Programme Objectives:
To enable to graduate students of Textile Technology to
1. Enhance their knowledge related to the theory textile processes and advances in processes
2. Design, conduct and interpret the results of the experiments, Design new process and product for textile industry
3. Manage research and development activities in textile industry, research organizations and
4. Enhance their skills for managing textile industry

Programme Outcomes:
Upon completion of the programme, the student shall be
a. Qualified to effectively teach the students at the undergraduate level
b. Able to develop new process or product at the textile industry or textile research organizations and
c. Qualified to effectively carry out fundamental and applied research.
d. Able to manage textile industry

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## M. TECH. TEXTILE TECHNOLOGY

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**Employability Enhancement Courses (EEC)**

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OBJECTIVES
To enable the students to learn various finishes applied on the textile fabrics for different applications.

UNIT I INKJET PRINTING
Concept and methods of inkjet printing; colour separation; selection of dyes and developments in inks; techno-economical features.

UNIT II ENZYMES IN PROCESSING
Enzymes; Enzymes Kinetics; Enzymes in Chemical processing

UNIT III COATING
Coating polymers and auxillaries; Coating techniques and Coated fabric assessment.

UNIT IV SOIL RELEASE AND ANTISTATIC FINISHING
Detergency and soil release concepts; soil release agents; applications of soil-release finishes and testing; antistatic finishes - measurement, mechanism and antistatic agents applied on substrates.

UNIT V UV PROTECTION AND APPLICATIONS OF NANOTECHNOLOGY
UV radiation; factors affecting UV protection; UV protection finishes; measurement of UV protection. Synthesis of Nanomaterials used in Textiles; Nanocoating methods on textile substrates.

TOTAL: 60 PERIODS

OUTCOME
Upon completion of this course, the student shall be able to state the Need for functional finishes and methods of application of finishes and its evaluation

REFERENCES
OBJECTIVES
To enable the students to learn about
- Fibre forming polymer characteristics and their related models and models describing fibre structure.
- Conducting of experiments to characterize the polymers and fibres

UNIT I
Synthetic fibre forming polymers, definition, terms and fundamental concepts of polymerization; molecular architecture in polymers—configuration and conformation, random chain model and rms end-to-end distance of polymeric chain

UNIT II
Glass transition temperature (Tg), Factors affecting Tg, WLF equation; Rubber Elasticity; Melting and Crystallization, polymer solutions—solubility parameter and its significance to fibre spinning.

UNIT III
Newton’s law of viscosity, velocity distribution in flow systems Newtonian and non-newtonian fluids; mass transfer operations: Fick’s law of diffusion, solid-liquid extraction and drying operations with application to polymer chips.

UNIT IV
Deformation of elastic solid, viscoelasticity and its measurement, non-linear viscoelasticity, yield behavior of solids and breaking phenomena

UNIT V
Mechanical properties of natural and synthetic fibres, moisture sorption behaviour of natural and synthetic fibres. Models describing fibre structure, Fringed fibrillar and fringed micellar model, One phase model.

PRACTICALS:
1. Analysis of fibres using FTIR
2. Analysis of fibres using TGA
3. XRD graph analysis of various fibres
4. Crystallinity determination using FTIR and XRD
5. Wettability analysis of various fibres assemblies

TOTAL: 75 PERIODS

OUTCOMES
Upon completion of this course, the student shall be
- able to correlate the physical properties of polymer to its microstructure
- able to characterize polymers and fibres
REFERENCES

TX7103 PROCESS CONTROL AND FABRIC ENGINEERING

OBJECTIVES
To enable the students to learn the
- Theory of preparation of yarn for fabric formation and different types of fabric formation techniques and
- Selection and control of process variables during preparatory and fabric formation.

UNIT I WEAVING PREPARATION
Yarn quality requirements - weaving and knitting; winding - yarn faults, quality of splice/knot, knot factor and clearing efficiency, Optimum clearing of yarn; wound yarn package requirements for different weft insertion system and high speed knitting warping; control of ends break in warping, warp beam quality requirements; quality control in size recipe, size pick-up control, yarn stretch control, quality requirements of sized beam – defects and their causes and remedies. Control of productivity in winding, warping and sizing; Waste control in winding, warping and sizing.

UNIT II WEAVING
Loom accessories – quality requirements and its effects on loom performance; control of cross ends and missing ends. Loom shed productivity control – loom speed, loom efficiency, loom stops. Fabric quality control – fabric defects and their causes and remedies; process control for weaving filament, blend yarn and dyed yarn.

UNIT III KNITTING
Types of stitches and their influence on knit fabric properties; weft knitting – method of setting the machine, factors affecting the formation of loops in weft knitting, performance of different yarns, Fabric defects- causes and remedies.

UNIT IV NON-WOVEN
Quality control in web preparation; Influence of material and process parameters on fabric quality and performance.

UNIT V UNCONVENTIONAL FABRIC FORMATION
3D Fabrics – Structure, Comparison of 2D and 3D fabrics, classifications; Multilayer fabrics – theory, weaving process, fabric properties, applications; 3D orthogonal weaving – weaving principles, properties and applications; 3D Braiding – 2D braiding, 3 D braiding, multilayer interlock braiding, properties and applications of braided fabric; concept of 3D multi axial warp knitting.
OUTCOMES
Upon completion of this course, the student shall be able to select and control the process variables at preparatory and fabric formation to achieve the fabric with required qualities.

REFERENCES

TX7104 THEORY OF SHORT STAPLE YARN SPINNING

OBJECTIVES
To enable the students to learn the theory of various operations carried out at different stages of yarn spinning, which would be helpful them in understanding the influence of various parameters on quality and productivity of short staple yarn.

UNIT I FIBRE DISPERSION AND CLEANING
Necessity of fibre-individualization; fibre opening and cleaning in blow-room machinery; forces acting on the fibre during carding operation; the mechanism of fibre dispersion, fibre transfer, short fibre removal and trash removal; entanglement and disentanglement of fibres; theory of hook formation; the new approaches to improve fibre-dispersion in carding operation; mechanism of removal of short fibre, neps and trash in comber.

UNIT II ATTENUATION AND FIBRE STRAIGHTENING
Principle of roller drafting and its application in yarn production; ideal drafting; factors affecting drafting force, fibre dynamics during drafting, drafting irregularities and their causes and remedies; amount of draft and draft distribution on strand irregularity; the function of
aprongs in roller drafting; limitation of apron-drafting and the scope for improvement; mechanism of wire-point drafting and its application in yarn production; merits and demerits of wire-point drafting; comparison of wire-point drafting with roller drafting; influence of fibre-extent on yarn quality; improvement of fibre-extent by carding, drafting and combing actions.

UNIT III  TWISTING
12
Twisted yarn geometry, forces acting on fibre and yarn during twisting, effect of fibre helix angle on strength, parameters affecting optimum twist level; balloon and spinning triangle formation and their effects on yarn quality and productivity; fundamental requirement to create real twist in a strand, mechanism of twisting principles in ring spinning; separation of twisting and winding actions of yarn; ply twisting, twist balance; modified twisting principles - open end twisting, false twisting, air-jet twisting, air-vortex twisting, up-twisting, two-for-one twisting, hollow-spindle twisting; merits and demerits of modern twisting system.

UNIT IV  FIBRE BLENDING AND LEVELLING
12
Importance of achieving homogeneous blending in fibre-mix; types of mixing during spinning preparatory process; lateral and longitudinal fibre blending; analysis of fibre blend index values; process parameters of spinning machinery for processing blended material; influence of intermediate product uniformity on yarn uniformity; different methods of levelling adopted during spinning processes.

TOTAL : 60 PERIODS

OUTCOMES
Upon completion of this course, the student shall be able apply the knowledge gained for
- Selecting suitable machine and process variables at different processes of yarn spinning to produce better quality yarn with maximum productivity and
- Designing processes for producing yarn of required parameters and Innovating design and process modification.

REFERENCES
OBJECTIVES
To enable the students to learn about
- Important characteristics of the fabric responsible for its comfort properties and
- Different phenomena which take place in the fabric related to the comfort properties of the fabric.

UNIT I FABRIC HAND

UNIT II CHARACTERISTICS OF POROUS MATERIALS
Geometrical characterization of single fibres; Structural analysis of fibrous materials with fibre orientations; Determination of the fibre orientation; Characterization of porous fibrous materials; Pore distribution in a fibrous material; Methods of Measurement of moisture vapour transfer.

UNIT III WICKING AND WETTING
Definitions; wetting – adhesive forces and interactions across interfaces; Surface tension; curvature; roughness and their effects on wetting phenomena. Wicking phenomena in fibrous materials – Capillarity; Hysteresis effects; Instability of liquid flow; Liquid spreading, absorbency in fibrous assemblies.

UNIT IV HEAT AND MOISTURE INTERACTIONS
Principles of Moisture diffusion; Thermal conduction and moisture diffusion in fibrous materials – Thermal conduction analysis; Effective thermal conductivity (ETC) for fibrous materials; Prediction of ETC by thermal resistance networks, volume averaging method and homogenization method; Structure of plain weave woven fabric composites and the corresponding unit cell

UNIT V PHYSIOLOGICAL COMFORT

TOTAL : 60 PERIODS

OUTCOMES
Upon completion of this course, the student shall be able to
- Understand different phenomena such as wetting, wicking and, heat and moisture interaction and
- Correlate the property of the fabric with comfort to the wearer.

REFERENCES
OBJECTIVES
To make the students to learn about the
- Probability distributions, sampling and testing of hypothesis
- Process control using charts and process capability
- Design of experiments for textile applications and
- Modeling the probabilistic phenomena.

UNIT I  PROBABILITY DISTRIBUTION AND ESTIMATIONS  6
Applications of Binomial, Poisson, normal, t, exponential, chi-square, F and Weibull distributions in textile engineering; point estimates and interval estimations of the parameters of the distribution functions

UNIT II  HYPOTHESIS TESTING  18
Sampling distribution; significance tests applicable to textile parameters – normal test, t-test, chi-square test and F-test; p-Values; selection of sample size and significance levels with relevance to textile applications; acceptance sampling

UNIT III  ANALYSIS OF VARIANCE AND NON-PARAMETRIC TESTS  12
Analysis of variance for different models; non-parametric tests - sign test, rank test, concordance test

UNIT IV  PROCESS CONTROL AND CAPABILITY ANALYSIS  12
Control charts for variables and attributes - basis, development, interpretation, sensitizing rules, average run length; process capability analysis

UNIT V  DESIGN AND ANALYSIS OF EXPERIMENTS  12
$2^k$ full-factorial designs; composite designs; robust designs; development of regression models, regression coefficients; adequacy test; process optimizations.

TOTAL : 60 PERIODS

OUTCOMES
Upon completion of this course, the student shall be able to
- Design the experiment, conduct statistical tests and analyse the results to arrive at the conclusions
- Study the capability of process and control the process based on data available and Make decisions with minimum error from available data.

REFERENCES
OBJECTIVES
To make the students to
- Understand different characteristics of yarns and fabrics
- Understand the effects of fabric characteristics on its end uses
- Test the yarn and fabric samples
- Analyze the various reports generated during quality evaluation of yarns and fabrics and
- Interpret the results obtained through these reports for process and quality control.

UNIT I  MASS VARIATION OF TEXTILE STRANDS  5
Depiction of mass variation of textile strands in time and frequency domain; interpretation and significance of U% and CV% for textile strands; classification and analysis of yarn faults created by mass variation

VARIANCE LENGTH CURVES AND SPECTROGRAM OF TEXTILE STRANDS  13
Effect of specimen length and total length on mass variation measurements of textile strands; theory of construction of VL curve; analysis of variance length curves to understand and avoid the introduction of mass variation during the spinning operation; determination of periodic mass variation in the form of spectrogram; determination of theoretical wave length from spectrum; comparison between normal and ideal spectrum; type of faults and their representation in spectrogram; interpretation of superimposed waves in spectrogram

UNIT II  TENSILE PROPERTIES OF YARN  5
Influence of testing factors on yarn tensile properties; measurement and application of yarn modulus; creep and stress relaxation of yarn; significance of estimating minimum yarn strength

UNIT III  MECHANISM OF FABRIC FAILURE  4
Mode of fabric failure – tensile, tear, abrasion, slippage, bursting and fatigue; influence of fibre, yarn characteristics and fabric structure on fabric failure

UNIT IV  COMFORT AND LOW STRESS MECHANICAL PROPERTIES  9
Role of transmission properties on thermal properties and thermal comfort viz., air permeability, water vapour permeability, resistance to penetration of liquid water, resistance to flow of heat and electrical conductivity; low stress mechanical properties during tensile, compression, bending, shear and buckling deformation; influence of low stress mechanical properties of fabrics on fabric handle, tailorability and sewability

UNIT V  FABRIC APPEARANCE AND OTHER PROPERTIES  9
Study of fabric appearance in terms of drape, formability, crease recovery, wrinkle recovery and pilling resistance; influence of fibre, yarn characteristics and fabric structure on the fabric appearance; evaluation of fabric properties like dimensional stability, flammability, impact resistance, absorbency

PRACTICALS:  30
1. Measurement of U% of sliver, roving and yarn
2. Measurement of imperfections and hairiness of yarn
3. Analysis of variance-length curve
4. Analysis of spectrogram
6. Measurement and analysis of single yarn tensile properties

Attested
S. Saliyan
DIRECTOR
Centre For Academic Courses
Anna University, Chennai-600 025
7. Study of creep and stress relaxation behaviour of yarn
8. Measurement and analysis of yarn faults
9. Measurement and analysis of surface and compression property of fabric

**TOTAL : 75 PERIODS**

**OUTCOMES**
Upon completion of this course, the student shall be able to apply the knowledge gained to
- Analyze and interpret the results obtained from quality evaluating systems of yarns and fabrics and
- Design fabrics with appropriate characteristics for the required end uses.

**REFERENCES**

**TX7001**

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**OBJECTIVES**
To enable the students to learn the
- Theory of yarn formation by rotor spinning, friction spinning, air-jet spinning and other spinning systems and
- Effect of process parameters used in the spinning system on yarn quality.
UNIT I  ROTOR SPINNING  18
Principle of open end spinning; description of the working of the rotor spinning; requirements of the raw materials; preparation of the sliver for rotor spinning; yarn formation and its structure; yarn withdrawal and winding; design of rotor, opening roller, transport tube, navel and their implications on production and yarn quality; developments in rotor spinning machine; production limits; process control; techno economic comparison with ring spinning.

UNIT II  FRICTION SPINNING  9
Principle of yarn formation - DREF-2, DREF-3 spinning systems; developments in friction spinning systems; raw material requirement; effect of process variables on yarn quality; application of these machines for different end products; the economics; technological limitations.

UNIT III  AIR-JET SPINNING  9
Description of the yarn production in air jet spinning machine; feasibility of higher draft applied in this machine; structure and quality of the air-jet spun yarn; raw materials requirement; process variables; production of by Airvortex system.

UNIT IV  OTHER SPINNING TECHNOLOGIES  9
Production of yarn in PLYfil, self twist, electrostatic, Bobtex spinning systems; working details of the production of double-rove yarns, wrap yarns and core spun yarns; use of raw materials; economics of these methods of yarn production; yarn characteristics and their applications.

OUTCOMES
Upon completion of this course, the student shall be able to select
- Process parameters for producing better quality yarn and
- Spinning system to be used (a) for raw materials of different qualities and types and (b) to produce yarn for specific end use.

REFERENCES
OBJECTIVES
- To enable the students to learn about different characteristics of polymers used in the production of textile fibres and their evaluation.

UNIT I MOLECULAR WEIGHT
Polymer solution thermo dynamics; molecular weight and molecular dimensions by end group analysis, osmometry, light scattering, viscometry, gel permeation chromatography, high performance liquid chromatography.

UNIT II MOLECULAR STRUCTURE CHARACTERISATION
Infrared, NMR, UV-visible, Raman spectroscopy, mass spectroscopy

UNIT III THERMAL PROPERTIES
Thermal properties by differential scanning calorimetry, differential thermal analysis, thermo gravimetry, thermo-mechanical analyzer, dynamic mechanical and dielectric analysis

UNIT IV OTHER PROPERTIES
Optical and electron microscopy; TEM, SEM, AFM, X-ray scattering from polymers, birefringence, crystallinity by density measurements, Surface area, pore volume measurements by B.E.T. method, porosimetry, surface energy measurements and particle size measurement.

TOTAL: 45 PERIODS

OUTCOMES
Upon completion of this course, the student shall be able to interpret data obtained from various analytical instruments.

REFERENCES

OBJECTIVES
To enable the students to learn about colour description and colour measurement.

UNIT I COLOUR AND COLOUR VISION
Definition of colour and its classification; Structure and function of the eye – Detail and study about eye and brain system; colour consistency tests for defective colour vision; properties of light.

UNIT II COLOUR DESCRIPTION
Arrangement of colour; visual attribution of colour; Beer-Lambert’s law; colour primaries and colour mixing; additive and subtractive colour mixing; colour specification; colour order systems– Munsel, Ostwald and CIE colour order systems.
UNIT III  COLOUR MEASUREMENT  9
Principles of colour measurement; Tristimulus values; CIE diagram; standard Illuminant;
standard observer; spectral reflectance; graphical and numeric representations.

UNIT IV  COLOUR MATCHING  9
Definition; Manual colour matching; single constant Kubelka – Munk theory, spectral and
tristimulus match; Metamerism; Concept of computer colour matching system. Application of
CCM system to Textile processing; Advantages and Limitations of CCM system.

UNIT V  COLOUR DIFFERENCE AND COLOUR PREDICTION  9
Colour difference - Perceptibility and acceptability; methods of assessment of colour
difference formula; Measurement of fluorescence – Visual, photoelectric colourimeter and
Spectro photometric; Characterisation of colour displays; colour mapping for two-dimensional
texture image; texture effect on visual colour difference evaluation; colour synthesis for three-
dimensional objects.

TOTAL : 45 PERIODS

OUTCOMES
Upon completion of this course, the student shall become knowledgeable about
• Fundaments of colour measurement and
• Prediction of recipe for colour matching.

REFERENCES
1. Shah H. S. and Gandhi R. S., “Instrumental colour measurement and computer aided
85274-426-9.

TX7004  ENZYME TECHNOLOGY FOR TEXTILE PROCESSING  L T P C
3 0 0 3

OBJECTIVES
To enable the students to learn about
• Enzymes, types and kinetics of enzyme reaction on textile fibres
• Application of enzymes on different fibres and
• Treatment of enzyme effluents.

UNIT I  ENZYMES  9
Nomenclature and classification of enzymes; characteristic features of enzymes; modifiers of
enzyme activity - activators and inhibitors; specificity of enzyme action; extraction and
purifications of enzymes.

UNIT II  ENZYME KINETICS  9
Kinetics of single-substrate enzyme-catalysed reactions; Basics of kinetics of multi-substrate
enzyme-catalysed reactions.
UNIT III ENZYMES FOR COTTON FIBRE 9
Chemistry and structure of cotton fibre; enzymes in pretreatment of cotton substrates – desizing, scouring, bleaching and bio finishes.

UNIT IV ENZYMES FOR OTHER FIBERS 9
Enzymes for processing and functionalizing protein fibres; enzymatic modification of polyester, polyamide, polyacrylonitrile and cellulose acetate fibres.

UNIT V ENZYMES IN EFFLUENT TREATMENT 9
Enzyme technology and biological remediation, Enzyme decolourisation and decolouration by biosorption and enrichment cultures.

TOTAL : 45 PERIODS

OUTCOMES
Upon completion of this course, the student shall be able to
- Give the rationale for selecting enzymes for particular processing and
- Appreciate limitations of existing processing operations using chemicals.

REFERENCES

TX7007 MANAGEMENT OF RESEARCH AND DEVELOPMENT  L T P C  3 0 0 3

OBJECTIVES
To enable the students to learn about the
- Management of Research and Development activity in industry
- Regulations governing R&D activities.

UNIT I
Technological Innovation- types, nature, processes, need and importance; R&D - in world economic development, Indian economic development; R&D - corporate function and for strategic partnership in industries; innovation and creativity

UNIT II
Innovation focus in textiles organisations; HRM issues in textile innovations, leadership and innovation management in textile industries; organizational design and structure in textile innovation management; measurement, evaluation and assessment of R&D

UNIT III
Indian R&D infrastructure and Institutional framework; R&D promotion, incentives and support, cooperation between industry, institution and government Departments; commercialization of R &D; financing of R&D projects

UNIT IV
Concept of intellectual property, different types of IP, rationale behind intellectual property, balancing the rights of the owner of IP and society, enforcement of IPR; IP and constitution of
India, world intellectual property organization (WIPO), WTO/TRIPS agreement, India and the TRIPS agreement; Patent law in India, interpretations and implementations, transitional period.

UNIT V

International patent laws, the patent cooperation treaty; Madrid system of international registration of trade marks, Hague system of international protection of industrial designs, The Lisbon agreement of protection of appellations of origin; Indian patent system, patentable inventions, difference between patentable and non patentable inventions; procedure for obtaining patent, consequences of grant of patent, rights of a patentee, limitations on patentee’s rights, revocation of patent for non-working; transfer of patent, licence, transmission of right by operation of law, infringement of patent; Case studies relevant to textile patents

OUTCOMES

Upon completion of this course, the student shall have the ability to manage R & D activities in organizations

REFERENCES


TX7008 MANAGEMENT OF TEXTILE EFFLUENTS

OBJECTIVES

To enable the students to learn about
- Pollutants from textile chemical processing industry, treatment and Government regulations.

UNIT I

Industrial policy of India; pollution monitoring and control; functions and activities of Ministry of environment; Central and State pollution control boards; environmental clearance and guidelines for industries; environment impact assessment; fiscal incentives for environmental protection; environmental auditing.

UNIT II

Wastewater characteristics; wastewater treatment - objectives, methods and implementation considerations; recycling of effluents.

UNIT III

Identification and reduction of pollution sources in textile wet processing; pollution control in man - made fibre industry; analysis of textile processing effluents – colour, odour, pH, total
solids, suspended solids, total dissolved solids, BOD, COD, total alkalinity, chloride, sulphates, calcium and chromium; tolerance limits for effluents; bio - degradability of textile chemicals and auxiliaries.

UNIT IV 9
Technical regulations on safety and health aspects of textile materials – banned dyes and chemicals; eco labeling, eco friendly textile processes - machines and specialty chemicals; natural dyes and environmental considerations.

UNIT V 9
Need for solid and hazardous waste management in textile industry, types and sources of solid and hazardous wastes, storage, collection and transport of wastes, waste processing technologies, waste disposal

TOTAL : 45 PERIODS

OUTCOMES
Upon completion of this course, the student shall know
- The hazards due to pollutants from textile chemical processing industry
- Method of treatment of pollutants
- Managing pollutants as per Government regulations and Methods of green processing.

REFERENCES

TX7009 MEDICAL TEXTILES

OBJECTIVES
To enable the students to learn about
- Different types of biomaterials and
- Biomedical application of textile structures.

UNIT I
Biomaterials–introduction, types; natural, polymeric and biological biomaterials
UNIT II
Textile based healthcare and hygiene products; application of nano technology in medical hygiene textiles; advanced textile materials in healthcare; infection control and barrier materials; plasma treated barrier materials.

UNIT III
Bandages and pressure garments - elastic and non elastic compression bandages, support and retention bandages; bandaging textiles; evaluation of bandages; bandages for various end uses.

UNIT IV
Wound – types, healing process; requirements of wound dressing; wound care materials – types, advantages and limitations; Testing of wound dressings; advanced wound dressings

UNIT V
Implantable products; sutures – requirements, classifications, specifications, materials and their applications; vascular grafts, artificial ligaments, artificial tendons; scaffolds for tissue engineering; intelligent textiles for medical applications

TOTAL: 45 PERIODS

OUTCOMES
Upon completion of this course, the student shall know the

- Types of materials available for biomedical applications
- Functional requirements of textile structures for specific end uses and
- Selection and characterization of textile materials used for biomedical applications.

REFERENCES

TX7014               STRUCTURE AND PROPERTIES OF FABRICS               L T P C
                                      3 0 0 3

OBJECTIVES
To enable the students to learn about the
- Geometrical properties of woven fabrics and its relationship with the mechanical properties of fabric
- Structure-property relationship of knitted and bonded fabrics
UNIT I GEOMETRICAL PROPERTIES OF FABRICS
Plain Fabric- theories, crimp ratio and thread spacing, jammed condition; geometry of non-plain fabric; Knitting- geometry of plain, complex knitted structures.

UNIT II MECHANICAL PROPERTIES OF WOVEN FABRICS
Tensile- geometrical changes during extension, load-extension modulus of fabrics; Buckling – buckling of elastic materials, complex forms of buckling; Shear and drape – complex fabric deformation, nature of shear, shear properties, drape of fabrics.

UNIT III MECHANICS OF KNITTED AND BONDED FABRICS

UNIT IV THEORY AND EVALUATION OF FABRIC HAND

TOTAL : 45 PERIODS

OUTCOMES
Upon completion of this course, the student shall be able to apply the knowledge gained to
- Determine the geometrical parameters of woven, knitted and bonded fabrics
- Correlate the geometry of fabric with the mechanical properties of fabrics and
- Evaluate the hand of fabric.

REFERENCES

TX7015 TEXTILE POLYMER RHEOLOGY

OBJECTIVES
To enable the students to learn about fluid flow and its related aspects with respect to melt and solution spinning.

UNIT I
Basic modes of deformation, Startup deformation, Step strain, Oscillatory shear; Linear responses-Elastic Hookean solids, Viscous Newtonian liquids and non Newtonian fluids; Viscoelastic responses - Boltzmann superposition principle, Maxwell model ; Classical rubberelasticity.
UNIT II
Viscosity- Effect of Pressure, temperature, activation energy, molecular weight and molecular weight distribution on viscosity, crosslinking, crystallinity branching, copolymerization, fillers, plasticizers and shear rate dependence of viscosity

UNIT III
Laminar flow through various profiles, flow analysis - power law, turbulent flow analysis, turbulence dumping.; rheological models for extensional viscosity; Flow in coni-cylindrical dies – pressure drop due to shear, extensional flow and pressure drop at die entry, flow in wedge shaped die; Swelling due to shear stresses and swelling due to tensile stresses.

UNIT IV
Shear rheometry- Linear displacement, Sliding plate rheometer, Co-cylinder axial sliding rheometer; Rotational motion - Parallel disks, Cone-plate and. Cone-partitioned plate; Rheo-optical methods- Flow birefringence, Scattering (X-ray, light, neutron), Spectroscopy (NMR, fluorescence, IR, Raman, dielectric)

UNIT V
Rheological behaviour of important thermoplastics, Applications of rheology to polymer processing.

TOTAL: 45 PERIODS

OUTCOMES
Upon completion of this course, the student shall be able to
- Characterize rheological behaviour of fluids and
- Analyse the effect of molecular parameters on the fluid flow.

REFERENCES

UNIT I
REINFORCEMENTS
Manufacturing, properties and applications of Glass, Quartz, Boron, Silicon carbide, Carbon, HPPE and Aramid fibers.
UNIT II MATRICES
Preparation, Chemistry, Properties and applications of thermoplastic and thermoset resins-Unsaturated Polyester, Vinyl Ester, Epoxy, Phenolics, polyimides, polyurethanes, polyamides, Polypropylene, PEEK and Polycorbanate

UNIT III COMPOSITE MANUFACTURING
Composites manufacturing for both thermoplastics and thermosets- Hand layup, Filament Winding, Resin transfer moulding, prepregs and autoclave moulding, pultrusion, vacuum impregnation methods, compression moulding; post processing of composites and Composite design requirements

UNIT IV TESTING
Fibre volume and weight fraction, specific gravity of composites, tensile, flexural, impact, compression, interlaminar shear stress and fatigue properties of thermoset and thermoplastic composites.

UNIT V MECHANICS
Micro mechanics, macro mechanics of single layer, macro mechanics of laminate, classical lamination theory, failure theories and prediction of interlaminar stresses using software

TOTAL : 45 PERIODS

OUTCOMES
Upon completion of this course, the student shall be able to
- Select different types of textile reinforcements and matrices for the manufacture of composites for getting different characteristics and
- Evaluate the characteristics of composites

REFERENCES

TX7017 TEXTILES IN CIVIL CONSTRUCTION AND TRANSPORTATION

OBJECTIVES
To enable the students to learn about
- Textiles used for civil construction and transportation applications and their functional requirements and
- Evaluation of textile materials used for civil construction and transportation applications.

UNIT I GEO TEXTILES
Geo textile – definition, types, functions; types of fibers and fabrics used in geo textiles; applications of natural fibers in geo-textiles; joining of geo- textiles; multi functional uses of
geo synthetics in civil engineering; usage of geo-synthetic in civil engineering applications as filters, reinforcement, separation and drainage medium; material specifications and design criteria of geo-synthetics for specific applications.

UNIT II ARCHITECTURE TEXTILES
Fiber and fabric property requirements for architecture textiles; Coated textiles; Tents, Awnings and Canopies; Inflatable structures – high pressure and low pressure inflatable structures; Textile for roofing applications; Acoustic and heat insulation textiles; Floor and wall covering, scaffolding nets.

UNIT III TRANSPORTATION TEXTILES
Quality and design of textile materials used in automobiles – tire cord, filter, air bag, belt, seat cover, noise insulation; Design and development of textile reinforced composites in automobile and aeronautic industry.

UNIT IV EVALUATION
Evaluation of textile material used in civil construction and transportation industry in terms of performance, construction survivability and durability.

OUTCOMES
Upon completion of this course, the student shall be able to
- Understand the requirements of textiles used for civil construction and transportation applications and
- Design the textile materials for the above applications.

REFERENCES
UNIT III  YARN MECHANICS  9
Analysis of tensile behavior, prediction of breakage - continuous filament yarn and spun yarn; effect of fibre properties and geometrical configuration of yarn on the tensile and bending properties of yarn; design of yarn structures for certain functional uses.

UNIT IV  BLENDED YARN MECHANICS  9
Blend irregularity; measurement of blending irregularity; concept of elongation balance; effect of properties of constituent fibres and blend composition on behavior of blended yarns.

UNIT V  STRUCTURE - PROPERTIES RELATIONSHIP  9
Structure - property relationship in yarns produce from different spinning systems.

REFERENCES

TX7006  HIGH PERFORMANCE FIBRES  L T P C
3  0  0  3

OBJECTIVES
To enable the students to learn about

- Advanced spinning technology for manufacturing high performance fibres, their properties and applications

UNIT I  ADVANCED SPINNING TECHNOLOGY  9
Advances in conventional fibre forming process; gel spinning; liquid crystal spinning; electro-spinning

UNIT II  HIGH PERFORMANCE FIBRES FOR INDUSTRIAL APPLICATIONS  9
Manufacturing, properties and applications of glass fibres, basalt fibres; carbon fibres, high performance polyethylene fibres; ceramic fibres

UNIT III  HIGH PERFORMANCE FIBRES FOR MEDICAL APPLICATIONS  13
Manufacturing, properties and applications of alginate fibres; chitosan fibres; regenerated silk and wool protein fibres; synthetic biodegradable fibres

UNIT IV  SPECIALITY FIBRES  14
Hollow and profile fibres; blended and bi-component fibres; film fibres and functionalized fibres for specific applications; manufacturing, properties and applications of chemical and thermal resistant fibres

TOTAL: 45 PERIODS
OUTCOMES
Upon completion of this course, the student shall be able to
- Understand the method of producing high performance fibres
- Select a high performance fibres for right type of end uses

REFERENCES

TX7005 FINANCIAL MANAGEMENT L T P C 3 0 0 3

OBJECTIVES
To enable the students to learn about
- Costing of textile products
- Different sources of finance, cost of capital and investment appraisal techniques
- Financial statements

UNIT I 14
Goals and functions of finance; types of costs; costing – concepts, classification; preparation of cost sheet; costing of yarn, fabric and garments; breakeven analysis

UNIT II 9
Investment appraisal; Payback period method, Accounting Rate of Return; DCF methods - IRR, NPV, PI; depreciation - concept, methods

UNIT III 9
Capital structure; sources of finance-debt, equity; cost of capital; working capital management; estimation of working capital

UNIT IV 13
Tools of financial analysis and control – profit and loss account, balance sheet; financial ratio analysis; analysis of operating and financial leverage; dividend policy; illustrations for spinning mill, composite mill and garment industry

TOTAL: 45 PERIODS

OUTCOMES
Upon completion of this course, the student shall be able to
- Calculate the cost of yarn, fabric and garment
- Identify the sources for capital and calculate cost of capital
- Calculate depreciation and carry out investment appraisal
- Interpret and analyze financial statements

REFERENCES

TX7010 OPERATIONAL RESEARCH L T P C 3 0 0 3

OBJECTIVES:
To enable the students to learn about
- Operations research (OR) methods that can be applied in the textile industry
- Formulating and solving OR problem related to textile industry

UNIT I LINEAR PROGRAMMING TECHNIQUES 9
Linear programming – formulation, solution by graphical and simplex methods; dual simplex method

UNIT II TRANSPORTATION AND ASSIGNMENT MODELS 13
Transportation problem – North / West corner Solution, least cost method, Vogel’s approximate method, optimality check - Modi method, stepping stone method; solution to assignment problem- Hungarian method; unbalanced, infeasible assignment problems; maximisation in assignment problems; transhipment problems

UNIT III INTEGER LINEAR PROGRAMMING, GAME THEORY 9
Solution to integer programming problem - Branch and bound algorithm, cutting plane algorithm; Game theory: Two person – zero sum games: saddle point, dominance rule, graphical method

UNIT IV PROJECT SCHEDULING 9
CPM and PERT networks for project scheduling- finding critical path, probability and cost consideration in the project scheduling; crashing; resource planning, levelling

UNIT V DECISION MAKING THEORY, QUEING MODELS 5
Decision making under risk: decision trees, decision making under uncertainty; Queueing theory – single and multi-channel models – infinite number of customers and infinite calling source

TOTAL: 45 PERIODS
OUTCOMES:
Upon completion of the course, the students will be able to
- Design operations research problems that can be applied to textile industry.
- Solve the OR problems

REFERENCES:

TX7019 TOTAL QUALITY MANAGEMENT IN TEXTILE INDUSTRY L T P C
3 0 0 3

OBJECTIVES:
To enable the students to understand about
- Total quality management concepts
- Different TQM tools and techniques and
- Quality standards

UNIT I INTRODUCTION TO QUALITY MANAGEMENT 9
Definitions of quality, quality philosophies of Deming, Crossby and Miller; customer focus; leadership – concepts; quality planning; quality costs; vision, mission statements and Quality Policy.

UNIT II PRINCIPLES OF TOTAL QUALITY MANAGEMENT 9
Evolution of TQM, TQM models; continuous process improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen; supplier performance measures; Deming wheel; internal external customer concept; customer satisfaction index, customer retention; team work and team building, empowerment

UNIT III QUALITY MANAGEMENT TOOLS 18
Principles and applications of Quality Function Deployment, Failure Mode and Effect Analysis, Seven old QC tools, Seven New Management tools, Statistical Quality Control techniques, Mistake proofing, Benchmarking, JIT, and Kanban; Taguchi Quality Loss Function, Total Productive Maintenance (TPM), Process Capability analysis
UNIT IV QUALITY SYSTEMS

ISO 9000 and other quality system – elements, implementation of quality system in spinning, weaving and garment industry; TQM implementation strategies

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to
- Understand the concept of TQM, different TQM tools and techniques
- Develop innovative tools to implement TQM in the textile industry

REFERENCES:

TX7012 PROTECTIVE CLOTHING

OBJECTIVES:
To enable the students to understand about
- Functional requirements of protective clothing
- Selection of fibre, yarn and fabric for developing protective clothing
- Evaluation of protective clothing

UNIT I FIBRE REQUIREMENTS
Suitability and properties of high performance fibres for various protective clothing – chemical composition and physical structure

UNIT II YARN AND FABRIC REQUIREMENTS
Types of yarns; woven, knitted and non - woven fabric structures, methods of production, effect of structure on their performance

UNIT III CLOTHING CONSTRUCTION
Method of construction of garments according to various protective end uses like protection against cold, ballistic protection, use of different fabric type (knitted, woven, and Non-woven), coated / laminated in different places; use of inter lining and composites; 3D structures; high tech textiles – variable electronics; protective garments for industrial and apparel end uses

UNIT IV FINISHING OF PROTECTIVE CLOTHING
Types of finishes - fire retardant finishes, water repellent finishes, anti - microbial finishes; chemical finishes against radiation and chemicals; method of application of finishes; protective finishes for health care garments
UNIT V  QUALITY EVALUATION

Evaluation of protective fabrics; desirable properties of protective textiles, method of testing for thermal protective performance, abrasion and wear resistance, evaluation of resistance to mildew, ageing, sunlight, chemical, electrostatic and electrical resistivity, impact properties; ASTM standards for protective garments

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to
- Select fibre, yarn and fabric for developing protective clothing for different applications
- Understand different types of finishes given to develop protective clothing
- Understand the evaluation of protective clothing

REFERENCES:

TX7011  PROCESS CONTROL AND OPTIMIZATION IN YARN SPINNING  L T P C
3 0 0 3

OBJECTIVES:
To enable the students to understand
- The process control at different stages of spinning preparatory and ring spinning process to achieve yarn of required quality

UNIT I  BLOWROOM PROCESS
Opening and cleaning efficiency-assessment and control; optimization of trash removal, control of lint in waste; causes for neps generation, control; role of blowroom accessories; assessment and control of blowroom output quality, its influence on yarn quality; process changes for processing manmade fibres
UNIT II  CARDING PROCESS  9
Optimization of trash removal – its influence on quality, control of lint in waste; neps removal efficiency, cleaning efficiency – factors, control; hooks formation; levelling – optimization; assessment and control of card sliver quality, it influence on yarn quality; process changes for processing manmade fibres

UNIT III  DRAWFRAME PROCESS AND COMBING PROCESS  9
Levelling in drawframe-optimization; blended yarn production- blending irregularity assessment and control; hooks straightening in roller drafting arrangement; quality of drawframe sliver-assessment and control, its influence on yarn quality; quality of comber lap - control of comber preparatory process; noil%, combing efficiency and neps removal efficiency of comber – assessment and control; hooks removal

UNIT IV  ROVING AND YARN PRODUCTION PROCESSES  9
Roving quality-assessment and control, its influence on yarn quality; ring spinning- control of end breakage rate; quality of yarn-assessment and control; changes for processing manmade fibres; classification of yarn defect, control of yarn defects

UNIT V  PRODUCTION CONTROL  9
Factors affecting the production limits of the spinning machinery; new concepts in achieving higher production in the spinning machinery; role of humidity and machinery maintenance-production and quality; computation of the labour and machine productivity indices

TOTAL : 45 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to
- Understand the process variables and their control at different stages of ring yarn production
- Analyse the test results and hence control the process
- Compute different indices of machine and labour productivity

REFERENCES
2. Lord P.R., “Yarn Production; Science, Technology and Economics”, The Textile Institute, Manchester, 1999
OBJECTIVES:
To enable the students to understand
- Different mechanisms of weft insertion, their advantages and limitations

UNIT I  INTRODUCTION
Introduction to shuttleless weaving; advantages of shuttleless weaving, comparison with shuttle weaving; features of unconventional weaving; different Selvedges: tucked-in, leno, fused, stitched, their mechanism of formation, their characteristics and uses; weft accumulator.

UNIT II  PROJECTILE WEAVING MACHINE
Basic principle of projectile weaving; feeding of yarn to projectile; sequence of weft insertion; cam driven shedding; dwelling Sley beat-up; torsion bar picking; energy utilization during picking.

UNIT III  RAPIER WEAVING MACHINE
Classification based on type of rapier; system of weft insertion and number of rapiers; Sequence of weft insertion for Gabler and Dewas systems, their comparison; driving of flexible and rigid rapiers; asynchronized rapier timing; rapier buckling.

UNIT IV  AIR-JET AND WATER-JET WEAVING MACHINE
Principle of weft insertion in air-jet weaving, air requirements; path of the yarn on loom; sequence of weft insertion; control of air stream by relay nozzle, confuser profile reed and suction; design of air jet nozzle, air drag force, factors affecting drag force
Principle of weft insertion in water-jet weaving machine, path of the yarn on loom; quality of water required; sequence of weft insertion; water jet nozzle, merits and demerits of water jet weaving; fabric drying on loom

UNIT V  MULTIPHASE WEAVING
Technological developments – models & features; functional description of multi-linear shed weaving – shed formation, filling insertion, beat-up, let-off, take-up and selvedge motion; characteristics of multi-linear shed weaving machine; circular and narrow weaving

OUTCOMES:
Upon completion of this course, the students will be able to understand
- mechanisms of picking in rapier, airjet, waterjet and projectile looms
- accessories required in the shuttleless weaving machines
- Principle of fabric formation in multiphase weaving machine

TOTAL: 45 PERIODS

REFERENCES: