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 ± B), cos (A ± B) and tan (A ± 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**


**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**


**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, scotchting, 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.


**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 Ziengler 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.

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


**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.


**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.


**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.

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


**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.

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

**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**


**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.


**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 dobby design fabric to produce the fabric simulation in different colour combinations – calculation sheet for a fabric with costing and printouts of dobby 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:**


**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.


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 selvedges. 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
Fabric Structure, Fashion Design and Garment Technology


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.


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


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.

**Errection 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.