

**SYLLABUS FOR LAB ASSISTANT**  
**(TEXTILE ENGINEERING)**

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## Syllabus for Lab Assistant for Textile Engineering

### Section 1: Textile Fibres

Introduction of Textile fibres, staple fibre and filament; Essential properties and Desirable properties of textile fibres; Classification of textile fibres; **Natural Fibres:** Introduction, varieties or Types, grading, chemical composition, Properties and Uses of cotton, wool, silk (with sericulture, reeling and throwing), Jute and Linen fibres.

Types of polymer, Copolymers, Polymerization and formation of polymers and Its Techniques, Essential requirements of fibre-forming polymers; Amorphous and crystalline region, glass transition temperature ( $T_g$ ), melting point ( $T_m$ ); Orientation and Crystallinity, Influences of orientation on fibre properties, Principles of Melt Spinning, Wet Spinning and Dry Spinning process.

Man-made fibres: Regenerated and synthetic fibre, Unique properties of synthetic fibres; Introduction, Raw material, Manufacturing process, Properties and uses of Regenerated cellulosic fibres such as Viscose Rayon, Polynosic, Cuprammonium rayon, Acetate rayon, and Lyocell fibres); and Synthetic fibres such as Polyamides (Nylon 6, Nylon 66), Polyester, Polyolefins (Polyethylene and Polypropylene), Polyacrylonitrile (Acrylic and Modacrylic) fibres; Post spinning operations such as drawing, heat setting, tow-to-tow conversion; Spin finish composition and applications; Different texturing methods. Properties and uses of Elastomeric fibres (Spandex, Lycra) and High-Performance fibres such as Carbon fibre, Glass fibre aramid (Nomex, Kevlar) and ultra-high molecular weight polyethylene fibres; Identification of textile fibres by various methods; Definition, Classification and Applications of Technical Textiles.

### Section 2: Yarn Manufacture

Principles of ginning and its types; Principles and different types of mixing and blending operations; Objectives of blow room process, Principles of opening and cleaning; Working principles of conventional and modern blow room machines; Speeds and settings; Sequence of blow room machineries for different varieties of cotton, manmade fibres and their blends; Fundamentals of carding, Passage of material through carding machine; Operating principle, construction and working of revolving flat carding machine, Conventional vs. modern carding machine, Card clothing, Card settings, Periodic mass variation in card sliver; Card auto leveller; Objects of Draw frame, Principles of roller drafting and doubling, Passage of material through Draw frame; Construction and working of Draw-frame, Roller arrangements in drafting systems; Periodic mass variation in drawn sliver; Draw frame auto leveller; Objectives and Principles of cotton Combing; Comber preparatory machines and comber; Combing cycle and mechanisms; Recent developments in combing machine; Speed, Draft, Hank and Production calculations related to blow room, carding, draw frame and combing; Objects of Speed frame, passage of material and working principle of Speed frame; Various components of machine and their functions; Principle of drafting, twisting and winding in roving frame; Bobbin building mechanisms in roving frame; Modern developments in roving machine; Objectives of Ring Frame, passage of material and working principle of Ring Frame; various parts of ring frame and their function; Principle of drafting, twisting and winding in ring frame, Ring and Traveller, Bobbin/cop building mechanism in ring spinning, Causes of end breakages and their remedies; Modern developments in ring spinning machine; Speed, Draft and draft, twist and twist constant and Production calculations related to speed frame and ring frame. Objects of Doubling, Passage of yarn through doubling frame; Working principle of Ring doubler and Two-for-one twister (TFO), Twist direction, Relationship between single yarn twist and folded yarn twist; Types of Fancy yarns. Limitations of ring spinning, classification of New spinning process, common features; Principles of compact and Open-End (rotor) Spinning; Passage of material through Rotor spinning and its working; Structure-property relationship in ring, compact and rotor spun yarns; Spinning waste and their classification, Uses of Spinning waste.

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### Section 3: Fabric Manufacture and Design

Concepts of Count, Type of yarn numbering System, Count Conversion, Folded yarns and resultant counts, Average counts, Simple calculations based on the yarn numbering system; Heald count, Reed count, Calculation of warp and weft in a fabric by indirect and direct methods.

**Weaving Preparatory Process:** Principles, purpose, and requirements of the preparatory process; Principles of winding processes, Classification of winding machines and methods, Types of package build, Wind, Traverse ratio or wind ratio or wind perdouble traverse, Angle of wind, Coil angle; Passage of material through the winding machine; Patterning mechanism, Yarn clearers and tensioners, Different systems of yarn splicing; Objectives and classification of Warping, Different types of warping creels, Passage of warp and working mechanism, Features of beam and sectional warping machines; Principles of pirn winding; Objects of Sizing, Different sizing systems, Passage of warp through sizing machine and their functions, Sizing ingredients and their functions, Size paste preparation, Sizing of spun and filament yarns, Sizing defects and their remedies, Features of modern sizing; Objects of the looming process, Drawing-in process; Calculations related to weaving preparatory machines and Process.

**Fabric Manufacture:** Different methods of fabric formation: Weaving, Knitting, Nonwoven, Felting, Braiding, Netting. Principle of Weaving, Type of looms, Passage of warp material through Loom, Various parts of looms and its function; Primary, Secondary and Auxiliary Motions of loom; Shedding Motion, the scope of tappet, dobby and jacquard shedding, Positive and negative shedding mechanisms, Types of shed; Picking motion, types of picking and its mechanism, Shuttle picking and checking, defects in shuttle and shuttle cop, shuttle flying out and shuttle trapping; Beat-up motion, Kinematics of sley, Eccentricity of sley motion, Factors affecting the sley-motion; Take-up and Let-off motions; Stop Motion, Weft Fork Motion and Warp Protecting Motion; Object and Importance of Multiple Box motion, Types of Multiple Box Motions and their working Mechanism; Types of Automatic Looms, Function of various parts of Automatic looms, Comparison between Copchanging and Shuttle changing Looms, Automatic Bobbin changing mechanism, Warp stop motion on Automatic loom; **Shuttleless Looms:** Advantage of Shuttleless weaving as compared to conventional Loom, Classification of Shuttleless Loom; Working principle, special features, advantages and limitations of Sulzer Projectile, Rapier, Air Jet and Water Jet Shuttleless Loom; **Dobby:** Types of Dobby, Mechanism of double lift single jack and double-lift double jack dobby, Methods of Pegging Lagsfor dobby, Dwell of dobby, Features of Modern dobby. **Jacquard:** Objects of Jacquard, Principle of Jacquard shedding, Types of Jacquard, Size and Figuring Capacity of Jacquard, Various parts of Jacquard; Working mechanism, features, advantages and disadvantages of different types of Jacquard; System of Harness Mounting, Card preparation for Jacquard Shedding. Different types of Cloth faults and Loom Faults; Calculations related to Loom production and efficiency; Fundamentals of warp and weft knitting; Fundamentals of Nonwoven fabrics and its applications.

**Fabric structure and design analysis:** Methods of fabric representation on design paper, Repeat of the design, Basic elements of a woven design, Types of drafts; Concept, basic characteristic and end use of Basic woven fabric constructions (Plain, Twill and Satin/Sateen) and their derivatives; diamond and Diaper, honey comb, Huckaback, Mock Leno, Crepe weave, Bedford Cords, Welts and piques, Stripe and check, warp and weft pile fabrics, Terry pile, Extra Figuring, Backed cloth and double cloth constructions; Drawing and lifting plans. Colour and its Application, Simple Colour and Weave Effects; Yarn diameter, cover factor and maximum set of woven fabrics.

### Section 4: Textile Chemistry

**Pre-Treatment of Textiles:** Objective and Advantages, Preparatory processes for cotton, wool and silk such as Singeing, Desizing, Scouring and bleaching; Mercerization of cotton; Preparatory processes for manmade fibres and their blends.

**Dyeing:** Basic concepts, common terms used in dyeing, Classification of dyes, Theory of dyeing, Factors affecting dyeing; Basic concepts and Properties of various classes of dyes, Dyeing of cotton, wool, silk, polyester, nylon and acrylic with appropriate classes of dyes; Dyeing of polyester/cotton, polyester/viscose and polyester/wool blends

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Dyeing machines; Dyeing processes and machines for cotton knitted fabrics; Methods for determination of wash, light and rubbing fastness, After treatment process to improve fastness.

Printing: Methods of printing such as Block printing, Screen printing, Roller printing, Rotary Screen printing, Transfer printing, and Foam printing; Preparation of printing paste; Various types of thickeners; Printing auxiliaries; Styles of printing and its types, Direct styles of printing of (i) cotton with reactive dyes, (ii) wool, silk, nylon with acid and metal complex dyes, (iii) polyester with disperse dyes; Resist and discharge printing of cotton, silk and polyester; Pigment printing; Fixation and after treatment processes, Printing faults.

Textile Finishing: Objective and Classification of Textile Finishing; Mechanical finishing of cotton; Stiff, soft, wrinkle resistant, water repellent, flame retardant and enzyme (bio-polishing) finishing of cotton; Milling, decatizing and shrink resistant finishing of wool; Antistatic and soil release finishing; Heat setting of synthetic fabrics; Minimum application techniques; Pollution control and treatment of effluents.

### Section 5: Textile Testing

Objectives and Reasons for textile testing, standardization of testing, Standard atmospheric conditions for testing of textile materials; Sampling techniques for fibres, yarns and fabrics; Sample size and sampling errors. Moisture Relations and Testing; Basic concepts and measurement of trash content, Fibre length, fineness and maturity; Tensile testing of fibres; Linear density of sliver, roving and yarn; Twist and hairiness of yarn; Tensile testing of yarns; Evenness testing; Fault measurement and analysis of yarns. Quality Particulars of Fabric; Fabric Length, width and Thickness, Crimp of Yarn in Fabric; Fabric Stiffness, Handle and Drape; Crease, Crease Resistance and Crease Recovery; Fabric wear, abrasion and serviceability; Air Permeability; Water and Fabric Relationships; Flammability of Fabric; tear strength, bursting strength and Tensile testing of fabrics; Garment Testing.

Elements of Statistics: Basic concept, frequency distributions and graphical representation of data, Measure of Central Tendency such as Arithmetic Mean, Median and Mode; Measurement of Dispersion such as Range, mean deviation, percentage mean deviation, standard deviation, co-efficient of variation (C.V.%), variance and standard deviation; Concepts of Probability; Sampling distribution and standard error of the mean, Causes of Variation in Quality; Techniques of Statistical Quality Control (Process and Product control); Quality Control Charts and Control Limits, Application of Quality control charts in Textile Industry.