

**List of Courses for the M.Engg. Programme in Textile Engineering**

<b>S.No.</b>	<b>Course No.</b>	<b>Course Title</b>	<b>Credit Hours</b>
		<u>Compulsory Courses</u>	
01	TE 501	Textile Quality Assurance	03
02	TE 502	Textile Printing	03
03	TE 503	Processes for Cotton Dyeing	03
04	TE 504	Automation & Control	03
05	TE 505	Advanced Statistics	03
		<u>Elective Courses</u>	
			03
01	TE 506	Fibre Engineering Science	03
02	TE 507	Fibre Forming Polymers	03
03	TE 508	Advanced Finishing Processes	03
04	TE 509	Colour Physics & Measurement	03
05	TE 510	Engineering in Textile Colouration	03
06	TE 511	Physico-Chemical Processes in Textiles	03
07	TE 512	Advanced Yarn Engineering	03
08	TE 513	Advanced Weaving Engineering	03
09	TE 514	Independent Study Project (For M.Engg. Morning Programme)	
10	TE 515	Technical Textiles	03
11	TE 516	Supply Chain Design & Management	03

**Note:** One course on Computer Applications (MS 553) may be recommended by the Chairman as a non-credit course.

**5.2.6 Detailed Contents of Courses for M.Engg. Programme in Textile Engineering**

**Compulsory Courses**

**TE 501 Textile Quality Assurance (Credit Hours: 3)**

Quality Assurance: Concepts (various definitions and approaches) used for quality, significance and applications of quality control. Difference in quality control and quality assurance, and their uses.

Statistical techniques SPC, FMEA, and their influence on improving the quality of textile processes and products. Sampling and measuring methods used for determining fabric and yarn properties.

Spinning Process Control: Raw material control, and its effects on process, on- line and off- line process controls, yarn clearing control.

Weaving Process Control: Raw material control, on- line and off- line weaving process control, fault control.

Making- up Process and Its Relation with Fabric Properties: Characteristics and faults of fabrics, AEIH Recommendations (Part I & II), Care labelling: types and use.

### **TE 502 Textile Printing (Credit Hours: 3)**

Pigment Printing: Pigment printing background, pigments, pigment dispersion and its production. Binder systems, chemical nature of binders, cross- linking, effects of binder on print and fabric. Thickening systems- types of thickening systems (emulsion based- o/w and w/o emulsions; and fully aqueous systems). Explaining the advantages and disadvantages of pigment printing. Preparation and Properties of Print Paste. Equipment used, characteristics of pigment print paste. Rheology and viscosity, measurement of viscosity. Pigment print as head colour, and ground colour in discharge and resist printing technique.

Machines for Textile Printing: Elaborating the elements, including belt and adhesive system, screen drives, squeegee systems, and speed, for the Rotary screen printing machine and flat belt printing machine.

Reactive and Disperse Dye Printing: Available range of dyestuffs, comparison and limitations of dyestuffs, effects and properties of printed fabric using various dyes, discharge and resist printing.

Thickener Systems: Choice of thickener system, properties, merits and effects on quality of printed fabric.

Printing Methods and Procedures: Principals for the use of all- in method and two-stage method for the printing of cotton, and the associated effects on the print quality. Methods for the printing of cotton blends. Dry heat fixation and steam fixation techniques for the printing of cotton and its blends. Effects of drying time, temperature and steaming conditions on the quality of printed fabric. Types of washing processes, washing processes for the printed cotton and its blend for various dyestuffs.

### **TE 503 Processes for Cotton Dyeing (Credit Hours: 3)**

Cotton Fibres and Blends: The origin and production of cotton fibres, factors determining its length, fineness and strength, morphology of cellulose macromolecules, structural characteristics of cellulose fibres for dyeing. Purpose of blending cotton fibres, modification in the properties of cotton fibres caused by the blending, effects of blending on the dyeing properties of fibres.

Dyeing Processes of Cotton and Its Blends: Processes and Machines related to the dyeing process of cotton and its blends, principals of batch wise dyeing, exhaust dyeing, semi continuous dyeing, and continuous dyeing.

Semi continuous Dyeing of Cotton and Its Blends: Methods of discontinuous dyeing, Types of machine used, Processing technologies (processing conditions and parameters affecting the quality of dyeing. Tests for the process quality

Continuous Dyeing of Cotton and Its Blends: Methods of continuous dyeing. Thermosol dyeing of cotton and polyester, Types of machine used for continuous and thermosol

dyeing. Steaming and washing processes. Processing technologies (processing conditions and parameters affecting the quality of dyeing. Tests for the process quality.

Dyes for Cotton: Dyes for cotton fibres, basic chemical structure, dyeing properties and their relation with the chemical structure and properties

Chemical Auxiliaries in Dyeing of Cotton: Explaining the use of auxiliary chemicals used in the dyeing of cotton and its blends with polyester, viscose and other cotton blend used in national textile industry.

### **TE 504 Automation and Control (Credit Hours: 3)**

Production Operations & Automation Strategies: Automation defined; Types of automation; Reasons for automation; Manufacturing industries; Types of production; Functions in manufacturing; Organization & information processing in manufacturing; Plant layout; Production concepts & mathematical models; Automation strategies.

Automotive Type Automation: Automated flow lines: Methods of workpart transport; Transfer mechanism; Buffer storage; Control functions; Automation for machining operations; Design & fabrication considerations; General terminology & analysis; Analysis of transfer lines without storage; Partial automation; Automated flow lines with storage buffers; Computer simulation of automated flow lines.

Assembly Systems & Line Balancing in Textile Production: The assembly process in textiles; Assembly systems; line balancing problem. Flexible manual assembly lines; Types of automated assembly systems, Analysis of single and multi-station machines.

Process Control: Modeling and Analysis, Computer Assisted Optimal Control; Structural model of a Manufacturing process; Steady state optimal control; Adaptive Control.

Computer Process Control: The computer-process interface; Interface hardware; Computer process monitoring; Types of computer process control; Direct digital control; Supervisory computer control. Programmable Logic Controllers (PLC's).

### **TE 505 Advanced Statistics (Credit Hours: 3)**

Probability Distributions & Transformation of Variables: Uniform, Binomial, Hypergeometric, Poisson. Normal, Exponential, Chi-square, F, & T distributions; Random sampling; Sampling distribution of mean; Central limit theorem.

Statistical Inference & Hypothesis Testing: Confidence & significance level; Sample size determination; Point & interval estimates; Interval estimates for population mean, population standard deviation, & population proportion. Type I, & type II errors; One tail & two tail tests; Tests concerning means & variances.

Linear & Multiple Linear Regression & Correlation: Simple linear regression; Properties of least square estimates; Confidence limits & tests of significance; Choice of a regression model; Correlation. Estimating the coefficients; Adequacy of the model.

Analysis of Variance: One way classification; Tests for the equality of several variances; Single degree of freedom comparisons; Multiple range test; Comparing treatment with a control; Comparing a set of treatments in blocks; Randomized complete block design; Random effects model.

Factorial Experiments: Two-factor experiments; Interaction in two-factor experiments; Two-factor analysis of variance; Three-factor analysis; Choice of sample size.

2<sup>K</sup> Factorial Experiments: Yate's technique for computing contrasts; Factorial experiments in incomplete blocks; Fractional factorial experiments; Analysis of fractional factorial experiments.

### **Elective Courses**

#### **TE 506 Fibre Engineering Science (Credit Hours: 3)**

Fibre Properties: Fibre length and its effects on properties, measurement of fibre length, fibre density, fineness, crimp. Transverse dimensions of fibres.

Absorption of water: Behaviour of cellulose and synthetic fibres in water, moisture regain, moisture content, water retention, swelling. Fibre and Yarn Conditioning

Fibrous Structures: Molecular arrangement and structures in fibres and their effects on mechanical and physical properties.

Strength characteristics: Tensile properties, breaking load, elongation at break, tear strength, factors determining the tensile and tear strength.

Measurement of Mechanical Properties: Heat setting treatments (natural and thermoplastic substrates). Static electricity -concepts, effects and measurement. Optical properties -concepts, effects and measurement.

#### **TE 507 Fibre Forming Polymers (Credit Hours: 3)**

Polymer and Synthetic Fibre Chemistry: Polymers, polymer chemistry, types of polymers, polymerisation, polymerisation of synthetic textile polymers- nylon, polyester, acrylics, modacrylics, flame retardant polymers, factors affecting the structure of polymers.

Fibre Characteristics and Engineering Properties: Effects of chemical structure of synthetic fibres on their properties, including engineering and high performance characteristics.

Scientific and Industrial Methods: Instruments and techniques used in the characterization of man- made fibres.

Significance of Characterization: Types of synthetic fibre characterization- molecular, physical, microscopic and thermal.

Production of Synthetic Fibres: Polymer extrusion processes and its effects on the fibre characteristics.

#### **TE 508 Advanced Finishing Processes (Credit Hours: 3)**

Types of Finishing Processes: Introduction to the types of textile finishing and chemical finishing processes. Requirements for water to be used in finishing- quality, softening

conditions, hardness and softness, water softening systems and effects of water on the finishing process.

Finishing Processes: Principal chemicals and auxiliaries used in the post- coloration finishing processes, effects of chemicals and auxiliary on the finishing processes. Formulation composition, physical conditions (pressure, temperature, liquor pick- up) and their effects on the process end- results. Details (formulation and processing method) for the following processes: Water- proofing, flame- proofing, antiseptics, oil- repellancy, soil- release finishing, softening of textiles, bluing (OBA treatments).

Quality Control: Quality control tests for finishing processes and the chemical used. Quality control tests for the finished textile products.

### **TE 509 Colour Physics and Measurement (Credit Hours: 3)**

Light sources and light interactions, photo physics, photo chemistry and light fastness, colour-order system, colour spaces and differences, recipe prediction for textile.

Colour Measuring Instruments: Spectrophotometer and colorimetry. Instrumental Colour Measurement of Textile Substrates: Visible spectrophotometers, uv/ vis spectrophotometers, factors involved in the colour measurement, significance and reliability of colour matching in textile dyeing and printing using spectrophotometer, accuracy and precision of available spectrophotometers. Kubelka and Monk expression for colour strength (K/S) assessment.

Colour Assessment Systems: CIE standard illuminants and system, CIE Lab, CMC Formula, Colour Order System, Colour Scales, Colour Spaces.

### **TE 510 Engineering in Textile Colouration (Credit Hours: 3)**

Course is under development.

### **TE 511 Physico-Chemical Processes in Textile (Credit Hours: 3)**

Physico-chemical Processes: Methods, materials and equipments used in: Coagulation and flocculation, sedimentation, filtration, adsorption, ion-exchange, membrane processes, chemical oxidation, distillation, sludge, dewatering, drying, centrifuges and conversion (combustion). Techniques used for the decolourisation of used dye bath. Dewatering and sizing of pigment cakes. Uses of chromatography in textile industry.

### **TE 512 Advanced Yarn Engineering (Credit Hours: 3)**

Yarn Manufacturing: Production processes for continuous filament, staple, novelty, bulk and stretched yarns. Explanations and discussions of stress- strain properties of nylon, polyester, viscose, aramid, spandex, sara, glass and metallic fibres.

Fibre Blending: Blends, blending system, processing of blend and synthetic staple fibres into yarn. Blending of cotton with man- made fibres.

PET Production Equipment: Equipment used for the production of polyester fibres, starting from the PET chips- study of equipment and material, and their effects on process.

Manufactured Fibres (Synthetic Fibres): Manufacturing process (brief), properties and application (uses) of Viscose Rayon, Lyocell, Polyamide, Acrylic.

### **TE 513 Advanced Weaving Engineering (Credit Hours: 3)**

Fabric Design and Development for Various Applications: Design and development of woven fabric structure for various applications including those in clothing, furnishing and industry. Development of fabrics for specific cover, weight and performance study of machines and devices used in the production of woven fabrics computer aided design and manufacturing tools. Design and construction of woven Fabrics. Effects of design and construction on the various physical properties of fabric gsm, performance.

Weaving Defects: Effects of yarn and fabric properties on weaving design and construction. Defects in woven fabrics, defects due fault yarn, and manufacturing mechanism and their effects on dyeing & finishing.

Principals, Mechanism and Functional Description: Principals, mechanisms and functional description of the machines and devices used in Air-Jet weaving, Rapier weaving. Projectile weaving and Water-Jet weaving.

Plant layout, Detailed study of supply chain management system of a weaving plant, Air conditioning for weaving plant, Automation and computer control weaving machine programming, electronic direct ordering system, CAD/CAM uses (examples with details), Production planning for weaving process. Planning considerations for the production of specific quality (design & construction) and quantity of woven fabric. Calculations used for the various aspects of woven fabric production including the machine production, efficiency, design/drawing, loom production, weaving cost, fabric gsm, material and labour cost and total cost.

Special Fabric Manufacturing: preparatory and weaving processes of Denim, geo-textiles, protective fabrics.

### **TE 514 Independent Study Project (Credit Hours: 3) (only for M.Engg. Morning Programme)**

Individual directed study in Textile Engineering projects in the chosen discipline. Project must be approved by faculty incharge prior to registration for the course. Written report and presentation of a Department Seminar based on material studied are required at the end of the semester.

### **TE 515 Technical Textiles (Credit Hours: 3)**

Definition and scope of Technical Textiles: Application of technical textiles in different fields of life such as Agriculture, Industry, Construction, Medical etc.

Development in fibre materials such as polyester, polyolefin, glass, high performance fibres for special applications in different technical products.

Technical products for automobiles: Seat belt system, Air bag system, Car interiors. Materials used, Manufacturing techniques and testing methods.

Protective Clothing; Ballistic body protection, Protection against heat and flame, Cold protective clothing, Physiological functions and parameters, Material used such as phase change material, Manufacturing techniques and testing methods.

### **TE 516 Supply Chain Design & Management (Credit Hours: 3)**

A broad view of management systems for inbound and outbound logistics planning, inventory control, transportation planning and facilities location decisions.

Key supply chain processes with particular reference to the textile and garment industry and the role of benchmarking in process improvements across the supply chain. Tools and techniques for process mapping.

Supply chain strategy for in-sourcing, out-sourcing and vertical integration. Computer software for the planning, design and coordination aspects of the supply chain.