

TEXTILE ENGINEERING AND FIBRE SCIENCE (TF)

General Aptitude

Verbal Ability: English grammar, sentence completion, verbal analogies, word groups, instructions, critical reasoning and verbal deduction.

Numerical Ability: Numerical computation, numerical estimation, numerical reasoning and data interpretation.

ENGINEERING MATHEMATICS

Linear Algebra: Matrices and Determinants, Systems of linear equations, Eigen values and eigen vectors.

Calculus: Limit, continuity and differentiability; Partial Derivatives; Maxima and minima; Sequences and series; Test for convergence; Fourier series.

Vector Calculus: Gradient; Divergence and Curl; Line; surface and volume integrals; Stokes, Gauss and Green's theorems.

Differential Equations: Linear and non-linear first order ODEs; Higher order linear ODEs with constant coefficients; Cauchy's and Euler's equations; Laplace transforms; PDEs – Laplace, heat and wave equations.

Probability and Statistics: Mean, median, mode and standard deviation; Random variables; Poisson, normal and binomial distributions; Correlation and regression analysis.

Numerical Methods: Solutions of linear and non-linear algebraic equations; integration of trapezoidal and Simpson's rule; single and multi-step methods for differential equations.

Textile Fibers

Classification of textile fibers; Essential requirements of fiber forming polymers; Gross and fine structure of natural fibers like cotton, wool, silk, Introduction to important bast fibres; properties and uses of natural and manmade fibres including carbon, aramid and ultra high molecular weight polyethylene (UHMWPE) fibers; physical and chemical methods of fiber and blend identification and blend analysis.

Molecular architecture, amorphous and crystalline phases, glass transition, plasticization, crystallization, melting, factors affecting T_g and T_m ; Production process of viscose and other regenerated cellulosic fibres such as polynosic, lyocell. Polymerization of nylon-6, nylon-66, poly (ethylene terephthalate), polyacrylonitrile and polypropylene; Melt Spinning processes for PET, polyamide and polypropylene; Wet and dry spinning processes for viscose and acrylic fibres; post spinning operations such as drawing, heat setting, tow-to-top conversion and different texturing methods.

Methods of investigating fibre structure e.g., Density, X-ray diffraction, birefringence, optical and electron microscopy, I.R. spectroscopy, thermal methods (DSC, DMA/TMA, TGA); structure and morphology of man-made fibres, mechanical properties of fibres, moisture sorption in fibres; fibre structure and property correlation.

Yarn manufacture, Yarn structure and Properties

Principles of opening, cleaning and mixing/blending of fibrous materials, working principle of modern opening and cleaning equipment; the technology of carding, carding of cotton and synthetic fibres; Drafting operation, roller and apron drafting principle, causes of mass irregularity introduced by drafting; roller arrangements in drafting systems; principles of cotton combing, combing cycle, mechanism and function, combing efficiency, lap preparation; recent developments in comber; Roving production, mechanism of bobbin building, roving twist; Principle of ring spinning, forces acting on yarn and traveler, ring & traveler designs, mechanism of cop formation, causes of end breakages; Working principle of ring doubler and two for one twister, single and folded yarn twist, properties of double yarns, production of core spun yarn; Principles of compact, rotor, air jet, air vortex, core, wrap, twist less and friction spinning.

Yarn contraction, yarn diameter, specific volume & packing coefficient; Twist factor, twist strength relationship in spun yarns; Fibre configuration and orientation in yarn; Cause of fibre migration and its estimation; Irregularity index; Structure property relationship of compact ring, rotor, air-jet and friction spun yarns.

TEXTILE ENGINEERING AND FIBRE SCIENCE (TF)Fabric manufacture, Structure and Properties

Principles of winding processes and machines, random, precision and step precision winding, package faults and their remedies; Yarn clearers and tensioners; Different systems of yarn splicing; Features of modern cone winding machines; Different types of warping creels; features of modern beam and sectional warping machines; Different sizing systems, sizing of spun and filament yarns, sizing machines; Principles of pirn winding processes and machines.

Primary and secondary motions of loom, cam design & kinematics of sley, effect of their settings and timings on fabric formation, fabric appearance and weaving performance; Dobby and jacquard shedding; Mechanics of weft insertion with shuttle, warp and weft stop motions, warp protection, weft replenishment; Principles of weft insertion systems of shuttle-less weaving machines; Principles of multiphase and circular looms.

Principles of weft and warp knitting, basic weft and warp knitted structures; Classification, production, properties and application of nonwoven fabrics, principle of web formation & bonding.

Basic woven fabric constructions and their derivatives; crepe, cord, terry, gauze, leno and double cloth constructions. Peirce's equations for fabric geometry; elastica model of plain woven fabrics; thickness, cover and maximum set of woven fabrics.

Textile Testing

Sampling techniques, sample size and sampling errors; Measurement of fibre length, fineness, crimp,; measurement of cotton fiber maturity and trash content; High volume fibre testing; Measurement of yarn count, twist and hairiness; Tensile testing of fibers, yarns and fabrics; Evenness testing of slivers, rovings and yarns; Classimat fault analysis; Testing equipment for measurement of fabric properties like thickness, compressibility, air permeability, wetting & wicking, drape, crease recovery, tear strength, bursting strength and abrasion resistance; Instruments and systems for objective evaluation of fabric hand. Statistical analysis of experimental results, frequency distributions, correlation, significance tests, analysis of variance and control charts.

Chemical processing

Impurities in natural fibre; Chemistry and practice of preparatory processes for cotton, wool and silk; Mercerization of cotton; Preparatory processes for manmade fibres and their blends.

Classification of dyes; Dyeing of cotton, wool, silk, polyester, nylon and acrylic with appropriate dye classes; Dyeing of polyester/cotton and polyester/wool blends; Dyeing machines; Dyeing of cotton knitted fabrics and machines used; Dye fibre interaction; Introduction to thermodynamics and kinetics of dyeing; Methods for determination of wash, light and rubbing fastness.

Styles of printing; Printing thickeners including synthetic thickeners; Printing auxiliaries; Printing of cotton with reactive dyes, wool, silk, nylon with acid and metal complex dyes, Printing of polyester with disperse dyes; Pigment printing; Resist and discharge printing of cotton, silk and polyester; Transfer printing of polyester; Inkjet printing.

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