Syllabus
for
Textile Engineering (MTQP12)

Note:

i. The Question Paper which will have 75 questions.

ii. All questions will be based on Subject-Specific Knowledge.

iii. All questions are compulsory.

iv. The Question paper will be in English.

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Section 1: Textile Fibres

Classification of textile fibres; Essential features of fibre forming polymers; fine structures of natural fibres like cotton, silk, wool, ; Introduction to bast fibres; Properties and applications of natural and man-made fibres including aramid, carbon, glass and ultra-high molecular weight polyethylene fibres; Physical and chemical methods of fibre and blend identification and blend analysis. Molecular architecture, amorphous and crystalline phases, glass transition, plasticization, crystallization, melting, factors affecting glass transition and melting temperature; Polymerization of nylon-6, nylon-66, poly (ethylene terephthalate), polyacrylonitrile and polypropylene fibre forming polymers; Melt spinning processes for PET, polyamide and polypropylene; Principles of wet spinning, Preparation of spinning dope; dry spinning, dry-jet-wet spinning and gel spinning; Spinning of acrylic, viscose and other regenerated cellulosic fibres such as polynosic and lyocell; Post spinning operations such as drawing, heat setting, tow-to-top conversion; Spin finish composition and applications; Different texturing techniques. Fibres characterization techniques such as density, x-ray diffraction, birefringence, optical and electron microscopy such as SEM and TEM, Infrared spectroscopy, thermal characterization by differential scanning calorimetry (DSC), Dynamic mechanical analyser (DMA), TMA and thermogravimetric analysis (TGA); Structure and morphology of man-made fibres; Mechanical behaviour of textile fibres; Concept of moisture sorption of fibres; Influence of fibre structure on fibre properties.

Section 2: Yarn Manufacture

Concept of yarn manufacturing and Yarn Properties, Principles of ginning; Principles of opening, cleaning and blending of fibres; Concept and description of modern blow room machines; Fundamentals of carding; Comparision between conventional and modern carding machine; Card setting; Card clothing; Carding defects and remedies, Card auto leveller; Principles of roller drawing; Roller arrangements in drafting systems; Periodic mass variation in drawn sliver; Draw frame auto leveller; Principles of cotton combing; Combing cycle and mechanisms; Recent developments in combing machine; Principles of drafting, twisting, and bobbin building in roving forming machine ; Modern developments in simplex machine; Principles of drafting, twisting and cop building in ring spinning; Causes of end breakages in Ring Frame during yarn formation; Modern developments in ring spinning machine; Working principles of ring doubler and two-for-one twister; Concept of yarn twist, Relationship between single yarn twist and folded yarn twist; Principles of compact, rotor, air-jet, air-vortex, friction, core, wrap and twistless spinning processes. Influence of fibre geometry, fibre configuration and fibre orientation in yarn; Fibre packing density of yarn; Yarn diameter; Yarn twist

and its relation to yarn strength; Helical arrangement of fibres in yarns; Fibre migration in yarns; Stress-strain relation in yarn; Mass irregularity of yarn; Comparison among ring, compact, rotor, air-jet and friction spun yarns

Section 3: Fabric Manufacture

Principles of yarn winding processes; Classification of winding methods; Patterning mechanism; Yarn clearers and tensioners; Different systems of yarn splicing; Warping objectives and classification; Different types of warping creels; Features of beam and sectional warping machines; Different sizing systems; Sizing of spun and filament yarns; Quality control during sizing process: different sized yarn drying systems, different techniques of warp yarn sizing: Sizing ingredients: Drawing-in process; Principles of pirn winding. Primary and secondary motions of loom; Shedding motion; Positive and negative shedding mechanisms; Type of sheds; Tappet, dobby and jacquard shedding; Weft insertion; Mechanics of weft insertion with shuttle; Shuttle picking and checking; Beat-up; Kinematics of sley; Loom timing diagram; Cam designing; Take-up and Let-off motions; Warp and weft stop motions; Warp protection; Weft replenishment; Principles of weft insertion systems of shuttle-less weaving machines such as projectile, rapier, water-jet and air-jet; Principles of functioning of multiphase and circular looms; Different types of rapier systems: Types of selvedges. Basic woven fabric constructions and their derivatives; Crepe, cord, terry, gauze, leno and double cloth constructions; Drawing and lifting plans. Fundamentals of weft knitting; Classification of weft knitting technologies; Weft knitted constructions such as plain, rib, interlock and purl; Different knit stitches such as loop, tuck and float. Principle of warp knitting; Classification of warp knitting technologies; Swinging and shogging motion of guide bar; Basic warp knit construction such as pillar, tricot, atlas, inlay and nets. Fibre preparation processes for nonwovens; Web formation and bonding processes; Spun-bonding and melt-blowing technologies; Applications of nonwoven fabrics. Principles of braiding; Type of braids; Maypole braiding technology. Peirce's equations for plain woven fabric geometry, basic calculation of production, efficiency, yarn requirement, machine requirement.

Section 4: Textile Testing

Sampling techniques for fibres, yarns and fabrics; Sample size and sampling errors. Moisture in textiles; Fibre length, fineness, crimp, maturity and trash content measurement; Tensile testing of fibres; High volume fibre testing. Linear density of sliver, roving and yarn; Twist and hairiness of yarn; Tensile testing of yarns; Evenness testing; Fault measurement and analysis of yarns by Classimat and Classifault system . Fabric thickness, compressibility, stiffness, shear, drape, crease recovery, tear strength, bursting strength, pilling and abrasion resistance; Tensile testing of fabrics; Objective evaluation of low stress mechanical characteristics; Air permeability; Wetting and wicking; Water-vapour transmission through fabrics; Thermal resistance of fabrics. Contact angle measurement for water proofness and water repellence.

Section 5: Chemical Processing

Impurities in natural fibre; Singeing; Chemistry and practice of preparatory processes for cotton; Preparatory processing of wool and silk; Mercerization of cotton; Preparatory processes for manmade fibres and their blends; Optical brightening agent.

Classification of dyes; Dyeing of cotton, wool, silk, polyester, nylon and acrylic with appropriate classes of dyes; Dyeing of polyester/cotton and polyester/wool blends; Dyeing machines; Dyeing processes and machines for cotton knitted fabrics; Dye-fibre interaction; Introduction to thermodynamics and kinetics of dyeing; Brief idea about the relation between colour and chemical

constitution; Beer-Lambert's law; Kubelka-Munk theory and its application in colour measurement; Methods for determination of wash, light and rubbing fastness. Methods of printing such as roller printing and screen printing; Preparation of printing paste; Various types of thickeners; Printing

auxiliaries; Direct styles of printing of (i) cotton with reactive dyes, (ii) wool, silk, nylon with acid and metal complex dyes, (iii) polyester with disperse dyes; Resist and discharge printing of cotton, silk and polyester; Pigment printing; Transfer printing of polyester; Inkjet printing; Printing faults. Mechanical finishing of cotton; Stiff, soft, wrinkle resistant, water repellent, flame retardant and enzyme (bio-polishing) finishing of cotton; antimicrobial, soil resistance and nanofinish: 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