Klein, The Technology of Short staple spinning, The Textile Institute Publication, 1998.
2. Merrill G.R, Cotton Drawing & Roving and Cotton Combing 364-Vernum Ave. Lowell, Mass. 1992
3. W. Klein, A Manual of Textile Technology: A practical guide to Combing and drawing, Vol 3, The Textile Institute Publication, 1987.
4. Szaloki Z.S, Opening, Cleaning & Picking, The Institute of Textile Technology, Charlottesville, Virginia (U.S.A.), 1976.

<b>Programme Name</b>	<b>Bachelor of Technology in Textiles</b>	<b>Semester</b>	<b>III</b>
<b>Course Code</b>	<b>TT2002P</b>		
<b>Course Title</b>	<b>Spinning Preparatory Lab</b>		
<b>Course objective</b>	<b>To provide practical knowledge on the mechanical processes involved in preparation of raw materials for short staple spinning.</b>		
<b>Course Outcomes</b>	<p>After completing this course, students will be able to:</p> <ol style="list-style-type: none"> <li>1. Get glimpses of ginning, opening, cleaning and carding action through demonstration.</li> <li>2. Get understanding about web stripping mechanism, coiling mechanism in carding and calculate transfer efficiency.</li> <li>3. Get hands-on experience of the construction and settings of draw frame machine components.</li> </ol>		
<b>Prerequisite</b>	Students should be convergent with basics operations of spinning industry.		

### Course Content

<b>Modules</b>	<b>Description</b>
<b>Module 1</b>	Study of Roller & Saw Gin, Different drives & Types of cotton
<b>Module 2</b>	Study of working mechanism of a bale breaker / bale opener. Calculate the rotational speed of evener roller and linear speed of the inclined lattice. Also calculate the number of rows of evener spikes passing per linear meter movement of spiked lattice.
<b>Module 3</b>	Study of Step Cleaner/Axi Flow - Construction, flow of material gearing, settings, speed and production calculations.
<b>Module 4</b>	Study the working mechanism of a bladed beater. Determine the intensity of beating (beats/cm) of a bladed beater. Also calculate the beater speed and feed rate.
<b>Module 5</b>	Determine the position of the belt on the cone drums due to step change in thickness of the material passing in between the pedals and pedal rollers.
<b>Module 6</b>	Study of Single scutcher and chute feed system - Construction, flow of material gearing, settings, speed and production calculations. Different cages in blow room
<b>Module 7</b>	Study of general passage of cotton through Carding machine, importance of various parts involved and their importance in the process. Calculations of speeds, drafts and production.
<b>Module 8</b>	Study of main carding action, construction of flats, and their bearing surface, importance of cylinder-flat setting, actual setting procedure, influence of this setting on the quality of the material processed, important Stripping & Grinding
<b>Module 9</b>	Transfer of fibres from cylinder, cylinder-doffer region, setting procedure, factors influencing the transfer of fibres on to doffer, Condensation of card web and its subsequent coiling in the form of web. Influence of tension drafts involved between doffer and final coiling. Card waste and its effect on actual and calculated draft, methods for controlling waste at card.
<b>Module 10</b>	Passage of material through draw fame, gearing diagram, settings and production calculations

**Recommended Readings:**

1. Spinning Blowroom and Card, NCUTE Publication, 1998.
2. W. Klein, The Technology of Short staple spinning, The Textile Institute Publication, 1998.
3. W. Klein, Manual of Textile Technology: A Practical Guide to Combing and Drawing Vol. 3, The Textile Institute, Manchester, 1987.
4. A practical guide to opening and carding, W. Klein, The Textile Institute Publication, 1987.

<b>Programme Name</b>	<b>Bachelor of Technology in Textiles</b>	<b>Semester</b>	<b>III</b>
<b>Course Title</b>	<b>Introduction to Fabric Manufacturing</b>		
<b>Course Code</b>	<b>TT2003T</b>		
<b>Course objective</b>	<b>To introduce the processes involved in the preparation for weaving</b>		
<b>Course Outcomes</b>	After completing this course, students will be able to: <ol style="list-style-type: none"> <li>1. Describe the fundamental techniques of winding, warping sizing and weaving.</li> <li>2. Analyze the problems encountered during the processing of yarn on winding, warping and sizing machines and their remedial measures.</li> <li>3. Demonstrate the control mechanisms used on these machines.</li> </ol>		
<b>Prerequisite</b>	Student should have background of engineering Physics, Chemistry, Mathematics and Mechanics		

### Course Content

<b>Modules</b>	<b>Description</b>
<b>Module 1</b>	Introduction to the methods of manufacturing different types of fabrics. Outline of weaving and preparatory processes.
<b>Module 2</b>	<p><b>Winding:</b> Objectives of winding, different types of wound packages, types of winding machines, conventional and modern automatic winding machines, yarn guides, tensioning devices, yarn clearers, knots, splicers, anti-patterning devices. Yarn tension in winding, end breaks, classimat yarn faults, package faults.</p> <p><b>Pirn winding:</b> Objectives, types of pirns, build of pirns, systems of weft preparation, different types of pirn winding machines, pirn winding for manmade filament yarns and Unifil loom winder.</p>
<b>Module 3</b>	<b>Warping:</b> Objects, classification, Beam warping, Sectional warping, creels, headstock, stop motions, modern developments, and comparison of various types of warping machine
<b>Module 4</b>	<p><b>Sizing:</b> Objects of sizing machine, passage of yarn through two cylinder and multi cylinder sizing machine. Sizing ingredients and their functions for cotton and synthetic yarns. Single end sizing.</p> <p>Common starches &amp; adhesives used in sizing for cotton and synthetic yarn. Study of modern sizing machine with reference to creel, sow-box, cylinder and beam drives. Mechanics of drying, drying methods like hot air and cylinder drying, its advantages and disadvantages, modern system of drying. Different control systems used in sizing such as - level controller, stretch controller, temperature controller and moisture controller. Calculations regarding add on %, pick up %, steam requirement, production and sizing cost calculation. Defects in sizing, Leasing devices.</p>

<b>Module 5</b>	<p><b>Drawing-in and knotting, Weaving Plain Looms:</b> Primary, secondary and auxiliary motions of loom, Shedding, objectives and introduction to different shedding devices, tappet shedding mechanism, negative and positive shedding tappets.</p> <p>Designing of tappets, heald reversing motions. Picking &amp; checking mechanisms. Over-pick &amp; under-pick mechanisms, picking cams. Beat-up mechanism. Eccentricity of sley.</p> <p>Take-up, various types and their calculations and negative let-off mechanism. Side weft fork motion, warp protector mechanism, loose reed, fast reed, brake motion, temple devices, oscillating back-rest. Anti-crack motion. Timing and setting of plain non-automatic loom</p>
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### **Text Books:**

1. P. K. Banerjee, Principles of fabric formation CRC Press, 2014
2. A. Ormerod, Modern preparation and weaving machinery, Woodhead Publishing Ltd, 2010 .
3. Talukdar and Ajgaonkar ,Weaving: Machines, Mechanisms, Management, Mahajan Publishers Ltd, 1996.

### **Recommended Readings:**

1. Talukdar M.K. & Ajgaonkar D.B and Wadekar, Sizing- Materials , Methods and Machines , Textile Trade Press ,Bombay,1982
2. Winding, Warping & Sizing – BTRA Silver Jubilee monograph series.
3. A. T. C. Robinson and R. Marks, Woven cloth construction, Manchester : Textile Institute , London : Butterworths, 1967
4. Sengupta R, Yarn Preparation , Popular Prakashan, 1963.



<b>Programme Name</b>	<b>Bachelor of Technology in Textiles</b>	<b>Semester</b>	<b>III</b>
<b>Course Code</b>	<b>TT2003P</b>		
<b>Course Title</b>	<b>Introduction to Fabric Manufacturing - Lab</b>		
<b>Course objective</b>	<b>To provide practical knowledge on the mechanical processes involved in preparation of yarns for weaving.</b>		
<b>Course Outcomes</b>	After completing this course, students will be able to <ol style="list-style-type: none"> <li>1. Describe the passage of material through winding, warping, Sizing and weaving machines.</li> <li>2. Study various machine settings and their effect on machine performance.</li> <li>3. Describe the primary and secondary mechanisms involved in making of fabric on weaving machine.</li> </ol>		
<b>Prerequisite</b>	Students should be aware of basics of weaving preparatory processes and weaving technology.		

### Course Contents

<b>Modules</b>	<b>Description</b>
<b>Module 1</b>	Study of passage of warp yarn through a plain power loom and introduction to primary and secondary motions of loom.
<b>Module 2</b>	Study of tappet shedding motion and related settings.
<b>Module 3</b>	Study and setting of beating motion and shuttle box.
<b>Module 4</b>	Study of take up motions (Negative, positive, intermittent and continuous, 5 wheel, 7 wheel) and related calculations & Study of negative let off motion on a loom setting of warp tension.
<b>Module 5</b>	Study and setting of loose reed and fast reed motions, setting of duck bill heater, organ handle, bow-spring, knock off dagger
<b>Module 6</b>	Study of weft fork motions, its settings and practice for running the loom (with warp & weft mending).
<b>Module 7</b>	Study of cheese and cone winding machines. Passage of yarn. Calculations of winding machines. Productions of machines. Study of pirn winding machines.
<b>Module 8</b>	Study of sectional warping machines and related calculations.
<b>Module 9</b>	Study of warp stop motion on various looms and setting.
<b>Module 10</b>	Study of sizing – headstock, gearing, beam drive, leasing, tape marking, size box, creel leasing.

### Recommended Readings:

1. Talukdar M.K. & Ajgaonkar D.B and Wadekar, Sizing- Materials , Methods and Machines , Textile Trade Press ,Bombay,1982
2. Winding, Warping & Sizing – BTRA Silver Jubilee monograph series.
3. A. T. C. Robinson and R. Marks, Woven cloth construction, Manchester: Textile Institute , London : Butterworths, 1967

<b>Programme Name</b>	<b>Bachelor of Technology in Textiles</b>	<b>Semester</b>	<b>III</b>
<b>Course Code</b>	<b>TT2004T</b>		
<b>Course Title</b>	<b>Textile Pretreatments and Dyeing</b>		
<b>Course objective</b>	<b>To appraise students about the principles of Textile Pretreatments and Dyeing</b>		
<b>Course Outcomes</b>	After completing this course, students will be able to: <ol style="list-style-type: none"> <li>1. Explain the fundamental techniques of preparing fabrics for dyeing.</li> <li>2. Describe the colour theory and concepts behind colour measurement systems.</li> <li>3. Demonstrate the methods dyeing various fibres.</li> <li>4. Analyze changes in properties of fibres after chemical treatment.</li> <li>5. Describe the underlying principles of eco-friendly processing of textile materials.</li> </ol>		
<b>Prerequisite</b>	Students should have knowledge of Applied Chemistry – I and Applied Chemistry – II		

### Course content

<b>Modules</b>	<b>Description</b>
<b>Module 1</b>	<b>Mechanical Fabric Preparation &amp; Desizing:</b> Grey inspection, Shearing, Cropping, Singing, Chemistry and technology of different desizing viz. Enzymatic, acid and oxidative
<b>Module 2</b>	<b>Scouring and bleaching:</b> Chemistry and technology of scouring cotton cloth in both batch and continuous process, Chemistry and technology of hypochlorite, peroxide and chlorite bleaching, Preparation processes for synthetic and blended fabric in brief, Bleaching performances evaluation and norms for bleached cloth.
<b>Module 3</b>	<b>Mercerisation:</b> Mercerisation, its chemistry and technology, Physical and chemical effect of mercerisation, Evaluations of mercerisation performances
<b>Module 4</b>	<b>Colour :</b> Concept of light and colour, Primary, secondary and tertiary colour. Additive & subtractive colour mixing, auto dispersive systems, Munsell and CIE lab colour measurement systems, Principles of spectrophotometer for colour measurement, Chemical constitution responsible for colour
<b>Module 5</b>	<p><b>Dyeing : Dyeing of Natural and other important fibres:</b> Elements of dyeing and classification of dyes based on mode of application</p> <p>Basics in dyes chemistry .Concept of Dye-Fibre interaction, Exhaustion of dyes, Expression, Percentage shade and Affinity. Mechanism of dyeing.</p> <p>Principles of dyeing cotton with various classes of dyes such as direct, reactive, vat, sulphur, solubilized vat and azoic, Dyeing of protein fibers( Wool and Silk) with various classes of dyes. Principles of dyeing man-made fibers such as rayon's, polyesters, polyamines &amp; mod-acrylics and their common blends</p> <p>Dyeing machinery such as package dyeing, jigger, padding mangle and jet dyeing machine.</p> <p>Working principle and various dyeing cycle used for coloration of natural and synthetic fibre fabric. Evaluation of colour fastness to various agencies such as light, wash and rubbing.</p>

**Text Books :**

1. A.K. Roy Chaudhary, Textile Preparation and dyeing, Science publisher, New Hampshire, 2006
2. R. S. Prayag, Bleaching, Mercerising and Dyeing of Cotton Materials 2000.
3. E.R. Trotman, Dyeing of Textile Fibres & Chemical Technology, B.I. Pub. New Delhi 1994.
4. Textile Scouring & Bleaching – Trotman E.R., B.I. Pub., 1993, New Delhi

**Recommended Readings:**

1. R.S. Prayag, Bleaching, Mercerising and Dyeing of Cotton Materials, 2000.
2. Dr. V.A. Shenai, Technology of Bleaching & Mercerising, Sevak Publication Mumbai, 1990
3. Dr. V.A. Shenai, Technology of Textile Processing, Sevak Pub. Mumbai, 1990.
4. R. R. Chakravarty & S.S. Trivedi, Technology of Bleaching & Dyeing of Textile Fibres Vol Part I & II, Mahajan Brothers, Ahmedabad 1979.

<b>Programme Name</b>	<b>Bachelor of Technology in Textiles</b>	<b>Semester</b>	<b>III</b>
<b>Course Code</b>	<b>TT2004P</b>		
<b>Course Title</b>	<b>Textile Pretreatments and dyeing Lab</b>		
<b>Course objective</b>	<b>To teach students actual methods followed in pretreatments and dyeing of textile substrates.</b>		
<b>Course Outcomes</b>	After completing this course, students will : 1. Practically carry out desizing, scouring, bleaching, mercerization of textile materials by different methods. 2. Get hands-on experience on affinity of various types of dyes and their application on the natural as well on the synthetic fibres		
<b>Prerequisite</b>	Student must be aware of Applied chemistry I and Applied chemistry II		

### Course Contents

<b>Modules</b>	<b>Description</b>
<b>Module 1</b>	Determination of amount of size in Textile Fabric/Yarn through enzymatic, Acid & chlorite desizing
<b>Module 2</b>	Cotton scouring & scouring loss determination.
<b>Module 3</b>	Estimation of available Chlorine in hypochlorite bleaching liquor
<b>Module 4</b>	Bleaching of cotton yarn/cloth with sodium hypochlorite.
<b>Module 5</b>	Bleaching of cotton yarn/cloth with hydrogen peroxides.
<b>Module 6</b>	Dyeing of cotton fabric with Direct Dyes.
<b>Module 7</b>	Dyeing of cotton fabric with cold brand reactive Dyes.
<b>Module 8</b>	Dyeing of cotton fabric with hot brand reactive Dyes.
<b>Module 9</b>	Dyeing of cotton fabric with Vat Dyes.
<b>Module 10</b>	Dyeing of cotton fabric with Azoic Dyes.
<b>Module 11</b>	Dyeing of cotton fabric with Solubilised Vat Colours.
<b>Module 12</b>	Dyeing of cotton fabric with Sulphur Colours.
<b>Module 13</b>	Dyeing of Wool with Acid Dyes.
<b>Module 14</b>	Dyeing of Polyester with Disperse Dyes( Carrier method)
<b>Module 15</b>	Dyeing of Polyester with Disperse Dyes( HTHP method)

### Recommended Readings:

1. R.S.Prayag, Bleaching, Mercerising and Dyeing of Cotton Materials, 2000.
2. Dr. V.A. Shenai, Technology of Bleaching & Mercerising, Sevak Publication Mumbai, 1990
3. Dr. V.A. Shenai, Technology of Textile Processing, Sevak Pub. Mumbai, 1990.
4. R. R. Chakravarty & S.S. Trivedi, Technology of Bleaching & Dyeing of Textile Fibres Vol Part I & II, Mahajan Brothers, Ahmedabad, 1979.

<b>Programme Name</b> :	<b>Bachelor of Technology in Textiles</b>	<b>Semester</b>	<b>III</b>
<b>Course Code</b> :	<b>TT2005A</b>		
<b>Course Title</b> :	<b>Business Ethics and Communication</b>		
<b>Course objective:</b>	<b>To present the importance of ethical practices and effective communication in professional life.</b>		
<b>Course outcome</b> :	After completing this course, students will be able to: <ul style="list-style-type: none"> <li>• Demonstrate ethical code of conduct in workplace and in business.</li> <li>• Co-relate corporate social responsibility with Business Ethics.</li> <li>• Interpret consumer rights in a business environment.</li> <li>• Apply the principles and practices of business communication in a professional environment.</li> </ul>		
<b>Prerequisite</b> :	<b>Knowledge of English and basic communication skills</b>		

### Course Content

<b>Modules</b>	<b>Description</b>
<b>Module 1</b>	Introduction to Business Ethics- Definition, Role in various types of business structures, Define responsibilities and obligations, Structure of business ethics, Ethics in the Workplace- Small Business Ethics, Codes of Conduct, Code of Ethics.  Corporate Responsibility- Definition, Case Study.  Corporate Compliance - Definition, Responsibility, Laws and Regulations
<b>Module 2</b>	Social Responsibility- Business accountability, Ethical Values Environment. Ethics' Positive Impact on Business- Employee rights, Productivity ,Legality Issues.  International Business Ethics- Importance of International business ethics, Global Competition, Corporate Integrity.
<b>Module 3</b>	Consumer Rights- Expectations vs. Reality, Bridge between Business and Society.  Business Ethics and the Financial World- Various examples of Insider

	<p>Trading, Junk Bonds and leveraged buyouts.</p> <p>Final Thoughts on Business Ethics- Where would we be without it, Conclusion</p>
<b>Module 4</b>	<p><b>Business Communications</b></p> <p><i>Introduction to Business Communication</i></p> <ul style="list-style-type: none"> <li>-Means of communication- oral, written ,visual ,audio visual</li> <li>-Principles and essentials of business communication</li> <li>-Process of communication</li> <li>-Barriers to communication</li> </ul> <p><i>Essentials of Good English</i></p> <ul style="list-style-type: none"> <li>-Grammar and Usage</li> </ul> <p>Presentation skills</p> <p><i>Business Correspondence</i></p> <ul style="list-style-type: none"> <li>-Preparation of resume, cover letter</li> <li>-Official letter writing</li> </ul> <p><i>E-correspondence</i></p>

<b>Programme Name</b>	<b>Bachelor of Technology in Textiles</b>	<b>Semester – IV</b>
<b>Course Code</b>	<b>MA2015S</b>	
<b>Course Title</b>	<b>Statistics For Textile Technology</b>	
<b>Course objective</b>	<b>To introduce the statistical tools useful for solving engineering problems.</b>	
<b>Course Outcomes</b>	After completing this course, students will be able to apply: <ol style="list-style-type: none"> <li>1. Concepts of statistics, probability theory, probability distribution to engineering problems.</li> <li>2. Sampling theory to engineering problems.</li> <li>3. The concepts of correlation as well as regression analysis to engineering problems.</li> <li>4. Knowledge of SQC, control chart and ANOVA one-way and two-way to the engineering problems.</li> </ol>	
<b>Prerequisites</b>	Knowledge of Mathematics	

### Course Content

<b>Modules</b>	<b>Description</b>
<b>1</b>	<b>Statistics &amp; Probability Theory</b> Review of measures of central tendency, measures of variation and probability, Discrete and continuous Random variable, Binomial- Poisson and Normal distribution.
<b>2</b>	<b>Sampling Theory</b> Random sampling, sampling distribution, standard error, Central limit theorem, Estimation of parameters, point estimation, interval Estimation, confidence interval, Testing of Hypothesis, large sample and small sample, tests ‘t’ test and ‘F’ test, Chi-square test.
<b>3</b>	<b>Correlation &amp; Regression Analysis</b> Correlation and regression., Coefficient of correlation and Rank correlation, Regression analysis, curve fitting, method of least square.
<b>4</b>	<b>SQC &amp; ANOVA</b> Statistical quality control and control charts, Analysis of variance (One way & two way).

### Text Books

1. Fundamentals of Mathematical Statistics, S.C. Gupta & V.K.Kapoor , S Chand & Sons Co. Ltd.
2. Engineering Statistics, T Veerarajan, Tata McGraw-Hill Publishing Company 2<sup>nd</sup> Edition.
3. Advance Engineering Mathematics , H K Dass, S Chand & Sons Co.Ltd, 3<sup>rd</sup> Edition, 2006.

### Recommended Reading

1. A Text Book of Engineering mathematics, N.P. Bali & Dr. Manish Goyal, Eight Edition, Laxmi Publication.
2. Applied mathematics for Semester-IV (Civil) by G V Kumbhojkar, C., n Jamnadas & Co. Ltd.



<b>Programme Name</b>	<b>Bachelor of Technology in Textiles</b>	<b>Semester IV</b>
<b>Course Code</b>	<b>TT2006S</b>	
<b>Course Title</b>	<b>Textile Printing and Finishing</b>	
<b>Course objective</b>	<b>To teach the principles and methods of printing and chemical finishing of textile products</b>	
<b>Course Outcomes</b>	After completing this course, students will be able to: 1. Describe the under-lying principles of textile printing and finishing. 2. Explain in detail the techniques of printing on textile materials. 3. Identify various functional finishes used for enhancement of aesthetic properties of textile materials.	
<b>Prerequisite</b>	Students must have knowledge of textile pretreatments and dyeing.	

### Course content

<b>Modules</b>	<b>Description</b>
<b>Module 1</b>	<b>Printing:</b> Study of printing paste ingredients and their role in printing of various textiles materials. Styles of printing and method of printing. Direct, Discharge and Resist style printing.
<b>Module 2</b>	Principles of working of flat bed and rotary screen printing machines, roller printing, Transfer printing, mechanism, merits and demerits. Colour fixation equipment: Steamers, curing chambers, loop ager, thermo fixation units used in various processes.
<b>Module 3</b>	<b>Digital printing:</b> Concept of inkjet & digital printing, various ink formulations, machineries involved. Fixation and fastness aspect.
<b>Module 4</b>	<b>Finishing:</b> Objects of process and study of various finishing agents. Classification of finishing process. Conventional finishing sequences used for cotton fabrics including starching, calendaring, sanforising, heat setting etc. Functional finishes for various fibre/fabrics including : softening finish, wrinkle free finishes, water repellency, flame retardency, anti-static ,antipilling, soil release, anti-microbial finish etc
<b>Module 5</b>	Methods for evaluation of efficiency of various functional finishes
<b>Module 6</b>	<b>Eco-friendly and Energy concepts in textile wet-processing.</b> Printing and finishing of various fibre
<b>Module 7</b>	<b>Tutorials:</b> Demonstrations of various advanced concepts of printing and finishing by using modern teaching tools

### Text Books:

1. WD Schindler and PJ Hauser, Chemical Finishing of Textiles, CRC Press, 2004.
2. R.S.Prayag, Textile Finishing, 1994.
3. Dr. V.A. Shenai, Technology of Printing, Sevak Publications, Mumbai, 1990

### Recommended Readings:

1. Derek Heywood, Textile Finishing, Society of Dyers and Colourists. 2003.
2. Technology of Finishing – Dr. V.A. Shenai, Sevak Pub. ,1999 , Mumbai
3. Textile Printing – Edited by L.W.C. Miles, SDC Pub., U.K., 1981
4. An Introduction to Textile Finishing – J.T. Marsh, Asia Pub. House, 1959, Mumbai.

<b>Programme Name</b>	<b>Bachelor of Technology in Textiles</b>	<b>Semester</b>	<b>IV</b>
<b>Course Code</b>	<b>CE2013S</b>		
<b>Course Title</b>	<b>Environmental Studies</b>		
<b>Course objective</b>	<b>To present the impact of technological development on the environment.</b>		
<b>Course Outcomes</b>	After completing this course, students will be able to <ol style="list-style-type: none"> <li>1. Identify and analyze impact of human development on natural resources.</li> <li>2. Interpret the impact of environmental problems on socio economic growth and human health.</li> <li>3. Suggest strategies, technologies, and methods for sustainable management of environmental systems and for the remediation of degraded environment.</li> <li>4. Identify impact of human population on the environment and human health.</li> </ol>		
<b>Prerequisite</b>	Basic Science and Social Science		

### Course Content

<b>Modules</b>	<b>Description</b>
<b>Module 1</b>	<b>The Multidisciplinary Nature of Environmental Studies</b> Definition, Scope and Importance Need for Public awareness
<b>Module 2</b>	<b>Natural Resources</b> Renewable and Non-renewable Resources: Natural resources and associated problems. <ol style="list-style-type: none"> <li>a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.</li> <li>b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.</li> <li>c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.</li> <li>d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, Case studies.</li> <li>e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.</li> <li>f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.</li> </ol> Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.
<b>Module 3</b>	<b>Ecosystems</b> Concept of an ecosystem. Structure and function of an ecosystem.

	<p>Producers, consumers and decomposers.</p> <p>Energy flow in the ecosystem.</p> <p>Ecological succession.</p> <p>Food chains, food webs and ecological pyramids.</p> <p>Introduction, types, characteristic features, structure and function of the following ecosystem: (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)</p>
<b>Module 4</b>	<p><b>Biodiversity and its Conservation</b></p> <p>Introduction, definition: genetic, species and ecosystem diversity.</p> <p>Biogeographical classification of India.</p> <p>Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.</p> <p>Biodiversity at Global, National and Local levels.</p> <p>India as a mega-diversity nation.</p> <p>Hot-spots of biodiversity.</p> <p>Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.</p> <p>Endangered and endemic species of India.</p> <p>Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.</p>
<b>Module 5</b>	<p><b>Environmental Pollution</b></p> <p>Definition, Causes, effects and control measures of (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards.</p> <p>Solid waste management: Causes, effects and control measures of urban and industrial wastes.</p> <p>Role of an individual in prevention of pollution.</p> <p>Pollution case studies.</p> <p>Disaster management: Floods, earthquake, cyclone and landslides.</p>
<b>Module 6</b>	<p><b>Social Issues and the Environment</b></p> <p>From unsustainable to sustainable development.</p> <p>Urban problems related to energy.</p> <p>Water conservation, rain water harvesting, watershed management.</p> <p>Resettlement and rehabilitation of people; its problems and concerns. Case studies.</p> <p>Environmental ethics: Issues and possible solutions.</p> <p>Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.</p> <p>Wasteland reclamation.</p> <p>Consumerism and waste products.</p> <p>Environment Protection Act.</p> <p>Air (Prevention and Control of Pollution) Act.</p> <p>Water (Prevention and Control of Pollution) Act.</p> <p>Wildlife Protection Act.</p> <p>Forest Conservation Act.</p> <p>Issues involved in enforcement of environmental legislation.</p> <p>Public awareness.</p>
<b>Module 7</b>	<p><b>Human Population and the Environment</b></p> <p>Population growth, variation among nations.</p>

	Population explosion—Family Welfare Programme. Environment and human health. Human rights. Value education. HIV/AIDS. Women and Child Welfare. Role of Information Technology in environment and human health. Case Studies.
<b>Module 8</b>	<b>Field Work</b> Visit to a local area to document environmental assets— river/forest/grassland/hill/ mountain. Visit to a local polluted site— Urban/Rural/Industrial/Agricultural. Study of common plants, insects, birds. Study of simple ecosystems—pond, river, hill slopes, etc.

#### **Text Books:**

1. Erach Bharucha, Text Book of Environmental Studies for Undergraduate Courses, Universities Press, Second Edition, 2014.
2. Benny Joseph, Environmental Studies, McGraw Hill Education (India) Private, Second Edition, 2008
3. Dr. JagdishKrishnaswamy and Dr. R. J. Ranjit Daniels, Environmental Studies, Wiley India Private Limited, New Delhi, First Edition, 2009.
4. Textiles and Environment by N.N.Mahapatra, 2015

#### **Recommended Readings:**

1. BharuchaErach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad,
2. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T., Environmental Encyclopedia, Jaico Publ. House, Mumbai, 2001
3. Jadhav, H &Bhosale, V.M., Environmental Protection and Laws. Himalaya Pub. House, Delhi, 1995
4. Wanger K.D., Environmental Management. W.B. Saunders Co. Philadelphia, USA, 1998

<b>Programme Name</b>	<b>Bachelor of Technology in Textiles</b>	<b>Semester</b>	<b>IV</b>
<b>Course Code</b>	<b>TT2006T</b>		
<b>Course Title</b>	<b>Spinning Technology</b>		
<b>Course objective</b>	<b>To present the information on function, working, construction and passage of materials through comber, speed frame and ring frame.</b>		
<b>Course Outcomes</b>	After completing this course, students will be able to: <ol style="list-style-type: none"> <li>1. Explain the significance of short fibre removal and hooks removal.</li> <li>2. Describe the combing index cycle, various settings their effect on sliver quality.</li> <li>3. Describe the construction and working of various components of speed frame.</li> <li>4. Describe the construction, working of various components and the process of yarn formation on ring frame.</li> </ol>		
<b>Prerequisite</b>	Students must be aware of fundamentals of yarn manufacturing process sequence.		

### Course Content

<b>Modules</b>	<b>Description</b>
<b>Module 1</b>	<b>Combing:</b> Objects of Combing process. Need for preparatory, process for combing, hook direction, pre-comb draft & doublings.
<b>Module 2</b>	Modern concept of lap preparation. Construction and working of Sliver Lap, Ribbon Lap, Super Lap & Lap Former.
<b>Module 3</b>	Construction and working of Nasmith Comber: Drive to different parts – cylinder, nippers, lap & feed rollers, detaching rollers, cradle, top comb and drafting rollers in draw box
<b>Module 4</b>	Setting and timing of different parts in Comber – time diagram. Various setting involved in changing waste (noil) percentage on comber. Level of waste for different end uses. Different faults & their remedies. Difference in yarn quality of a carded and combed yarn.
<b>Module 5</b>	<b>Speed Frame:</b> Objects of speed frame passages. Construction and working of a speed frame. Introduction to top arm drafting. Construction of Spindles & Flyers for twisting and winding. Flyer & bobbin leading principles. suspended flyer technology, auto-doffing techniques. Roving bobbin transportation technologies. Contour of cone drum and its construction. Roller settings. Principles of differential motion & building motion. Swing motion and Change Places Faults & Remedies. Calculations related to speeds, drafts and production in combing and speed frame, calculation of noil percentage in combing, calculations of twist, differential speeds in speed frame. Importance and calculations of various constants and corresponding change wheels.

<b>Module 6</b>	<p><b>Ring Frame:</b> Objects of ring frame. Construction and working of a ring frame. Details of creel, lappet, traveller (c-shape, elliptical, spiv, and clip). Ring (conventional, antiwedge, SU rings etc.) and spindle on ring frame. Pneumafil (bonda) collection</p> <p>Building mechanism on ring frame - chain building chainless, modern package building. Roving / Cop / Combination build.</p> <p>Winding and binding coils. Setting a frame for a particular count. Twist factors for different counts, strength of the yarn and twist factor, strength for different counts. Change Places, wrapping procedure. Forces acting on the traveller and yarn balloon in ring spinning. Different types of drives to ring frame. Ring frame auto doffing techniques and ring-data type online measurement and monitoring systems</p> <p>Improvements in various parts and features of modern ring frame for high speed spinning. Twist flow in ring spinning, Effect of various parameters on twist flow. Yarn and Package faults. Linking ring frame to winding (requirements for winding).</p>
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#### **Text Books :**

1. Ganapathy, Nagarajan, Textile Mechanisms in spinning & weaving Machine, woodhead puplication, 2015.
2. Oxtoby Eric, Spun Yarn Technology, Butterworths publication, London (U.K.) 1987.
3. Elements of Combing and Ring Frame & Doubling – Khare A.R, Sai Book Centre publication, Mumbai, 1999.

#### **Recommended Readings:**

1. Carl A. Lawrence “Fundamentals of Spun Yarn Technology” CRC Press, 2003.
2. P.R. Lord, Hand Book of Yarn Production : Science, Technology and Economics, Tailor and Francis, 2003
3. W. Klein, A Practical guide to Ring Frame- Manual of Textile Technology, Vol. I, The Textile Institute, Manchester, London, U.K., 1990
4. NCUTE publications on Yarn Manufacturing, Indian Institute of Technology, Delhi

<b>Programme Name</b>	<b>Bachelor of Technology in Textiles</b>	<b>Semester</b>	<b>IV</b>
<b>Course Code</b>	<b>TT2006P</b>		
<b>Course Title</b>	<b>Spinning Technology Lab</b>		
<b>Course objective</b>	<b>To provide hands-on experience in working of comber, speed frame and ring frame.</b>		
<b>Course Outcomes</b>	After completing this course, students will be able to: <ol style="list-style-type: none"> <li>1. Describe the flow of material through comber.</li> <li>2. Demonstrate drive to various parts, settings and production calculations on comber machine.</li> <li>3. Explain speed frame mechanism, building mechanism, differential motion.</li> <li>4. Describe the flow of material through Ring frame, chain building mechanism and production calculations</li> </ol>		
<b>Prerequisite</b>	Student must have knowledge of various blow room lines, combers and basics of spinning technology.		

### Course content

<b>Modules</b>	<b>Description</b>
<b>Module 1</b>	A General Study of Sliver Lap Machine – Construction, material flow through machine, gearing, setting and speed/production calculations. Stop motions, lap forming.
<b>Module 2</b>	General study of Ribbon Lap Machine - Construction, material flow through machine, gearing, setting and speed/production calculations. Stop motions, lap forming.
<b>Module 3</b>	A General study of a comber – name of the parts, flow of material, index cycle. Comber – gearing calculations – feed per nip, nips per min., draft, production, waste%, head to head variation.
<b>Module 4</b>	Comber settings – nipper crank, nipper pivot, step gauge, leaf gauge, feed roller, top comb, plain segment & quadrant setting.
<b>Module 5</b>	Study of combing mechanisms – driving of different parts. Construction of half lap, top comb, nippers & study of stop motions.
<b>Module 6</b>	General study of speed frame – Construction, material flow through machine, gearing, setting, speed calculation, twist per inch, production. Truing of rollers and roller stand alignment.
<b>Module 7</b>	Study of Swing motion, stop motions on speed frame, change places, dimensions of staff & gauge.
<b>Module 8</b>	Study of various types of differential motions on speed frame.
<b>Module 9</b>	A Study of Building mechanism on speed frame and related important settings.
<b>Module 10</b>	General study of a ring frame – construction, material flow through machine, gearing, settings and speed calculation. Calculations of twist, spindle speed, front roller speed and production.
<b>Module 11</b>	Study of ring rail leveling, spindle gauging, thread wire setting, measurement of staff, gauge, ring dia. Study of spinning geometry of ring frame.
<b>Module 12</b>	Study of building mechanism on ring frame. Change Places. Procedure for count changing.

**Recommended Readings:**

1. Carl A. Lawrence , Fundamentals of Spun Yarn Technology, CRC Press, 2003.
2. P.R. Lord, Hand Book of Yarn Production : Science, Technology and Economics, Tailor and Francis, 2003
3. W. Klein, A Practical Guide to Ring Spinning, Manual of Textile Technology –Vol-1, The Textile Institute, Manchester, UK 1990.
4. NCUTE publications on Yarn Manufacturing, Indian Institute of Technology, Delhi.



<b>Programme Name</b>	<b>Bachelor of Technology in Textiles</b>	<b>Semester</b>	<b>IV</b>
<b>Course Code</b>	<b>TT2007T</b>		
<b>Course Title</b>	<b>Weaving Technology</b>		
<b>Course Objective</b>	<b>To explain the function of various mechanisms associated with weaving machine.</b>		
<b>Course Outcomes</b>	After completing this course, students will be able to: <ol style="list-style-type: none"> <li>1. Describe the functioning of automatic looms.</li> <li>2. Explain mechanism of various dobbies, knowledge of card punching, and pegging.</li> <li>3. Recognize the features and working of jacquard mechanism.</li> <li>4. Explain the concept of weft patterning.</li> </ol>		
<b>Prerequisite</b>	Student must have knowledge of fundamentals of yarn preparation for weaving.		

### Course Content

<b>Module</b>	<b>Description</b>
<b>Module 1</b>	<b>Automatic looms</b> , Pre-requisites for successful installation of automatic looms, Essential features, types and their comparison,
<b>Module 2</b>	Weft feeler, electrical and electronic weft feeler, pirn changing looms with reference to automatic looms
<b>Module 3</b>	Positive let off motions, shuttle changing loom, non-stop shuttle change, Temple cutters and shuttle eye cutter
<b>Module 4</b>	Mechanical and electrical warp stop motions, multi-shuttle weft replenishment, Centre weft fork, center selvedge motion
<b>Module 5</b>	<b>Dobby:</b> Classification of dobbies, mechanisms of doobby.
<b>Module 6</b>	Left hand and right hand double lift doobby and their methods of pegging, cross border dobbies, timing and setting of doobby parts
<b>Module 7</b>	Cam dobbies, paper cam dobbies, positive dobbies, Rotary dobbies, three-shed doobby. Electronic doobby: Working principle, machine parameters, microelectronics design features, drive arrangement, systems for pattern data transfer and design development
<b>Module 8</b>	<b>Jacquard:</b> Classification, mechanism and design developments. Electronic Jacquard: working principle, constructional variants, various electronic jacquard systems, selection system, pattern data, transfer and management.
<b>Module 9</b>	CAD for doobby, jacquard, label and carpet: Design algorithm, development of Jacquard designs, process of drafting and sketch design, development of figures, composition of design, geometric ornamentation, arrangement of figures, weave simulation.
<b>Module 10</b>	<b>Weft Patterning:</b> Significance of weft patterning system. Mechanism of Cowburn and Peck Drop Box motion, card saving device.
<b>Module 11</b>	Pattern chain design using card saving device. Comparison of various box motion systems available.
<b>Module 12</b>	Advantages and disadvantages of Drop Box and Circular Box motion, Mechanisms of Pick & Pick and Pick at Will. Weft mixing motions.

**Text Books:**

1. P.K. Banerjee ,Weaving Mechanism, Woodhead Publications, 2014
2. Talukdar and Ajsaonkar, Weaving: Machines, Mechanisms, Management, Mahajan Publishers Ltd, 1996
3. Marks R. & Robinson ATC, Principles of Weaving, Textile Institute publication, 1986, Manchester (U.K.)

**Recommended Readings:**

1. Sabit Adanur, Handbook of Weaving - CRC Press, 2000
2. A Ormerod and W S Sondhelm, Weaving Technology and Operations ,The Textile Institute, Manchester, 1995
3. K. T. Aswani, Fancy Weaving Mechanisms –Mahajan Book publishers, 1990
4. Fox T.W, The Mechanism of Weaving, Universal Book Corporation Mumbai 1977.

<b>Programme Name</b>	<b>Bachelor of Technology in Textiles</b>	<b>Semester</b>	<b>IV</b>
<b>Course Code</b>	<b>TT2007P</b>		
<b>Course Title</b>	<b>Weaving Technology Lab</b>		
<b>Course Objective</b>	<b>To provide hands-on experience on the construction and working of weaving machine</b>		
<b>Course Outcomes</b>	After completing this course, students will be able to: <ol style="list-style-type: none"> <li>1. Describe the working of basic components of shuttle looms, dobby and jacquard looms.</li> <li>2. Examine various mechanisms associated with these machines.</li> <li>3. Get hands on of experience on running these machines.</li> </ol>		
<b>Prerequisite</b>	Student must have knowledge of basics of weaving technology and mechanism of dobby's and jacquards		

### Course Contents

<b>Modules</b>	<b>Description</b>
<b>Module 1</b>	General study of auto loom, Study of feelers & three try motion, Battery setting on loom.
<b>Module 2</b>	Study of shuttle change loom & Study of multi-colour cop-changing loom.
<b>Module 3</b>	Study of semi positive & automatic Let off motion
<b>Module 4</b>	General study of various dobbies, Study of negative cam dobby & Study of pick finding devices.
<b>Module 5</b>	Study, Timing and setting of dobby, Pegging of dobby lattice & weaving of dobby sample-pique.
<b>Module 6</b>	Study of cross-border dobbies (two/three cylinder) & Study of positive double lift dobby.
<b>Module 7</b>	Study of dobby and of weft mixing mechanism on dobby.
<b>Module 8</b>	Study of pick and pick drop box timing & setting.
<b>Module 9</b>	Study of Drop Box mechanism ,pick and pick& pick at will.
<b>Module 10</b>	Study of Single Lift Single Cylinder Jacquard.
<b>Module 11</b>	Study of Double Lift Single Cylinder & Double Cylinder Jacquard.
<b>Module 12</b>	Study of Cross-Border Jacquard.

### Recommended Readings:

1. Sabit Adanur, Handbook of Weaving - CRC Press, 2000
2. A Ormerod and W S Sondhelm, Weaving Technology and Operations, The Textile Institute, Manchester, 1995
3. K. T. Aswani, Fancy Weaving Mechanisms –Mahajan Book publishers, 1990
4. Fox T.W, The Mechanism of Weaving , Universal Book Corporation Mumbai 1977.

<b>Programme Name</b>	<b>Bachelor of Technology in Textiles</b>	<b>Semester</b>	<b>IV</b>
<b>Course Code</b>	<b>TT2008T</b>		
<b>Course Title</b>	<b>Testing of Fibre and Yarn</b>		
<b>Course Objective</b>	<b>To introduce processes involved in physical testing of textile fibres and yarns.</b>		
<b>Course Outcomes</b>	After completing this course, students will be able to: <ol style="list-style-type: none"> <li>1. Summarize the significance of textile testing.</li> <li>2. Discover the importance of statistics in textile testing</li> <li>3. Outline different types of testing used for assessing textile materials.</li> <li>4. Recognize different terminologies used in textile testing.</li> </ol>		
<b>Prerequisite</b>	Students must have knowledge of applied mathematics & applied physics.		

### Course Content

<b>Module</b>	<b>Description</b>
<b>Module 1</b>	Object of textile testing. Tested quality schemes like wool mark ISE mark. ASTM, ISO, BS, and BIS standards. The elements of statistics-frequency distribution, sampling distribution, standard error, significance test, t-test, f-test, level of confidence. number of test to be carried out, concept of S.D, C.V. Mean, Mode Median. Quality control charts, interpretation of control charts. Calculations based on all above.
<b>Module 2</b>	Selection of samples for testing, Types of sampling, Fibre sampling methods from combed slivers, roving and yarns, Yarn sampling techniques, Fabric Sampling techniques.
<b>Module 3</b>	Fibre dimension and quality testing- Fibre length testing, Fibre Fineness testing by various methods and fibre maturity, Trash % ,single fibre strength and bundle strength of fibre testing. Moisture relations, introduction to regain and moisture content and its measurement. Measurement of atmospheric conditions, regain humidity relations & hysteresis, effect of regain on fibre properties.
<b>Module 4</b>	Yarn structure and dimension testing – Yarn numbering system, yarn count measurement, yarn diameter testing, relation between yarn diameter and count. Yarn twist: importance, effect of twist on various properties of yarn, twist measurement methods. Hairiness of yarn measurement. Uster tester-3, Yarn evenness U%, long term short term irregularity of yarn & its measurement.
<b>Module 5</b>	Terminology and definitions employed in measurement of tensile properties of textile. Principles of textile testing instruments CRL, CRE & CRT, pendulum lever principal with CRT, stelometer, press-ley fibre strength tester. The balance principle, inclined plane principle. Electronic dynamometer strain guage, transducer. Instron yarn, single yarn strength, Yarn CSP testing

### Text Books :

1. V. K. Kothari, Testing and Quality Management, IAFL Publications, New Delhi, 2005
2. B. P. Saville, Physical Testing of Textiles, Woodhead Publishing Ltd., U. K, 1999.
3. J. E. Booth, Principles of Textile Testing by, Heywood Books, London, 1961.

### Recommended Readings :

1. E. B. Grover and D. S. Hamby, Handbook of Textile Testing and Quality Control, 1960.

<b>Programme Name</b>	<b>Bachelor of Technology in Textiles</b>	<b>Semester</b>	<b>IV</b>
<b>Course Code</b>	<b>TT2008P</b>		
<b>Course Title</b>	<b>Testing of Fibre and Yarn Lab</b>		
<b>Course Objective</b>	<b>To provide hands-on experience about the physical testing of textile fibres and yarns.</b>		
<b>Course Outcomes</b>	After completing this course, students will be able to: <ol style="list-style-type: none"> <li>1. Demonstrate the methods of identifying textile fibres.</li> <li>2. Explain the different methods of evaluating physical characteristics of textile fibres and yarns.</li> <li>3. Get idea about the precautions to be taken during testing and sampling of textile materials.</li> </ol>		
<b>Prerequisite</b>	Students must have knowledge of Applied Chemistry, Applied Physics.		

### Course Content

<b>Module</b>	<b>Description</b>
<b>Module 1</b>	Study of microscope and fibre identification. Convolutions and Ribbon width.
<b>Module 2</b>	Measurement of Mean fibre length (oiled plate method) and other parameters of length variation.
<b>Module 3</b>	Baer Sorter and fibre length and Weight per unit length of fibres measurement.
<b>Module 4</b>	Study of Shirley Analyzer- Cleaning efficiency of Blowroom & Card- Raw cotton, Lap & Sliver testing.
<b>Module 5</b>	Measurement of Crimp of fibre – Wool.
<b>Module 6</b>	Evaluation of Maturity of cotton by NaOH method, Maximum & minimum width of cotton fibre – microscopically.
<b>Module 7</b>	Measurement of fibre fineness by Shirley fineness tester.
<b>Module 8</b>	Study of Shirley moisture meter. Evaluation of moisture regain in fibres, Swelling of fibers
<b>Module 9</b>	Measurement of bundle strength of fibres by Stelometer
<b>Module 10</b>	Measurement of Count by lea method and lea CSP, Tex number and work of rupture of yarn.
<b>Module 11</b>	Measurement of Single thread strength
<b>Module 12</b>	Measurement of yarn crimp%
<b>Module 13</b>	Measurement of yarn count .
<b>Module 14</b>	Measurement of Yarn Twist tester.
<b>Module 15</b>	Measurement of relative humidity by hygrometer.

### Recommended Readings:

1. V. K. Kothari , Testing and Quality Management , IAFL Publications, New Delhi, 2005
2. B. P. Saville, Physical Testing of Textiles, Woodhead Publishing Ltd., U. K, 1999.
3. J. E. Booth, Principles of Textile Testing by, Heywood Books, London, 1961.
4. E. B. Grover and D. S. Hamby, Handbook of Textile Testing and Quality Control, 1960.

<b>Programme Name</b>	<b>Bachelor of Technology in Textiles</b>	<b>Semester</b>	<b>IV</b>
<b>Course Code</b>	<b>TT2009A</b>		
<b>Course Title</b>	<b>Science and Technology for Society</b>		
<b>Course Objective</b>	It will be innovative course dealing with social, human and ethical implications of engineering and technology, with special reference to the Indian situation.		
<b>Course Outcomes</b>	After completing this course, students will become aware of: 1. Social and Cultural history of technology. 2. Social and Human critiques of technology. 3. Engineering Ethics and Professional Ethics.		
<b>Prerequisite</b>	Knowledge of Basic Science and Technology		

### Course Content

<b>Module</b>	<b>Description</b>
<b>Module 1</b>	Science, Technology and Engineering, as knowledge and as social and professional activities.
<b>Module 2</b>	Inter-relationship of technology growth and social, economic and cultural growth, historical perspective.
<b>Module 3</b>	Ancient, medieval and modern technology/industrial revolution and its impact. The Indian Science and Technology.
<b>Module 4</b>	Rapid technological growth and depletion of resources. Limits to growth; sustainable development.
<b>Module 5</b>	Energy crisis, renewable energy resources.
<b>Module 6</b>	Environmental degradation and pollution. Eco-friendly technologies, Environmental regulations. Environmental ethics.
<b>Module 7</b>	Technology and the developing nations. Problems of technology transfer.
<b>Module 8</b>	Human operator in the engineering projects and industries. Problems of man machine interaction. Impact of assembly line and automation. Human centered technology.
<b>Module 9</b>	Industrial hazards and safety. Safety regulations. Safety engineering.
<b>Module 10</b>	Engineering profession. Ethical issues in engineering practice. Conflicts between business demands and professional ideals. Social and Ethical responsibilities of the Engineer. Codes of professional ethics. Whistle blowing and beyond. Case studies.