

**FURTHER DETAILS REGARDING MAIN TOPICS OF  
PROGRAMME No. 08/2019 (Item No.12)**

**LECTURER IN TEXTILE TECHNOLOGY  
(NCA NOTIFICATION)**

**TECHNICAL EDUCATION  
(POLYTECHNIC COLLEGES )  
(Category No.430/2017)**

**PART I**

**(a) Technical Mathematics**

- I. Matrices – Identification of Matrices, matrix operations, adjoint and inverse.
- II. Determinants – Evaluation of second and third order, minors and cofactors, solutions of simultaneous linear equation in three unknown using Cramer's rule.
- III. Binomial Series – Expansions using Binomial theorem.
- IV. Trigonometric functions – Signs of functions in each quadrant. Trigonometric values of angles, properties of trigonometric functions, applications of the identities  $\sin(A \pm B)$ ,  $\cos(A \pm B)$  and  $\tan(A \pm B)$ .
- V. Coordinate geometry – Equations to a straight line – slope-intercept form, intercept form, Angle between two lines, condition for two lines to be perpendicular, parallel.
- VI. Differentiation – Limits and continuity, derivatives of functions, equation to tangents and normals. Maxima and minima of functions of one variable.
- VII. Integration of functions – Integration of different types of functions.
- VIII. Applications of integration – Area bounded by a curve and X or Y axis, solutions of differential equations using the method of variable separable, solutions of linear differential equations of first order.

## **(b) Basic Civil Engineering**

**Materials:** Brick – varieties and strength, characteristics of good brick. Cement – varieties and grade of cement and its uses. Steel – types of steel for reinforcement bars, steel structural sections. Aggregates – types & requirements of good aggregates. Concrete – grades of concrete as per IS code, water cement ratio. Workability, mixing, batching, compaction and curing.

**Construction:** Parts of 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).

**Surveying:** Chain surveying – principles, instruments, ranging, and chaining survey lines, field work and field book, selection of survey stations, units of land area.

**Levelling:** Levelling instruments, different types, bench mark, reduced level of points, booking of field notes, reduction of levels by height of collimation method (simple problem). Modern survey – instruments – Total station, Electronics theodolite, Distomat.

## **(c) Basic Mechanical Engineering**

**The importance of IC Engines:** Definition, classification – two stroke engines, four stroke engines, working of two stroke engines and four stroke engines with the help of line sketches, comparison between two stroke and four stroke engines, comparison between petrol and diesel engines, function of fly wheel, clutch, gearbox, propeller shaft and differential in power transmission, explain with sketch the working of differential, briefly explain power transmission of 4 wheel vehicle with line diagram.

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

## **(d) Basic Electrical Engineering**

Review with discussion of electric current, potential difference, power, EMF, resistance and its laws, Ohms law and series parallel circuit, electromagnetism, generation of AC and DC supply.

**Idea of Basic electrical circuit:** Electrical supply and load and its functioning, division of voltage and current in a parallel and series circuit – simple problems, units of power and energy, solution of DC circuit with calculation of energy consumption in an installation.

**Circuit parameters:** Resistance, Capacitance and inductance. AC circuit with R, L, C. Simple solution of typical AC circuit with resistance, impedance, power and power factor.

**Electrical circuit of an installation:** Earthing, lightning protection.

### **(e) Basic Electronics**

Active and passive devices – review only. LED – working, applications, comparison of LED lighting and CFL lighting. Full wave rectifier – diagram and explanation, 5 V power supply – with bridge rectifier and 7805. SMPS – block diagram and advantages. Integrated circuits. SMDs – advantages. Static electricity – precautions in handling electronic circuits.

**Switches:** ON / OFF, push to ON, push to OFF, push to ON / OFF, SPST, SPDT, DPDT. Working and application of limit switches, proximity switches, relays.

**Microcontrollers:** Simple block diagram of 8 bit microcontrollers – application.

**Mobile technology:** CDMA and GSM. Compare – 2G and 3G technologies.

**Inverter & UPS:** Block diagram. Compare – inverter and UPS. Online and off line UPS – differentiate. Battery selection for UPS and inverter.

**E-waste:** Health hazards of e-waste.

## **Part II**

### **Textile Technology**

#### **Textile Fibres and Textile Wet Processing**

**Introduction to Textile Fibres:** Definitions of textile fibre, spun yarn, filament yarn, monofilament, texturised yarn, single yarn, ply yarn etc – classification of textile fibres on the basis of origin and chemical nature with examples, general properties of textile fibre, essential properties, desirable properties.

**Cotton:** Introduction to cotton fibre – cotton producing countries, Botanical classification of cotton, Types of commercial cottons and their properties, organic cotton & Bt cotton, hybrid Indian cotton and their properties, soil conditions, climate, cultivation, harvesting and picking of cotton, structure of cotton, longitudinal and cross sectional views, chemical composition, physical chemical properties.

**Bast Fibres:** Features of bast fibres – Jute and Linen, Climate, soil condition and cultivation of linen, extraction of linen, rippling, retting – chemical, water and dew retting, breaking, scotching, hackling, advantages and disadvantages of each retting process, chemical combination and microscopic appearance of linen, physical and chemical properties of linen, cultivation of jute, extraction of jute fibre from the plant, chemical and physical properties of Jute, Composition of jute.

**Silk:** Varieties of silk, silk producing countries, Sericulture – Pre-cocoon operations, Life cycle of silk worm, various stages involved in production of raw silk from cocoons, reeling, throwing and doubling of silk, structure of silk filaments and microscopic appearances, chemical composition of silk, degumming and weighting of silk, physical and chemical properties of silk.

**Wool:** Varieties of wool, types & grades, shearing of wool, composition and structure of wool, chlorination, carbonisation, scouring and felting of wool, physical and chemical properties of wool.

**Regenerated Fibres:** Different types of Rayons, manufacture of viscose rayon, polynosic and properties, physical and chemical properties of viscose rayon, uses of viscose rayon, various steps involved in manufacture of acetate rayon, physical and chemical properties of acetate rayon, uses of acetate rayon, microscopical appearance of viscose and acetate rayon, cuprammonium and Nitro rayon, Lyocell, Modal, FR viscose & Bamboo fibre.

**Introduction to Fully Synthetic Fibres:** Polyamides – Nylon 66, Nylon 6 - Polyester Terylene, Dacron – Poly olefin, Poly ethylene and polypropylene – Poly acrylonitrile, acrylic mod acrylic – poly vinyl alcohol – poly urethane fiber spandex – aramid fibres nomex & Kevlar – definition of monomers, polymers, polymerization, degree of polymerization – classification of polymerization – condensation polymerization, addition polymerization and co-polymerization – their examples with equations – Random, Alternative, Block co-polymers – Linear, branched, and cross linked polymers. Principles of spinning and methods of – melt spinning, wet spinning, dry spinning, advantages, disadvantages and suitability. Importance of drawing or stretching – advantages – draw ratio – Filament ratio – stretch ratio – cold drawing – hot drawing – Draw twist machine – Importance of Staple fiber

**Polyesters and Polyamides:** Chemistry of polyamide fibres – Nylon 66 – Nylon 6 – Manufacture of nylon 66 – raw materials – polymerization – spinning – drawing – with equation – properties of Nylon 66 – microscopic appearance – physical and chemical properties.

Production of Nylon 6 – production of Caprolactum – condensation polymerization – melt spinning – stretching – properties – microscopic appearance – physical and chemical properties.

Introduction to PET fibre. Different types – Terylene – Dacron – Manufacture of Terylene – Production of Ethylene glycol and DMT – Polymerization – Melt spinning – Hot drawing – Filament and staple fiber – Properties – Microscopic appearance – Physical and chemical properties.

**Recently Developed Synthetic Fibres:** Names of recently developed synthetic fibre, poly ethylene, poly propylene, Acrylic fibre, PVA Fibre, Poly Urethane Fibre, Nomex fibre, Kevlar fibre. Method of manufacturing HDPE – Raw material – Polymerization with Ziegler type catalyst – Melt spinning and Drawing – Properties, differentiate LDPE & HDPE.

Polypropylene – Three different types of Polymers, Manufacture – raw material, Polymerization, Melt spinning and drawing – Properties and appearance of Polypropylene.

Differentiate acrylic and Modacrylic – production of Orlon Fibre – Vinyl cyanide – continuous polymerization – Wet spinning and dry spinning – stretching – properties and appearance of Acrylic fiber.

PVA fibre – Manufacture – Raw materials – polymerization – saponification – wet and dry spinning – drawing – properties of PVA.

Polyurethane Fiber – Manufacture and properties of “Spandex”. Aramid, Nomex, and Kevlar fibres.

**Blending and Processing of Man-made Fibres:** Two methods of Blending – Blow room blending and draw frame blending – advantages and disadvantages.

Texturisation – objects – types of texturized yarns – stretch yarn – Modified stretch yarn – Bulk yarn – Texturization methods – False twist texturization – Stuffer Box crimping – Knife edge crimping – Air texturizing – Knit – De-knit texturizing – Gear crimping – Knife edge crimping – texturizing machines – advantages – uses of texturised yarn.

Changes in spinning line while processing man-made fibres – Blow Room – Card – Draw frame – Simplex – Ring frame

Size recipe for – Polyester filament yarn – Polyester / Viscose – Polyester / Cotton, control of static charges and humidity.

**Chemistry of Wetting & Preparation of Cotton for Dyeing:** Definition of surface tension and contact angle – Relationship of surface tension and contact angle with wetting of textile materials – important surface active agents – manufacture of Washing Soap & Detergents – Sequence of operations in wet processing cotton textiles – Singeing – objects – principle – methods – hot plate, roller, Gas singeing machines – De-sizing – objects – principle – methods – Rot steeping – Acid steeping, Enzymatic de-sizing, Scouring – objects and importance – principle and mechanism – Definition and types of Kiers.

**Bleaching & Mercerising:** Objects of bleaching – Types of bleaching agents – Bleaching with hypochlorites – Comparison of sodium hypochlorite in terms of their properties, chemical behaviour and application. Preparation of hydrogen peroxide – properties and chemical behaviour of hydrogen peroxide – Strength of hydrogen peroxide in volume & percentage – Bleaching with hydrogen peroxide (Batch process) – definition and principle of mercerizing – changes in the dimension of cotton by mercerizing – parameters affecting mercerisation, concentration of NaOH, pH, Temperature and Time.

**Introduction to Dyeing, Dyes and Dyeing of Cotton, Viscose, Silk and Wool using Soluble Dyes:** Classification of colouring matters – general terms used in dyeing, Fastness, Liquor ratio & Dye bath – General mechanism of dyeing, physical, chemical & Solvent theories of dyeing – fastness properties of dyed materials. Method of application of Direct Dyes and Reactive Dyes on Cotton & Viscose, Basic colours on Cotton & Silk, Acid colours on Wool.

**Dyeing of Cotton and Viscose using Water Insoluble Dyes and Natural Indigo:** Dyeing with Sulphur, Vat, Solubilised vat, Natural Indigo, Oxidized colours, Mineral and Naphthol colours.

**Dyeing of Wool, Silk & Man-made Fibres:** Various dyes used for protein fibres – preparation of wool and silk for dyeing – Dyeing of wool with – Acid dyes – Basic dyes – Reactive Dyes – Dyeing of silk with – Acid dyes – Basic dyes – 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 Machineries:** 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 – dyeing machinery – 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.

**Textile Printing:** Differentiate between dyeing & printing – ingredients used in printing & preparation of print paste – preparation of cloth for printing – after treatments given to printed fabrics – differentiate between methods of printing & styles of printing. 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 following styles of printing – direct, discharge, resist and dyed styles – Batik style and dyes used for batik style – tie-dyeing – Foam printing – flock printing – Damask printing – Kalamkari printing.

**Finishing:** Water mangles – Three and Six bowl mangles – Hydro extraction – Roller and centrifuge type – drying machines – blanket drying & Buti hot air drying machines – Damping machines – Brush and spray – objects of stentering – description of pin & clip stenter – Hot air stenter – Starch finishing – objects – various ingredients. Calendaring – objects – different types of calendars – Beetling – Sanforizing – objects – principle and mechanism of compressive shrinkage – pre-shrinkage process – Sanforizing machines – Anti-crease finish – objects – types of anti-crease finishes – water repellent & water proof finishes – study of mildew, moth and rot proof finishes Flame retardant finishes.

### **Yarn Manufacture**

**Cotton Selection and Mixing:** Ginning – Gins for different cottons – FQI – Lea CSP of yarn – mixing plans for coarse, medium and fine counts – Methods of mixing – Mixing bale opener – Multi mixer – Auto mixer – Aero mixer – Blendomat.

**Blow Room & Calculations:** Contaminants in Cotton fibre – Opening and cleaning – cleaning efficiency, trash content – classification of Blow Room lines, Minor and Major cleaning points – Hopper blender and Hopper feeder – Shirley opener – ERM cleaner – Axi-flow cleaner – 2 Bladed and 3 bladed beater – Krischners beater – Scutching – Single process scutcher – cages, Shirley wheel, Lap forming unit, lap – measuring motion, auto Doffing mechanism – piano feed regulating mechanism, reserve bin & photo cell arrangement – Two way distributor, dust filter bags, dust trunks, pneumatic delivery boxes, magnetic traps – lap defects – their causes and remedies – modern blow room line and chute feeding system – beater

speed, cleaning efficiency of beater, cleaning efficiency of blow room – Hank of lap, production, draft and efficiency of blow room.

**Carding:** Objects of Carding – principle of stripping and carding – passage of material in a revolving flat carding machine – functions of each part of carding machine – setting of flats – H&B flexible bends – Heal and Toe arrangement – Philipson's brush – types of waste in carding & percentage – defects in carding and remedial measures – Tandem carding – stripping and Grinding of cards – Traverse grinder – vacuum stripper – fibre hooks – Leading & Tailing hooks – Setting on quality and waste extraction.

**Modern Developments in Carding & Calculations:** Features of LR C 1/3 Card – Developments in Feed part and Licker – in region – Cylinder region – condensing region and Web doffing mechanism, Coiler mechanism – India roll – Cross roll – Auto levellers – closed loop & Open loop auto levellers – Shirley pressure point system – Automatic waste extracting system – Automatic doffing – Automatic stop motions in cards – calculation of Speed, Draft and Draft constant, production and efficiency in Card – Lap exhausting time, Can fill time in Card.

**Draw Frames & Lap Formers and Comber:** Draw frame process – principle of roller drafting – passage of material through a modern draw frame – principle of roller setting – roller weighting – electrical and electronic stop motions – auto levellers – top & bottom rollers – roller cleaning devices – polar drafting system – Platts pressure bar systems – defects in silver – their causes and remedies. Silver lap machine – objects – L.R. silver lap machine – Ribbon lap machine – Objects – Super lap machine – Objects of combing – passage of material through a comber – Nasmith comber – Half lap – Nipper – Top comb – Feed roller – Detaching roller – waste percentage – modern developments in combing – combing defects – causes and remedies – post comb drawing.

**Simplex:** Objects of speed frame process – high drafting system – bottom rollers – top rollers, and weighting of top rollers – condensers & spacer – spindle and flyer – false twister – collar – spindle rail – bobbin rail – bobbin leading and flyer leading – T & S and Sun & planet differential motion – building motion – features of Rovematic speed frames – defects in roving – their causes and remedies.

**Ring Frames:** Objects of ring frames – types of creels – apron drafting – SKF PK211, SKF PK 225 – LR drafting system – spacers – condenser – roller clearers – ring, traveller, spindle, ring rail and spindle rail, separator, traveller cleaner – tin roller – 'Z' twist and 'S' twist – bobbin building – yarn defects – causes and remedies.

**Calculations:** Main draft, break draft, main draft constant, break draft constant, hank of silver in drawing frame – production and efficiency, draft, hank of lap, production and efficiency in silver lap machine. Production, efficiency and draft in comber – break draft, main draft, break draft constant, main draft – constant and hank of roving of simplex – production & efficiency of simplex.

**Modern Developments in Ring Spinning:** Developments in drafting region – advantages – SKF – PK 225 – INA-V drafting system – Developments in twisting region – traversing thread guide and balloon control rings – advantages and limitation – special finishes to rings – special finishes to travellers – S-twist and Z-twist – traveller number – running in period of ring frame – energy saving spindle – variable

speed spinning – auto doffing mechanism – long length frames – compact spinning – Elite compact spinning – advantages of compact spun yarns – super high drafting system.

**Advanced Yarn Manufacturing:** Advanced yarn manufacturing systems – open end Rotor spinning – principle of Rotor spinning – feed part – opening roller – rotor – rotor grooves – effect of rotor speed on yarn quality – relation between rotor speed, rotor diameter and yarn draw off tension – Navel – doff tube – Take-up roller – Traverse guide – Winding head – vacuum in spin box – advantages of open end spinning over ring spinning – limitations of open end spinning – Friction spinning – DREF-I friction spinner – DREF – II friction spinner – Air jet spinning – Siro spinning.

**Doubling and Fancy Yarn:** Types of doubled yarn – Twist and twist direction effects – methods of doubling – styles of doubling – types of doubling machine – preparatory process for doubling – Ring doubler – stop motions – two for one twister [ TFO ] – Function of various parts for Two for one twister – advantages of Two for one twister – Three for one Twister – Advantages of three for one twister over two for one twister – Manufacture of Sewing threads – Manufacture of tyre cord – Fancy doubling – fancy yarn – Reeling – yarn conditioning – plain reel and cross reel – types of reeling – bundling and baling.

**Introduction and Process Control in Mixing & Spinning Preparation:** Objects of process control – 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 – control of mixing quality and cost – stimulations control of mixing quality and cost – linear programming for cotton mixing – the application of linear programming in a Mill – The control of yarn realization – Records for estimating yarn realization and waste – Norms for yarn realization. Control waste in cleaning in blow room and carding – determination of trash content and cleaning efficiency – norms for waste and cleaning efficiency in blow rooms and cards – assessing the performance of a blow room – locating and improving machines with substandard performance – optimizing cleaning at cards – control of comber waste – optimum level of comber waste – norms for improving mean length in combing – The need for routine check of comber waste – procedure of control of comber waste – control of silver evenness – control of stretch at fly frames – assessment and control of variability in blow room and draw frames – control of selective 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 – improving mechanical conditions in ring frame – renovation at ring frame to reduce end breaks – control of yarn quality, count, strength and their variability – assessing process capability for count control – reducing within bobbin count variation – reducing between bobbin count variation – routine control of count – control of variability in lea strength – meeting the requirement of yarn strength – Factors affecting yarn strength – norms for yarn strength – control of yarn quality – unevenness and imperfections – measurement of unevenness – types of yarn



irregularity – random irregularity and periodic irregularity – control of yarn irregularity – causes of yarn irregularity – yarn faults and package defects.

**Calculations:** Ring frame – draft, twist and production calculation – 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

### **Fabric Manufacture**

**Basic Mechanisms of Looms:** Basic mechanisms in power loom. Importance of Primary motions – principles of Shedding – Differentiate 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 motion – working of Under Pick motions – Method of Altering Picking Force and Setting of Picking band – Timing and Setting of Cone Over Pick – Discuss the beating operation – Illustrate and explain the working of beating mechanism – Calculate the eccentricity of the Sley.

**Warp Winding and Weft Winding:** Objects of Warp Winding – working of Warp Winding Machines – 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 over ordinary slub catchers – 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 – Schweiter high-speed automatic pirn winder – defects in pirns, their causes and remedies.

**Warping Sizing and Drawing:** Objects of warping – beam warping and sectional warping – Ruti high speed warper – functions of various components of a warping machine – creel – Thread stop motion – length measuring motion – Head stock – Expanding Comb - doffing motion – Brake Motion – Driving Drum – Tensioners – 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 – functions of the various controls in a modern sizing machine like – Temperature, size level, stretch, moisture, viscosity – size recipe for coarse, medium and fine cotton yarns – defects in sized beams – precautions to be taken for sizing synthetics and blends – improved fibre lay – after waxing – Healds and Reeds – objectives of drawing – in and denting – selection of suitable healds and reeds for different fabrics.

**Yard Count and Production Calculation:** The different methods of Yarn Numbering Systems – English, French, Metric, Denier, Tex – direct and indirect systems of yarn numbering - equations for calculating 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 – ends per section and the number of sections required per set – sized yarn weight, un-sized yarn weight and size percentage – production, speed and efficiency of sizing machines.

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

**Auxiliary Motions:** Side weft fork and centre weft fork motions – working of side weft fork motion with sketch – working of centre fork motion with sketch – 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 with neat sketch – working of electrical warp stop motion with neat sketch – objects and types of warp protector motions – working of loose reed motion – the working of fast reed motion – the objects of brake motions – the working of brake motion – the objects and general description of brake motions – the objects and general description of check strap – the objects and general description of Temples – timing and setting of auxiliary motion.

**Dobby Shedding:** Various classification 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 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 and steadying mechanism in doobby.

**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 – working of Double Lift Single Cylinder Jacquard – working of Double Lift Double Cylinder Jacquard – working of Cross Border Jacquard – harness mounting like London and Norwich systems – harness ties and various types of harness ties like straight tie, centre tie, mixed tie – 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 commands to produce a Jacquard design fabric simulation – analysis of a Jacquard design fabric and to produce fabric simulation in different colour combinations – take graph print outs as per the requirements of loom and design creation – step by step commands to produce stripe and cross over designs – step by step commands to produce check designs – analysis of a doobby design fabric to produce the fabric simulation in different colour combinations – calculation sheet for a fabric with costing and printouts of doobby fabric – simulation and design details – step by step commands to produce a printed design and its colour separations – step by step commands to make a texture mapping on various objects and models with new designs created in other software – create yarn using computer software – create a yarn library using different count and quality

– automatic creation of draft and peg plan from weaves – use of menu driven software.

**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 Vs Circular boxes – Skip Vs Nonskip – Pick at will / Pick and Pick. Working of Eccle’s Drop box motion – 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 Dugdale’s Terry motion – working of Holden’s Terry motion.

Features of automatic looms – classification of automatic looms – advantages of automatic looms – compare automatic and non-automatic looms. Working of midget weft feeler mechanism – Timing and setting – Features of two prong electrical feeler and photo electric 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 – advantages of shuttle less weaving machines. The various stages of weft insertion in Sulzer shuttle less weaving machine with 4 colour weft insertion – Torsion bar picking mechanism – working of cam beat – up. Mention the quality of Sulzer woven cloth – Give brief note on warp and weft preparation for shuttle less weaving. Rapier shuttle less weaving – various classifications of Rapier shuttle less looms – merits, demerits and limitations of Rapier 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 – merits, demerits and limitations of water jet looms. Comparison charts of popular shuttleless looms.

**Calculations:**

Calculate the production and efficiency of power looms – Evaluate the times required for the exhaustion of a weavers beam – Evaluate the time required for the exhaustion of a pirn, cone etc – Estimate the number of pirns required for the loom in a given time – Estimate the number of pirns / cones required to produce a particular quantity of fabric – Compute the number of pirn winders required to feed a given number of looms – Estimate the number of warping machines required to feed the given number of looms – prepare a chart showing the standard loom speeds for various widths of plain and automatic looms – Find out the quantity of warp and weft required to weave a particular fabric. Find out the cost of different types of fabrics.

**Manufacture of Non-wovens:** Definition of non-wovens – classification of Non-wovens – stages involved in the production of Non-woven fabrics – comparison between woven and non-woven 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 needling loom – study of various methods of chemical bonding – study of various methods of thermal bonding – prepare a chart showing the important properties of woven and non-woven fabrics – discuss the limitations of non-woven fabrics.

**Knitted Structure:** Definition of Knitting – Classification of Knitting – Compare woven and knitted structures – compare the process of knitting and weaving – Define the term – 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.

**Warp & Weft Knitting:** Machine – 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 Inter Lock – passage of Yarn through 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 and protective coverings, Bullet proof fabrics, Fire Proof Fabrics, Agriculture fabrics, Shoe fabrics, Parachute fabrics – Study of Geo Textiles – Application of Geo Textiles – Medical Textiles, Medical Fabrics, Surgical Dressings.

**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 headless and reeds – Selection of proper reed and heald – Effect reed parameters on weavability of yarn – Control of productivity in loom shed – control of loom speed – Control of efficiency variable – Staggering of heald – improving production by snap

reading – 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 spinning and weaving – Balancing of machinery for different capacity of spindles – Balancing machineries from winding to loom shed for 100, 200, 400, 600 loom capacities – Essential factors in textile costing – process cost per Kg of finished yarn – Process cost particulars from blow room to spinning – Cost / meter of finished fabric – Determination of Ex-mill cost of one meter of fabric.

### **Fabric Structure, Fashion Design and Garment Technology**

**Plain and Twill Weaves:** Application of Point paper in textile Designing – count of point paper and definition – 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 cork – screw and weft cork – screw 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 honey comb, Brighton's honey comb – features of Huck – a – Back fabrics – Construction of Devon's Huck – a – Back, 10 X 10 Huck – a – Back, Honey comb 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, Half the pile over each wire – 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, Corded velveteen with twill as ground weaves – Features of crepe weaves – Different systems of constructing crepe weaves – By adding marks to satin weaves, Combining plain threads with a floating weave, Inserting one weave over another, Reversing a small repeat, Chemical treatments used to impart crepe effects – Principle of seer sucker 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, Plain one shuttle of pique, 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 – Construct 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 – Plain shed, open shed and cross shed formed in cross weaving with bottom douping – Differentiate mock leno and huck – a – back and compare their draft and lifting plan – 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 lay out – 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 – 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 – button hole, 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.

## **Textile Testing, Errection and Maintenance of Textile Machinery**

**Elements of Statistics, Humidity and Moisture:** Definition of Textile Testing – Definition of quality assurance – objects of Textile Testing – Importance of statistics – Definition 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 air flow and fibre fineness – Determination of fibre fineness – Importance of fibre strength – Different strength technologies – Stress-strain curve for different – Elastic property – 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 – Importance of FQI and its relation to lea CSP – 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 by – 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 – Define air permeability – air

permeability, air resistance and air porosity – Shirley air permeability tester – water permeability and water repellency – Bundesmann water permeability tester.

**Introduction to Maintenance of Workshop Machinery:** List the types of maintenance and application – State new methods introduced in textile machinery maintenance – The duties and responsibilities of maintenance supervisor – Introduce work order procedure, store control – State the importance of work – study techniques – purpose and working of various types of fundamental workshop machineries – Calliper, micrometer, Feeler gauge, Dial gauge, Height & depth gauge – Express the principle of annealing, normalizing, hardening, tempering, carburizing & case hardening – State different types of bearings and functions – State 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 – Erect various textile machineries – Erection tools and equipments – Measure the vibration of textile machineries – Dampers – functions – Balancing – types.

**Maintenance of Textile Machineries:** The maintenance schedules for different spinning machineries – overhauling maintenance schedules of spinning machineries – Identify the defects due to improper maintenance – maintenance schedule during strike and lay-off periods.

Introduce safety precautions & maintenance of safety equipments in textile mill. The maintenance schedule for different preparatory sections – The maintenance schedule for loom shed – Overhauling schedule of machineries in preparatory and weaving department – The defects due to improper maintenance.

The maintenance schedule for dyeing & processing machineries.

***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***