### COURSE CATALOGUE

**SEMESTER I**

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**TOTAL NUMBER OF CREDITS : 66**
## LIST OF ELECTIVES
### M.TECH. TEXTILE TECHNOLOGY

#### SEMESTER – II

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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.

OUTCOME
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.

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 aprons 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
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; 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
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

REFERENCES

TX7102 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.

OUTCOME
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.

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; 3 D 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.

TOTAL : 60 PERIODS
## TEXT BOOKS

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### TX7103 TEXTILE QUALITY EVALUATION

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#### OBJECTIVES

To make the students to
- Understand different characteristics of yarns and fabrics
- Understand the effects of fabric characteristics on its end uses
- 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.

#### OUTCOME

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.

#### UNIT I  MASS VARIATION OF TEXTILE STRANDS

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

#### UNIT II  VARIANCE LENGTH CURVES AND SPECTROGRAM OF TEXTILE STRANDS

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 III  TENSILE PROPERTIES OF YARN
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

MECHANISM OF FABRIC FAILURE
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
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
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
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
5. Measurement and analysis of single yarn tensile properties
6. Study of creep behaviour of yarn
7. Measurement and analysis of yarn faults
8. Measurement and analysis of surface and compression property of fabric

TOTAL : 75 PERIODS

REFERENCES:
OBJECTIVES
To enable the students to learn about the
- fibre forming polymer characteristics and their related models and
- models describing fibre structure.

OUTCOME:
Upon completion of this course, the student shall be able to correlate the physical properties of polymer to its microstructure.

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
Models describing fibre structure, Fringed fibrillar and fringed micellar model, One phase model.

TOTAL : 60 PERIODS

REFERENCES
UNIT I REPELLENCY FINISH

Wetting and Wicking; surface energy – concept, measurement and relevance to repellency; repellents applied to textile substrates; repellency tests; application of repellents by impregnation, coating and surface modification techniques.

UNIT II 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 III FLAME PROOFING

Terminology related to flammability; flame retardant mechanisms; flame retarding chemicals for textile materials and testing of flame retardant finishes.

UNIT IV UV PROTECTION

UV radiation; factors affecting UV protection; UV protection finishes; measurement of UV protection.

UNIT V ANTIMICROBIAL FINISH

Basic of microbiology; classification; chemistry and application of antimicrobial finishes; evaluation of antimicrobial finishes.

TOTAL : 60 PERIODS

REFERENCES


TX7201 STATISTICS FOR TEXTILE ENGINEERING L T P C

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.

OUTCOME
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.

UNIT I PROBABILITY DISTRIBUTION AND ESTIMATIONS

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

REFERENCES

TX7202  CLOTHING SCIENCE  L T P C
4 0 0 4

OBJECTIVES
To enable the students to learn about the
- 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.

OUTCOME
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.

UNIT I  FABRIC HAND  12

UNIT II  CHARACTERISTICS OF POROUS MATERIALS  12
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 12
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 12
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 12

TOTAL: 60 PERIODS

REFERENCES

TX7001 THEORY OF YARN STRUCTURES L T P C
4 0 0 4

OBJECTIVES
To enable the students to learn about the structure of ideal and real yarn, migration of fibres in the yarn, breakage mechanism of yarn, mechanics of blended yarns and relationship between structure and property of yarns produced by different spinning systems.

OUTCOME
Upon completion of this course, the student shall be able to apply the knowledge gained to
• Estimate the parameters related by structure of yarn and
• Engineer the structure of yarn with required properties and end uses.

UNIT I YARN GEOMETRY 18
Elements of yarn geometry; geometry of helix and its application to yarn structures; yarn diameter, packing of fibres in yarn; estimation of packing density and radial packing density of yarn; geometry of folded yarns

UNIT II FIBRE MIGRATION 6
Migration characteristics in continuous filament and spun yarns; effect of various parameters on migration; measurement of fibre migration in yarn; effect of migration on tensile behaviors and hairiness of the yarn

UNIT III YARN MECHANICS 12
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  
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  
Structure - property relationship in yarns produce from different spinning systems.

REFERENCES:

TX7002  STRUCTURE AND PROPERTIES OF FABRICS  

OBJECTIVES
To enable the students to learn about the
- Geometrical properties of fabrics and its relationship with the mechanical properties of fabric and

OUTCOME
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.

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  

REFERENCES

TX7003 MANAGEMENT OF RESEARCH AND DEVELOPMENT L T P C 4 0 0 4

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

OUTCOME
Upon completion of this course, the student shall be able to manage R & D activities in organizations

UNIT I 6
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 12
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 12
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 12
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 18
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

TOTAL : 60 PERIODS

REFERENCES
TX7004  ENZYME TECHNOLOGY FOR TEXTILE PROCESSING  L T P C
4 0 0 4

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.

OUTCOME
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.

UNIT I  ENZYMES  12
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  12
Kinetics of single-substrate enzyme-catalysed reactions; Basics of kinetics of multi-substrate
enzyme-catalysed reactions.

UNIT III  ENZYMES FOR COTTON FIBRE  12
Chemistry and structure of cotton fibre; enzymes in pretreatment of cotton substrates –
designing, scouring, bleaching and bio finishes.

UNIT IV  ENZYMES FOR OTHER FIBERS  12
Enzymes for processing and functionalizing protein fibres; enzymatic modification of polyester,
polyamide, polyacrylonitrile and cellulose acetate fibres.

UNIT V  ENZYMES IN EFFLUENT TREATMENT  12
Enzyme technology and biological remediation, Enzyme decolourisation and decolouration by
biosorption and enrichment cultures.

TOTAL : 60 PERIODS

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

OUTCOME
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.

UNIT I
12
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
12
Wastewater characteristics; wastewater treatment - objectives, methods and implementation considerations; recycling of effluents.

UNIT III
12
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
12
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
12
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 : 60 PERIODS

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

OUTCOME
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.

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 rubber elasticity.

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: 60 PERIODS

REFERENCES
OUTCOME
Upon completion of this course, the student shall be able to

- Select different types of textile reinforcements and matrices used for the manufacture of composites and their behaviours and
- Evaluate the characteristics of composites.

UNIT I  REINFORCEMENTS  12
Manufacturing, properties and applications of Glass, Quartz, Boron, Silicon carbide, Carbon, HPPE and Aramid fibers.

UNIT II  MATRICES  12
Preparation, Chemistry, Properties and applications of thermoplastic and thermoset resins-Unsaturated Polyester, Vinyl Ester, Epoxy, Phenolics, polyimides, polyurethanes, polyamides, Polypropylene, PEEK and Polycarbonate

UNIT III  COMPOSITE MANUFACTURING  12
Composites manufacturing for both thermoplastics and thermosets- Hand layup, Filament Winding, Resin transfer moulding, prepeg and autoclave moulding, pultrusion, vacuum impregnation methods, compression moulding; post processing of composites and Composite design requirements

UNIT IV  TESTING  12
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  12
Micro mechanics, macro mechanics of single layer, macro mechanics of laminate, classical lamination theory, failure theories and interlaminar stresses.

TOTAL : 60 PERIODS

REFERENCES

TX7008  ALTERNATIVE SPINNING SYSTEMS  L T P C
4 0 0 4

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.

OUTCOME
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.
UNIT I  ROTOR SPINNING
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
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
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
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.

TOTAL : 60 PERIODS

REFERENCES

TX7009  DESIGN AND ANALYSIS OF TEXTILE EXPERIMENTS  L T P C
4 0 0 4

OBJECTIVES
To make the students to learn about the
- Fundamentals of experimental design and
- Selection of suitable design and analysis of the results.

OUTCOME
Upon completion of this course, the student shall be able to
- Design the experiment suitable for a given study and
- Conduct statistical tests and analyze the results to arrive at the conclusions.

UNIT I  EXPERIMENTAL DESIGN FUNDAMENTALS
Importance of experiments, experimental strategies, basic principles of design, terminology, ANOVA, steps in experimentation, sample size, normal probability plot, linear regression model.
UNIT II  SINGLE FACTOR EXPERIMENTS  12
Completely randomized design, Randomized block design, Latin square design. Statistical analysis, estimation of model parameters, model adequacy checking, pair wise comparison tests, in respect of textile process, machine and quality parameters.

UNIT III  MULTIFACTOR EXPERIMENTS  12
Two and three factor full factorial experiments, $2^K$ factorial Experiments, Confounding and Blocking designs; application in textile experiments.

UNIT IV  SPECIAL EXPERIMENTAL DESIGNS  12
Fractional factorial design, nested designs, Split plot design, Introduction to Response Surface Methodology, Experiments with random factors, rules for expected mean squares, approximate F- tests for textile applications.

UNIT V  TAGUCHI METHODS  12
Steps in experimentation, design using Orthogonal Arrays, data analysis, Robust design- control and noise factors, S/N ratios, parameter design, case studies related to textile engineering.

TOTAL : 60 PERIODS

REFERENCES

TX7010  COLOUR SCIENCE AND ITS APPLICATIONS  L T P C
4 0 0 4

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

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

UNIT I  COLOUR AND COLOUR VISION  12
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.

UNIT II  COLOUR DESCRIPTION  12
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  12
Principles of colour measurement; Tristimulus values; CIE diagram; standard Illuminant; standard observer; spectral reflectance; graphical and numeric representations.

UNIT IV  COLOUR MATCHING  12
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  12
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 : 60 PERIODS

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

TX7011 CHARACTERIZATION OF TEXTILE POLYMERS  L T P C
4 0 0 4

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

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

UNIT I MOLECULAR WEIGHT  12
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  18
Infrared, NMR, UV–visible, Raman spectroscopy, mass spectroscopy

UNIT III THERMAL PROPERTIES  12
Thermal properties by differential scanning calorimetry, differential thermal analysis, thermo
gravimetry, thermo-mechanical analyzer, dynamic mechanical and dielectric analysis

UNIT IV OTHERS  18
Optical and electron microscopy; TEM, SEM, AFM, X-ray scattering from polymers,
birefregence, crystallinity by density measurements, Surface area, pore volume
measurements by B.E.T. method, porosimetry, surface energy measurements and particle
size measurement.

TOTAL : 60 PERIODS

REFERENCES
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.

OUTCOME
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.

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.

TOTAL : 60 PERIODS

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

OUTCOME
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.

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 :60 PERIODS

REFERENCES