

**DETAILED SYLLABUS FOR THE POST OF LECTURER IN TEXTILE  
TECHNOLOGY (GOVT. POLYTECHNICS) IN Technical Education  
(Polytechnics) - Direct Recruitment  
(Category Nos.:238/2023)**

**Module I      Basics of Civil Engineering – 4 Marks**

**Building Materials:** Brick – varieties and properties, characteristics of good brick. Cement – varieties, grades of cement, properties and its uses. Steel – types of steel for reinforcement bars, and steel structural sections. Aggregates – types & requirements of good aggregates. Concrete – grades of concrete as per IS code, water cement ratio, and Workability. Modern construction materials - Architectural glass, ceramics, Plastics, composite materials, thermal and acoustic insulating materials, decorative panels, waterproofing materials.

**Building Construction:** Parts of the building – foundation – types of foundations – spread footing, isolated footing, combined footing, Raft, pile and well foundations. Masonry – types rubble masonry, brick masonry, English bond, and Flemish bond. (One brick wall). Types of buildings, selection of site for buildings, components of a residential building and their functions.

**Surveying and Levelling:** Chain surveying – principles, instruments, ranging, and chaining survey lines, fieldwork and field book, selection of survey stations, units of land area. Levelling instruments, different types, benchmark, reduced level of points, booking of field notes, reduction of levels by height of collimation method (simple problem). Modern survey – instruments – Total station, Theodolite.

**Building rules and regulations:** Relevance of NBC, KBR & CRZ norms, fire safety for buildings.

**Green buildings:** Materials, energy systems, water management and environment for green buildings.

**Module II      Basics of Mechanical Engineering - 4 Marks**

**Analysis of thermodynamic cycles:** Carnot, Otto, Diesel cycles, Derivation of efficiency of these

cycles, Problems to calculate heat added, heat rejected, net work and efficiency.

**IC Engines:** Spark Ignition engine, Combustion Ignition engine, 2-Stroke, 4-Stroke engines. Air, Fuel, cooling and lubricating systems in SI and CI Engines, Concept of hybrid engines.

**Pumps and Turbines:** Brief study of Reciprocating pump, Centrifugal pump, Pelton turbine, Kaplan turbine. Overall efficiency, Problems on calculation of input and output power of pumps and turbines.

**Manufacturing Process:** Brief study of the manufacturing processes – Sand Casting, Forging, Rolling, Extrusion and their applications.

**Metal Joining Processes:** Types of welding, Soldering and Brazing and their applications.

**Basic Machining operations:** Turning, Drilling, Milling and Grinding.

**Power Plants:** Introduction, classification of power plants – working of hydroelectric power plant – working of thermal (Steam and Diesel) power plant – working of nuclear power plant.

### **Module III      Basics of Electrical Engineering - 4 marks**

**DC Circuits:** Basics of electrical circuits, including components like conductors, resistors, inductors, and capacitors - Ohm's Law and Kirchhoff's Laws to solve simple circuit problems.

**Nodal and Mesh Analysis:** Techniques for analyzing circuits with independent voltage sources in steady-state conditions.

**AC Circuits:** Understanding alternating current (AC) circuits, waveforms, average and RMS values, instantaneous power, real power, reactive power, apparent power, and power factor. Steady-state analysis of RLC circuits and three-phase power systems in star and delta configurations.

**Magnetic Circuits:** Exploring concepts like MMF (magnetomotive force), flux, reluctance, magnetic field intensity, flux density, and self and mutual inductances with simple problems.

**Electrical Installations:** Learning about domestic wiring, types of wires and cables, earthing, and protective devices like switch fuse units, miniature circuit breakers, and earth leakage circuit breakers.

**Electrical Machines:** Understanding the construction and working principles of DC Generators, DC Motors - torque equations, types, and applications. - Studying the construction, working principles, and applications of transformers and three-phase alternators - Synchronous and Induction Motors.

## **Module IV Basics of Electronics Engineering - 4 marks**

**Electronic Components:** Understanding the role of resistors, inductors, and capacitors in electronic circuits. Semiconductor Materials: silicon and germanium, PN junction diodes and Zener diodes, their characteristics, and applications. Transistors: Learning about bipolar junction transistors, silicon-controlled rectifiers (SCR), and insulated gate bipolar transistors (IGBT). current-voltage (I-V) characteristics, and applications. - Rectifiers and Inverters.

**Sensors:** Sensors, solenoids, pneumatic controls with electrical actuators, mechatronics, types of valves and their applications, electro-pneumatic systems, proximity sensors, and limit switches.

**Communication Systems:** Radio communication: principle of AM & FM, frequency bands used for various communication systems, Principle of antenna – radiation from accelerated charge. Mobile communication: basic principles of cellular communications.

## **Module V Engineering Mathematics – 9 Marks**

**MATRICES:** Introduction to eigenvalues and eigenvectors of a real matrix -Development and application of the characteristic equation -Properties of eigenvalues and eigenvectors - Cayley-Hamilton theorem - Diagonalization of matrices by orthogonal transformation -Reduction of a quadratic form to canonical form by orthogonal transformation.

**DIFFERENTIAL CALCULUS:** Function Representation and Behavior - Limits and Continuity - Derivatives - Differentiation Rules (sum, product, quotient, chain rules) - Implicit Differentiation Techniques - Applications of Derivatives: Maxima and Minima in Single-variable Functions.

**FUNCTIONS OF SEVERAL VARIABLES:** Study of Partial Differentiation - Homogeneous Functions and Euler's Theorem - Total Derivative and Change of Variables - Jacobians and Partial Differentiation for Implicit Functions -Taylor's Series for Functions of Two Variables - Applications: Maxima and Minima of Functions of Two Variables and Lagrange's Method of Undetermined Multipliers.

**INTEGRAL CALCULUS:** Definite and Indefinite Integrals - Substitution Rule and Techniques of Integration - Integration by Parts, Trigonometric Integrals, Trigonometric Substitutions - Integration of Rational and Irrational Functions - Improper Integrals.

**MULTIPLE INTEGRALS:** Double integrals – Double Integrals and Change of Integration Order - Double Integrals in Polar Coordinates - Area Enclosed by Plane Curves - Triple Integrals - Volume of Solids - Change of Variables in Double and Triple Integrals.

## **Module VI Fibre Science and Textile Chemistry – 15 Marks**

**Fundamentals of Textile Fibres:** Definitions of textile fibre - classification of textile fibres on the basis of origin and chemical nature with examples, Essential and desirable properties of textile fibre. Physical and molecular structure of various Textile fibres.

**Cotton:** Botanical classification of cotton, Types of commercial cotton and their properties, organic cotton & BT cotton, hybrid Indian cotton. chemical composition of Cotton

**Bast Fibres:** Features of bast fibres – Jute and Linen, Climate and Soil condition for cultivation of Linen and Jute. Extraction of linen from Flax plant - cultivation of jute, extraction of jute fibre from the plant. chemical composition of Linen and Jute.

**Silk:** Varieties of silk, Various stages involved in the production of raw silk from cocoons, reeling, throwing and doubling of silk, degumming and weighting of silk. Chemical composition of Silk.

**Wool:** Varieties of wool, types & grades, shearing of wool, Treatment processes (chlorination, carbonization, scouring and felting). Chemical composition of Wool.

**Man-Made Fibres and Their Production:** Introduction to Synthetic Fibres - Classification of Polymers based on the structure, Polymerization and Molecular Forces. Principles of spinning - Melt spinning, Solution spinning - Wet spinning, Dry spinning. Importance of Drawing or Stretching in Fibre Production.

The manufacturing process of man-made fibres like Viscose Rayon, Acetate rayon, Cuprammonium Rayon , Polyester, Nylon Polypropylene, Acrylic and Orlon Fibre.

Texturization – objectives – types of texturized yarns – Texturization methods – False twist texturization – Stuffer Box crimping – Knife edge crimping – Air texturizing – Knit – De-knit texturizing – Gear crimping – Knife edge crimping – texturizing machines – Changes in spinning line while processing man-made fibres.

The physical properties, chemical properties and features of various Textile fibres like Cotton, Linen, Jute Silk, Wool, Rayon, Polyester, Nylon, Poly propylene, Acrylic fibre, PVA Fibre, Poly Urethane Fibre, Nomex fibre and Kevlar fibre.

Features of Ecofriendly fibres and newly developed Textile fibres - High-performance fibres-linear polymer fibres - Carbon fibre - Glass and ceramic fibres - Chemical and thermal resistance fibres.

**Wetting and Preparation of Cotton for Dyeing:** Surface tension & contact angle - Relationship between surface tension, contact angle, and the wetting of textile materials- Important surface active agents - Manufacturing of Washing Soap and Detergents.

Sequence of operations in wet processing cotton textiles – Singeing – objects – principle and methods – hot plate, roller, Gas singeing machines – De-sizing – objects – principle and methods – Rot steeping – Acid steeping, Enzymatic de-sizing, Scouring – objects and importance – principle and mechanism – types of Kiers.

**Bleaching & Mercerizing:** Objects of bleaching – Bleaching of cotton with hypo chlorites and hydrogen peroxide – Comparison of hypochlorite and peroxide bleaching in terms of their properties, chemical behaviour and application – principle of mercerizing – changes in the dimension of cotton by mercerizing – parameters affecting mercerization, concentration of NaOH, pH, Temperature and Time.

**Dyeing of Cotton, Viscose, Silk and Wool using Soluble Dyes:** Basic characteristics of dyes and pigments, classification of dyes, Properties and principle of application of various types of dyes. - general terms used in dyeing, Dyeing equilibrium, dye-fibre interaction, adsorption isotherm, dye affinity, Liquor ratio – General mechanism of dyeing, physical, chemical and solvent theories of dyeing – fastness properties of dyed materials.

Method of application of Direct Dyes and Reactive Dyes on Cotton and viscose, Basic colours on Cotton and silk, Acid colours on Wool. Dyeing of Cotton and Viscose using Water Insoluble Dyes and Natural Indigo: Dyeing with Sulphur, Vat, Solubilized Vat, Natural Indigo, Oxidized colours, Mineral and Naphthol colours.

**Dyeing of Wool, Silk & Manmade Fibres:** Various dyes used for protein fibres – preparation of wool and silk for dyeing – Dyeing of wool with Acid dyes, Basic dyes and Reactive Dyes – Dyeing of silk with Acid dyes, Basic dyes and Reactive dyes – Methods of dyeing of man-made fibres – Dyeing of man-made material – polyester with disperse dyes – Acrylic with basic dyes.

**Dyeing of Blend and Dyeing Machinery:**Method of Dyeing – Dyeing of polyester-cotton blends with Disperse and vat dyes, Disperse and reactive dyes – dyeing of polyester viscose blends with disperse and vat dyes, disperse and reactive dyes – dyeing of polyester wool blends with disperse and acid dyes – loose cotton dyeing machines – yarn package dyeing machines – cop dyeing machine – cheese dyeing machine – beam warp dyeing machine – fabric dyeing machines – jigger dyeing machine – winch dyeing machine – padding mangles – HPHT jet dyeing machines – HTHP jigger – HTHP beam dyeing – Thermosol process - Process control in Textile Dyeing.

**Textile Printing:** Ingredients used in printing & preparation of print paste – after treatments given to printed fabrics – Different methods of printing – block printing – stencil printing – screen printing – automatic flat bed screen printing – rotary screen printing – roller printing – transfer printing. Basic concepts of the styles of printing – direct, discharge, resist and dyed styles – Batik style and dyes used for batik style – tie and dye– Foam printing – flock printing – Damask printing – Kalamkari printing.

**Textile Finishing:** Objectives and Classification of Textile Finishing - Mechanical and Chemical finishes - temporary, semi-permanent and permanent finishing. Hydro extraction - Stiffeners and softeners -Objectives of stentering - Working of Hot air stenters. Mechanical Finishes: Method of application - Calendering – Objectives - Different types of calenders - Beetling - Sanforizing - Principle and mechanism of pre-shrinkage process - Description of the sanforizing machine. Chemical Finishes: Anticrease finish - Study of Water repellent & water proof finishes - Study of fire retardant finishes – Study of mildew, moth and rot proof finishes .

## **Module VII                      Yarn Manufacture- 15 Marks**

**Cotton Selection and Mixing:** Ginning – Gins for different cottons – Relationship between FQI and Lea CSP of yarn – Mixing plans for coarse, medium and fine counts – Objectives and Methods of mixing – Factors to be considered while mixing different types of cotton. Working of Mixing bale opener, Multi mixer, Auto mixer, Aero mixer and Blendomat.

**Blow Room:** Objectives of blow room process – cleaning efficiency, trash content – classification of Blow Room lines, Minor and Major cleaning points – Working of Hopper feeder, Mono cylinder, ERM cleaner, Axi-flow cleaner, Krischners beater, Single process scutcher – cages, lap measuring motion, auto Doffing mechanism, piano feed regulating mechanism, reserve bin & photocell arrangement, Two-way distributor, dust filter bags, dust trunks, pneumatic delivery boxes, magnetic traps. Lap defects, their causes, and remedies – chute feeding system.

**Carding:** Objects of Carding – principle of stripping and carding – working of a revolving flat carding machine – functions of each part of carding machine – Heal and Toe arrangement – types of waste in carding & percentage – defects in carding and remedial measures – Tandem carding – stripping and Grinding of cards – Traverse grinder – vacuum stripper – Study of fibre hooks – Setting on quality and waste extraction. Card setting for processing short, medium, and long staple fibres. Study of card wire clothing.

**Modern Developments in Carding:** Modern Developments in Feed part and Licker in region, Cylinder region, condensing region and Web doffing mechanisms, Objectives, and types of Card Auto levellers – Shirley pressure point system – Automatic waste extracting system – Automatic doffing – Stop motions in cards.

**Draw Frames & Lap Formers and Comber:** Principle of roller setting and roller drafting in Draw frame – roller weighting – electrical and electronic stop motions in Draw frame – auto levellers in Draw frame – polar drafting system and Platts pressure bar systems – defects in Draw frame silver – their causes and remedies. Objects and working of Silver lap machine, Ribbon lap machine, Super lap machine and Comber machine. Study of parts of Comber like Half lap, Nipper, Top comb, Feed roller, Detaching rollers. Types of feed, Waste percentage and Degree of combing – Factors affecting combing performance -Importance of pre-comber draft – modern developments in combing – combing defects – causes and remedies.

**Speed frame :** Objects and working of speed frame – high drafting system – systems of weighting of top rollers – functions of each part of speed frame machine – Methods of roving winding - Study of differential motion and building motion – features of Rovematic speed frames – defects in roving – their causes and remedies.

**Ring Frame:** Objects and working of ring frames – types of creels – apron drafting – Various drafting systems in Ring frame – functions of each part of Ring frame machine – ‘Z’ twist and ‘S’ twist – bobbin building – yarn defects – causes and remedies.

**Modern Developments in Ring Spinning:** Developments in drafting region – SKF – PK 225 – INA-V drafting system – Developments in the twisting region – traversing thread guide and

balloon control rings – special finishes to rings – special finishes to travellers – traveller number – running in period of the ring – energy saving spindle – variable speed spinning – auto doffing mechanism – long length frames – compact spinning – super high drafting system.

**Advanced Yarn Manufacturing:** Advanced yarn manufacturing systems – open end Rotor spinning – principle of Rotor spinning – functions of each part of Rotor spinning machine – rotor grooves – effect of rotor speed on yarn quality – relation between rotor speed, rotor diameter and yarn draw off tension – Friction spinning – DREF-I friction spinner – DREF – II friction spinner – Air jet spinning – Siro spinning. Structure of Ring spun, Rotor spun, Friction spun and Air jet spun yarns. Idealized helical yarn structure -twist contraction and retraction; the relationship between yarn parameters- packing of fibres in yarns - measurement of packing density and radial packing density of yarn - measurement of yarn diameter – the study of fibre migration in yarn, Fibre migration in blended yarns, mechanisms of migration, the effect of various parameters on fibre migration.

**Doubling and Fancy Yarn:** Types of doubled yarn – Twist and twist direction effects – methods of doubling – styles of doubling – types of doubling machine – two for one twister [ TFO ] – Function of various parts for Two for one twister – Three for one Twister – Manufacture of Sewing threads – Manufacture of tyre cord – Fancy doubling – Types of fancy yarns – yarn conditioning – types of reeling – bundling and baling.

**Spinning Calculations:** Blow room : Calculation of beater speed, beats per minute, cleaning efficiency of beater, cleaning efficiency of blow room, Hank of lap, production, draft and efficiency of blow room. Carding: Calculation of Speed, Draft and Draft constant, Lap exhausting time, Can fill time, Production and efficiency of Carding machine. Draw frame: Main draft, break draft, hank of silver, production, and efficiency in drawing frame. Draft, hank of lap, production, and efficiency in silver lap machine. Production, efficiency, and draft in comber. Break draft, main draft and hank of roving of simplex – production & efficiency of simplex. Draft, twist, and production calculation of Ring Frame – Angle of yarn pull – Traveller speed – production and efficiency of rotor spinning – draft in rotor spinning – production and efficiency of Ring doubler – production and efficiency of Two for One twister.

**Process Control in Mixing & Spinning Preparation:** Key variables for the process control in spinning – Norms – Establishment of norms. Productivity – Factors influencing it – Minimizing cost of production. Control of mixing, quality, and cost – instrumental evaluation of cotton – stimulations control of mixing quality and cost – linear programming for cotton mixing – the application of linear programming in a Spinning Mill – The control of yarn realization – Records for estimating yarn realization and waste – Norms for yarn realization. Control of waste in blow room and carding – determination of trash content and cleaning efficiency – assessing the performance of a blow room – optimizing cleaning at cards – control of comber waste – optimum level of comber waste – control of silver evenness – control of stretch at fly frames – control of relative humidity – scope and means for increasing machine productivity in preparatory section.

**Process Control in Spinning:** Measurement and analysis of productivity – definitions of indices of productivity – analysis of short fall in productivity – productivity and profitability –

means to improve productivity – maximizing machine efficiency in ring spinning – controlling the end breakage in ring spinning – control of yarn quality, count, strength and their variability – reducing within bobbin count variation – reducing between bobbin count variation – control of variability in lea strength – Factors affecting yarn strength – control of yarn quality – unevenness and imperfections – measurement of unevenness – types of yarn irregularity – random irregularity and periodic irregularity – causes of yarn irregularity – yarn faults and package defects.

## **Module VIII      Fabric Manufacture – 15 Marks**

**Warp Winding and Weft Winding:** Working of Warp and Weft Winding Machines – Drum Winding and precision winding – Warp Winding Machine – Creel – types of tensioners – Slub catchers – Broken thread stop motion – Full package stop motion - ribbon breakers – package arm holders – traversing mechanism – features of Disc and Gate type tensioners – working of Electronic Yarn clearers – advantages of Electronic yarn clearers – Angle of wind – wind ratio – Roto Coner – Auto Coner – types of knots – splicing – defects in winding – causes & remedies – weft winding – objects – Bunching mechanism – Layer locking device – Pirn diameter control – working of high-speed automatic pirn winder – defects in pirns, their causes and remedies.

**Warping, Sizing and Drawing:** Study of beam warping and sectional warping – high speed warping machines – functions of various components of a warping machine – defects in warp beams, their causes and remedies – sectional warping machine – limitations of sectional warping – objectives of sizing – ingredients used in the size paste and their functions – multi cylinder sizing machine – various controls in a modern sizing machine like Temperature, size level, stretch, moisture, viscosity controls– size recipe for coarse, medium and fine cotton yarns – defects in sized beams – precautions to be taken for sizing synthetics and blends – objectives of drawing – in and denting – selection of suitable healds and reeds for different fabrics.

**Basic mechanisms in power looms.** Importance of Primary motions – principles of Shedding – positive and negative shedding – Tappet Shedding – Dobby Shedding - Jacquard Shedding – Different types of Sheds – General function and working of Plain Tappet Shedding mechanism – Early shedding and late shedding – Setting of tappet Shedding – picking – Positive picking and negative picking – working of Cone Over Pick and Cone Under Pick motions – Method of Altering Picking Force and Setting of Picking band – Timing and Setting of Cone Over Pick – working of beating mechanism.

**Secondary Motions:** Take up motions – 7-wheel take up motion – continuous and intermittent take up motion – working of continuous type take up motion – Let off motions – working of a negative let off motion – working of positive let off motions.

**Auxiliary Motions:** Working of Side weft fork and centre weft fork motions – timing and setting of side weft fork motion – objects and types of warp stop motions – working of a mechanical warp stop motion used in ‘Northrop’ looms – working of a mechanical warp stop motion used in ‘Sakamoto’ looms – working of electrical warp stop motion – objects and types of warp protector motions – working of loose reed motion – the working of fast reed motion – objects of



brake motions – the working of brake motion – the objects and general description of check strap – the objects and general description of Temples – timing and setting of auxiliary motion

**Weaving Calculation:** The different methods of Yarn Numbering Systems – English, French, Metric, Denier, Tex – direct and indirect systems of yarn numbering – calculations to find equivalent count – resultant count of folded yarn with and without contraction – beam count – average count – heald and reed count – speed, production and efficiency of warp winding machines, weft winding machines, warping machines – size percentage, production, speed and efficiency of sizing machines.

Calculation of the production and efficiency of power looms – Evaluation of the time required for the exhaustion of a weavers beam – Finding the time required for the exhaustion of pirn, cone etc.. – Estimating the number of pirns required for the loom in a given time – Estimation of the number of pirns/cones required to produce a particular quantity of fabric – Computing the number of pirn winders required to feed a given number of looms – Estimating the number of warping machines required to feed the given number of looms – Calculation of the eccentricity of the loom Sley– Calculations related to take up motions - Finding out the quantity of warp and weft required to weave a particular fabric-Finding out the cost of different types of fabrics.

**Dobby Shedding:** Various classifications of doobby shedding mechanisms – working of Keighley doobby and its limitations – timing and setting of Keighley doobby – advantages of double jack doobby over single jack doobby – working of Climax doobby – method of the pegging of lags for L.H and R.H. doobbies – use of Cross Border doobby – working of Cross border doobby – working of Ruti Cam doobby – working of Knowles positive open shed doobby – functions of heald levelling device.

**Jacquard Shedding:** Advantages of Jacquard shedding – basic principle of Jacquard shedding – various classifications of Jacquards like – Single lift Jacquards, Double lift Jacquards, Single Cylinder Jacquards, Double Cylinder Jacquards, Cross border Jacquards – working of Single Lift Jacquards, Double Lift Single Cylinder Jacquard, Double Lift Double Cylinder Jacquard, Cross Border Jacquard – harness mounting like London and Norwich systems – various types of harness ties – terms like count of comber board, First hook and First needle of the Jacquard – construction and development of Jacquard designs – working of Piano card cutting machine – card punching and card lacing – use of special Jacquards and the working of Pressure Harness.

**Computer-Aided Textile Designing:** Step by Step procedure to produce a Jacquard design in Computer Aided Textile Designing - analysis of a Jacquard design fabric and to produce fabric simulation in different colour combinations – step by step procedure to produce stripe and cross over designs using software – step-by-step procedure to produce check designs using software – step by step procedure to produce a printed design and its colour separations – step by step procedure to make a texture mapping on various objects and models with new designs created in other software – creation of a yarn library using different count and quality – automatic creation of draft and peg plan from weaves.

**Multiple Box Looms, Terry Motions and Automatic Looms:** Introduction to weft patterning – type of box motions – use of multiple box looms – classification of multiple boxes –

Drop boxes, circular boxes – Pick at will / Pick and Pick. Working of Eccle's Dropbox motion – the study of card saving mechanism – Arrangement of pattern cards for various picking patterns – study of various positions of stud and pin when different boxes are in line with the slay race – Timing and setting. Working of non-Skip type circular box motion. Object and classification of Terry motions – working of Dug dale's Terry motion – working of Holden's Terry motion. Features of automatic looms – classification of automatic looms – advantages of automatic looms. Working of midget weft feeler mechanism – Timing and setting – Features of two prongs electrical feeler and photoelectric feeler. Working of automatic weft replenishment motion with respect to cop changing looms – Timing and settings. Shuttle protector – functions and uses. Different types of Thread cutters and their uses. Features of shuttle changing looms. Compare shuttle changers and cop changers.

**Advanced Fabric Manufacture:** Introduction on various methods of fabric production – compare the advanced method of fabric production with conventional types of looms – types of shuttle less looms – basic requirement of shuttle less weaving. The various stages of weft insertion in Sulzer shuttle less weaving machine with 4 colour weft insertion – Torsion bar picking mechanism. Warp and weft preparation for shuttle less weaving. Rapier shuttle less weaving – various classifications of Rapier shuttle less looms - various stages of weft insertion in rapier looms – picking mechanism in a flexible rapier loom (Rack and pinion type). Features of different types of selvages used in shuttle-less weaving.

Jet Weaving: Features of Air Jet looms – The passage of warp yarn on Maxbo Air Jet loom. Air Jet nozzle for weft insertion in air-jet looms – functions weft insertion elements used in air jet looms – various stages of weft insertion on Maxbo air jet looms. Basic features of water Jet looms – 4 stages of weft insertion in water jet loom – working of weft supply system on water jet looms – the pump, throttle valve and water jet nozzle.

**Manufacture of Nonwovens:** Definition of non-wovens – classification of Non-wovens – stages involved in the production of Non-woven fabrics – comparison between woven and nonwoven fabrics – Field of application of Non-woven fabrics – Basic requirements of fibres used for the – manufacture of non-woven – Methods of web-formation – card web – Different methods of web – Reinforcement – Need of binding & strengthening of fiber webs – various methods of Fibre bonding like – mechanical bonding, chemical bonding, thermal bonding – importance of needle punching machine for fibre bonding – study of the needling loom – the study of various methods of chemical bonding – study of various methods of thermal bonding – properties of non-woven fabrics – Study of the structure of non-woven fabrics - limitations of non-woven fabrics.

**Knitted Structure:** Definition of Knitting – Classification of Knitting – Compare woven and knitted structures – Define the terms – courses, wales, Gauge, face loop, back loop, loop length, texture – Single Jersey – Double Jersey – various knitting elements – Latch needle – Bearded Needle – Compound Needle – Sinker – Cams – Knitting action of various types of needles – study the functions of Sinker and raiser cams – Define knitted structures – Define Knit stitch – Miss stitch – Tuck stitch – Define – (1 X 1 Rib) – (1 X 1 Inter Lock) – the properties of Plain,

Rib, Interlock. Geometry of plain knitted structure - influence of friction on knit geometry - load extension of knitted fabrics.

**Warp & Weft Knitting:** Passage of yarn through flat knitting machine – Features of warp knitting – Different types of knitting elements – Knitting actions of Rachel Warp knitting machine – the knitting actions of Tricot warp knitting machine – compare Rachel and Tricot Knitting machine – Define weft knitting – Application of weft knitted fabrics – weft knitted structures like Plain, Rib and InterLock – Working of weft knitting machines- single Jersey weft knitting.

**General Study of Technical Textiles:** Classify Non-apparel textiles – Identify the fields of application of Technical textiles – scope of application of Technical Textiles – Industrial Textiles like Tyre fabrics, Filter fabrics, Conveyor fabrics, Tarpaulins, Bulletproof fabrics, Fire Proof Fabrics, Agriculture fabrics, Shoe fabrics, Parachute fabrics – Study of Geo Textiles – Application of Geo Textiles – Medical Textiles, Medical Fabrics, Surgical Dressings – Protective Textiles - Smart Textiles - Textile reinforced composites.

**Process Control in Weaving Preparatory:** Process control in winding – optimizing quality in winding preparation – control of quality of knot – production of good packages – Detailed study of stitches on cones, patterning, soft nose or base, wild yarn, snarls etc. – Cleaning efficiency, knot factor and quality factor – Effect of unwinding tension and minimizing end breaks in warping, control of tension level, conditions of beam flanges, stop motions, break – driving drum - importance of length measuring motion, control of density of beams – Choice of size, scope of size pick up through controlling sizing condition – control of yarn stretch – control of moisture in sized yarns, quality of sized beams, Density, broken ends, missing ends, crossed ends, sticky ends – defective selvages. Formation of ridges on beams – Minimizing stoppages due to mechanical failures – Improving the build of pirn – Improving productivity in winding warping sizing and pirn windings.

**Process Control in Weaving and Machine Balancing:** Different types of healds and reeds – Selection of proper reed and heald – Control of productivity in loom shed – control of loom speed – Control of efficiency variable – Staggering of heald – Control of waste in winding, warping, sizing, drawing – in and loom shed – Control of fabric defects – Selection of accessories – Care of accessories – Shuttles, pickers, picking bands, healds, Reeds etc. – Balancing machinery in weaving – Balancing machineries from winding to loom shed for 100, 200, 400, 600 loom capacities – Essential factors in textile costing. Effect of yarn structure on woven fabric properties.

## **Module IX Fabric Structure, Fashion Design and Garment Technology – 15 Marks**

Plain and Twill Weaves: Application of Point paper in textile Designing – count of point paper , design, draft, lifting plan and denting plan – straight draft, broken draft, point draft, mixed draft – plain weave, warp rib weaves, weft rib weaves and mat weaves, modification of plain weaves – twill weaves – classification – warp faced twill – weft faced twill – Even faced twill – Steep twill – Flat twill – Left-hand twill – Right-hand twill – simple twill – compound twill – modification of twill weaves – satin and sateen designs – warp corkscrew and weft corkscrew designs – combined twills – figured twill – zigzag twills – diamond twills – broken twills – broken and reversed twill - drafts for the above designs – Influence of yarn twist on the prominence of twill lines.

**Towelling Fabrics:** General requirements of a towelling fabric – weaves used for towelling fabrics – construction of 3-pick terry, 4-pick terry and 5-pick terry – construction of ordinary honeycomb, Brighton’s honeycomb – features of Huck-a-Back fabrics – Construction of Devon’s Huck – a – Back, 10 X 10 Huck – a – Back, Honeycomb Huck – a – Back weaves, Reversible Huck – a – Back weaves – Drafts applicable to the above designs – Features of pile fabric – Classification – construction of Velvet, Velveteen – True warp pile, Two pick to a wire, Three pick to a wire, Fast true warp pile– Differentiate warp pile and weft pile structures – importance of cutting and finishing in the production of weft piles – velveteen – Classification of velveteen – Construct Plain back, Twill back, Corded velveteen with twill as ground weaves – Features of crepe weaves – Different methods of constructing crepe weave – Principle of seersucker fabrics.

**Compound Structures:** General features of Bedford cord fabrics – Construction of plain face Bedford cord, Twill face Bedford cord, Wadded Bedford cord and develop their drafts – Functions of cutting ends, face ends and wadding ends – Features of Pique fabrics – Differentiate pique fabrics and Bedford cord fabrics – Functions of cutting, face, wadding and back picks – Construction of various types of pique fabrics, Coarse cut pique, Fine cut pique, Wadded pique, Backed pique – System of Drafting and Denting applicable to above weaves – Additional attachments required in a loom to weave Bedford cord and Pique fabrics – Importance of Double, Open Double width, Treble, Tubular and Interchanging double cloth – Construct Double cloth, Double width cloth, Tubular, Treble, Interchanging Double cloth – Importance of extra warp and extra weft figuring in ornamentation of fabrics – importance of All over figuring, Stripe figuring and Spot figuring – Features of Toilet Quilt fabrics – Construct examples for 2 pick, and 3 pick Toilet Quilt.

**Perforated Fabrics and Jacquard Designs:** Perforated fabrics – uses – Construction of 3 X 3, 4 X 4, 5 X 5 Mock Leno – Draft and Denting plan – speciality of denting for Mock leno designs – principles of cross weaving – application of Doup Healds – Differentiate Gauze and Leno – Standard diagram of the cloth structure, Drafting and lifting plan for Plain Gauze, Cellular leno, Net leno / Spider leno – various types of sheds formed in cross weaving – Importance and general characteristics of Jacquard designs – Steps involved in the reproduction of Jacquard design from Jacquard cloth – Steps involved in the reproduction of Jacquard design from motif designs.

**Classification of Garments, Patterning and Grading:** Classify garments for men, women and children – selection of fabrics for various garments – Theory of Human Anatomy – measurements and importance of measurements – body measurements for children, ladies and gents garments – importance of paper patterns – types of paper patterns – Importance and principles of pattern drafting – pattern grading – study of pattern making for various types of top and bottom garments – Grading of various components of garments – Study of marker planning – draft pattern for gents shirts – draft pattern for ladies skirts.

**Spreading, Cutting and Sewing :** Objects of spreading – methods of spreading – various types of woven fabrics – types of lay – pattern layout – Rules in pattern layout – methods for layout – layout for asymmetrical designs – Economy of fabric in placing pattern – Rules for placement of pattern if the fabric is insufficient – the importance of ‘Marshden’ layout, ‘Marshden’ lay and lay length – cutting process – types of cutting machines and die cutters – tools required for clothing construction – types of stitches and classification of stitches – Seams and different types of seams – types of sewing machines – buttonhole, buttoning – Importance of trimmings – Selection of needles and threads for different types of garments – individual and group production systems.

**Fusing, Pressing and Packing:** Object of fusing – Fusing – base cloth and resin coating system – Effect of temperature time and pressure in fusing – Effect of pressing and various types of pressing – machinery used for pressing – controls in pressing – material handling systems – packing materials and various types of packing – Labels and tags.

**Fashion Designing and Product Development:** Define design – requirement of design – structural and decorative design – application of structural and decorative design in dresses – create variety through structural and decorative design – Define harmony – aspects of harmony – Define proportion – Aspects of proportion and space relationship – Define rhythm – Define emphasis – balance in dress design – social psychology of clothing – customers requirement of clothing – Designing and quality control – Fashion garments Vs Basic garments – Concept of technological environment of production development – Importance of process and product development – product performance and importance of specifications - Balance between aesthetic, performance and price factors.

## **Module X Textile Testing, Erection and Maintenance of Textile Machinery – 15 Marks**

**Elements of Statistics, Humidity and Moisture:** Definition of Textile Testing – Definition of quality assurance – objects of Textile Testing – Importance of statistics – Quality control and Quality assurance – selection of Sample for testing - population and individual in statistics – classification and tabulation of data – frequency table – graphical representation of frequency distribution – types of frequency curves – measures of central Tendency – Measures of Dispersion – Humidity – expressions of humidity – measurement of Humidity of the atmosphere – standard atmospheric condition, standard atmosphere and standard testing atmosphere – expression of moisture in a textile material – standard moisture regain of important textile fibres

– Estimation of standard regain of a blend – Moisture Hysteresis – Estimation of Moisture content and regain of Textile materials.

**Fibre Testing:** Properties of Textile fibres – Importance of fibre length – fibre length parameters – Determination of fibre length parameters by different instruments – Importance of fibre fineness – Relationship between airflow and fibre fineness – Determination of fibre fineness – Importance of fibre strength – Different strength technologies – Estimation of fibre strength – Importance of fibre maturity – List the different methods of determination of fibre maturity – Estimation of fibre maturity by Caustic soda swelling method – Features of Advanced Fibre Information System (AFIS) – Features of High Volume Instrument (HVI) – Cleaning efficiency, Lint, Trash and invisible loss – Estimation of trash content in cotton by Shirley trash analyzer.

**Yarn Testing:** Properties and characteristics of yarn – Importance of yarn count – Determination of yarn count – The importance of Yarn twist – Definition of twist, S twist, Z twist, twist on twist, weft on twist – Relationship between yarn count & TPI – Different methods of twist determination – Estimation of twist in yarn – Importance of yarn strength – Factors affecting yarn strength – Principles of tensile strength testing – Estimation of single thread strength –lea tester – Importance of evenness of the yarn – terms in evenness – Methods of determination of evenness – Yarn appearance grading by ASTM standard boards – Uster evenness tester, spectrograph and imperfection indicator – Classification of basic classimat faults – Uster classimat – yarn hairiness – Determination of yarn hairiness.

**Fabric Testing:** Fabric properties and characteristics –Dimensional properties of Fabric – Threads density – Fabric weight – Count of the yarn used for fabric manufacture – Determination of cover factor – Warp cover factor, Weft cover factor and Cloth cover factor – Crimp in yarn – Crimp percentage and crimp amplitude –Shirley yarn crimp tester – Definition of pill and causes of pill formation – ICI Pill box tester – Fabric strength – Determination of Fabric tensile strength by tester working on CRT principle – Elmendorf Tearing strength tester – Hydraulic bursting strength tester – Fabric abrasion resistance – Types of abrasions – Martindale abrasion tester – Fabric stiffness – Bending length, flexural rigidity and bending modulus – Cantilever principle – Shirley stiffness tester – Drape and drape co-efficient – Determination of drape by Drape meter – Crease property – Crease resistance and Crease recovery – Shirley crease recovery tester – air permeability, air resistance and air porosity –Shirley air permeability tester – water permeability and water repellency – Bundesmann water permeability tester.

**Maintenance of Workshop Machinery:** List the types of maintenance and application – The duties and responsibilities of the maintenance supervisor – work order procedure and store control – the importance of work study techniques – purpose and working of various types of fundamental workshop machinery – Calliper, micrometer, Feeler gauge, Dial gauge, Height & depth gauge – Study the principle of annealing, normalizing, hardening, tempering, carburizing & case hardening – different types of bearings and functions – the objects of lubricants, various types of lubricants – various characteristics of lubricants.

**Erection of Textile Machineries:** The importance of levelling & methods of levelling – Instruments used in levelling – Erection of various textile machinery – Erection tools and

equipment – Measurement of the vibration of textile machinery – Dampers – functions – Balancing – types.

**Maintenance of Textile Machineries:** The maintenance schedules for different spinning machinery – overhauling maintenance schedules of spinning machinery – Identifying the defects due to improper maintenance – maintenance schedule during strike and lay-off periods. Introduce safety precautions & maintenance of safety equipment in textile mills. The maintenance schedule for different preparatory sections – The maintenance schedule for the loom shed – Overhauling schedule of machinery in the preparatory and weaving department – The defects due to improper maintenance. The maintenance schedule for dyeing & processing machinery.

**NOTE: - It may be noted that apart from the topics detailed above, questions from other topics prescribed for the educational qualification of the post may also appear in the question paper. There is no undertaking that all the topics above may be covered in the question paper.**