THEORY OF TEXTILE STRUCTURE

Subject Code: BTEXS1-601   **L T P C 3 1 0 4**   **Duration: 60 Hrs.**

Course Objectives
1. To provide the knowledge geometry of different yarn structures.
2. To impart knowledge about structural parameters of yarns.
3. To study the structural property relationship of yarns.
4. To study the fabric geometry and its properties.

Course Outcomes
At the end of the course students will be able to
1. Understood different yarn structures in relation to properties.
2. Apply the effect of yarn structure to mechanical properties of yarn.
3. Understood different models to explain yarn structure.
4. To explain relation between fabric structural parameters in relation to properties.

UNIT-I (10 Hrs.)
Yarn Geometry: Basic geometry of twisted yarns. The idealized helical yarn structure and deviation. Real Yarn: Twist contraction and retraction, packing of fibres in yarn, Forms of Twisting.

UNIT-II (15 Hrs.)
Fibre Migration: Ideal migration, Parameters affecting migration, characterization of migration behavior, mechanism of migration in single and plied structure. Criteria for interchange of fibre position. Conditions for migration to occur, combination of the mechanics of migration.

UNIT-III (15 Hrs.)
Structural Mechanics: Extension of yarn under small load. Analysis of tensile forces of yarnunder stress. Prediction of breakage, Nature of rupture for continuous filament yarn. Extension and breakage of spun yarn: Traditional view and approach by Hearle and E1-Sheikh. Blended Yarn: Blended yarn structure, Humburgers Theory. Structure property relationship of ring, rotor, air-jet, friction spun yarn.

UNIT-IV (20 Hrs.)
Fabric Geometry: Engineering approach to the analysis of fabric, Pierce geometrical model relationship between h, p, c, Crimp interchange, Jammed Structure, concept of similar cloth. Minimum possible cover factor. Race track geometry, concept of similar fabric, Geometry of plain knitted fabric. Fabric Properties: An elementary idea about tensile, bending, shear and drape behavior of fabric. An elementary idea about fabric objective measurement.

Recommended Books:
1. J.W.S. Hearle, P. Grosberg and S. Backer, 'Structural Mechanics of Fibres Yarns and Fabrics', Wiley Inter-Science, New York, **1969**.
2. B.C. Goswami, J.G. Martindale and F. Scardino, "Textured Yarn Technology, Structure and Applications', Wiley Interscience Publisher, New York, **1995**.
3. F.T. Peirce and J.R. Womersley, 'Cloth Geometry', Reprint, The Textile Institute,Manchester,**1978**.

PROCESS CONTROL IN TEXTILES

Subject Code: BTEXS1-602   **LT P C   3 1 0 4**   **Duration: 60 Hrs.**

Course Objectives
1. To provide knowledge of choosing process parameters and application of the chosen parameters at preparatory and ring spinning stages.
2. To impart methodology of process and product performance evaluation and role of norms.
3. To provide knowledge of process control in weaving preparatory to optimize qualityand improvement in efficiency after each process.
4. To explain process management in weaving with respect to fabric productivity and machine audit.

Course Outcomes
> At the end of the course students will be able to
1. Able to understand the role of process parameters on product quality.
2. Have understood the process of choosing process parameters at preparatory and ring spinning stages.
3. Have understood process management in weaving preparatory to optimize quality.
4. Understand process management in weaving with respect to fabric production, inspection, and machine audit.

Unit I (4 Hours)

Control of Mixing quality and cost; Formulation of LPP; Concept and method of bale management.

Unit II (26 hours)

System of process control in spinning: Role and scope, key variables, establishing norms and standards, collection and interpretation of data and corrective action.
Yarn Realisation: Records and estimation of yarn realisation and waste in spinning mill, norms for yarn realisation.
Waste and cleaning in blow room and carding: Calculation of trash content and cleaning efficiency. Norms for waste and cleaning efficiency. Assessing the performance of blow rom and card.
Comber waste control: Technological conditions, Optimization of comber waste extraction, norms and procedures for control of comber waste.
Control of yarn quality: Measurement, assessment and control of count, strength, unevenness and imperfections of yarn.

Unit III (20 hours)

Winding: Factors affecting quality and productivity in winding; Approach to process control in Winding. Classification of yarn faults by UsterCassimat System. Removal of yarn faults by clearing devices – mechanical slub catchers and electronic clearers. Control of quality in Winding – brief idea about quality of knots. Different package defects – their nature, causes and remedies.
Warping: Approach to process control in Warping; performance in warping, control of productivity – causes of low productivity and their elimination.
Sizing: Process control in Sizing – quality aspects of sized beam, performance assessment in sizing, - size add-on, moisture control, strength of yarn and control of stretch. Norms and

properties of sized yarns. Major defects in sizing and their mitigation. Process control in pirn winding – methods to improve productivity and built of pirns.

Unit – IV (10 hours)

Loom Shed: Control of productivity and efficiency in loom shad – basic concepts. Factors affecting process control – loom speed, belt slippage and loom condition. Loom efficiency and their improvement. Assessment of loom performance.

Grey fabric inspection; standard for damages of cotton fabrics; norms for cause wise defects in grey fabrics. Norms for hard waste in various processes. Care, selection and consumption norms of accessories.

Machinery audit; measurement and analysis of productivity; means to improve productivity.

Recommended books
1. A R Garde & T A Subramanian, "Process Control in Cotton Spinning", ATIRA, Ahmedabad, 1978.
2. M C Paliwal& P D Kimothi, "Process Control in Weaving", ATIRA, Ahmedabad, 1983
3. K R Salhotra, "Spinning of Man-made Fibres& their Blends in Cotton System", Textile Association of India.
4. R Chattopadhyay, " Process Control in Spinning", IIT, Delhi, 2001.
5. Anon. " Quality Control in Spinning", SITRA, Coimbatore, 1994

KNITTING TECHNOLOGY

Subject Code: BTEXS1-603   LT P C   3 1 0 4   Duration-60 Hrs.

Course Objectives:
1. Understand basics of knitting and its comparison woven structures
2. Understand various weft knitted structures and their formation techniques
3. Understand technology of warp knitting
4. Understand theoretical aspects of knitted structures

Course Outcomes:
At the end of the course students will be able to
1. appreciate the potentiality of knitting vis-a-vis weaving technology
2. Demonstrate various weft knitted structures, and working of different parts of their machines
3. have an idea about the designing potential of different warp knitting machines
4. design knitted fabrics based on its basic structural elements

UNIT– I (8 Hrs.)

BASIC concept of Knitting: Basic warp and weft knitting. Difference between warp and weft knitting. Classification of knitting machine and their application. Comparison of knitted and woven fabrics.

UNIT– II (25 Hrs.)

WEFT KNITTING:
Study of Knitting Elements: Types and specifications of needles. Functions of sinkers. Basic knitting action of Beard, Latch and Compound needles
Study of Different Types of Stitches: knit, tuck and float and their effects on fabric properties and structures.
Knitting Cam Systems for Plain, Rib, Interlock and Purl structures. Machine and mechanism for producing basic structures viz. - Plain, Rib, Interlock and Purl and their derivatives.
Properties & Uses of different types of weft knitted fabrics.
Introduction to Patterning in Circular knitting machine: General concept, Four cam track system, Pattern wheel and Pattern drum and design area calculations. Electronic needle selection. Computer controlled knitting machines.
Hand Operated Flat V-bed Knitting Machine and its cam system.

UNIT– III (15 Hrs.)

WARP KNITTING:
Study of Knitting Elements in Tricot and Raschel knitting machine and loop formation processes. **Pattern mechanism**, development of designs and properties of different warp knitted fabrics. Uses of warp knitted fabrics. Study of Let-off and take-up mechanisms.

UNIT– IV (12 Hrs.)

Concept of Loop Length and their effect on fabric structure & properties. Doyles's and Munden's research on loop length, Control of loop lengthand Positive Feed devices.
Basic study of knitting tensioning devices and stop **motions**.

Calculations: Production calculations of knitting machines and fabric weight in g/m2.Calculations of wales and courses per inch from k-factors.Tightness Factor and related calculations.

Recommended Books
1. D.J. Spencer, 'Knitting Technology', 3rdEdn.,Woodhead Publishing Limited, England, **2001**.

2. S.C. Ray, 'Fundamentals and Advances in Knitting Technology', <u>Woodhead Publishing IndiaLimited</u>, New Delhi, **2013**.
3. C. Mazza and P. Zonda, 'Knitting: Reference Book of Textile Technologies', 2ndEdn,,<u>ACIMIT, Italy</u>, **2001**.
4. J.E. Booth, 'Textile Mathematics', Vol. – 3, <u>Textile Institute, Manchester</u>, **1975.**

TEXTILE TESTING-II

Subject Code: BTEXS1-604	LT P C 3 1 0 4	Duration-60 Hrs.

Course Objectives
1. To impart knowledge about innovations in yarn testing machine.
2. To provide knowledge about principle and testing methodology of fabric properties.
3. To provide knowledge about testing methodology of garment properties.
4. To impart knowledge to apply statistical techniques to access the properties of textile products.

Course Outcomes
At the end of the course students will be able to
1. Understand the significance of yarn and fabric properties.
2. Having understood the factors affecting fabric and garment properties.
3. Analyse fibre, yarn properties and interpret the results by applying statistical techniques.
4. Apply statistical techniques to interpret fabric properties.

UNIT-I (10 Hrs.)

Testing of Yarn: Innovations in yarn testing instruments (dynamic, continuous, and on-line testing of yarn quality).

UNIT-II (22 Hrs.)

Testing of Fabric: Measurement of fabric dimensions and other physical properties such as thickness, weight, crimp, shrinkage, air-permeability, thermal properties, wettability, water proof ness, and flame resistance, Fabric low stress mechanical properties such as smoothness, stiffness, softness and shear, drape behavior. Test related to fabric appearance such as pilling, crease recovery. Fabric handle and factors influencing it, fabric comfort. Serviceability testing parameters such as abrasion resistance, fabric strength, tear strength, bursting strength test, honey dew, stickiness measurement, assessment of barre and other form of fabric defects.

UNIT-III (12 Hrs.)

Testing of Garments: Tests related to garment appearance and performance such as measurement of seam pucker, seams slippage and seam strength etc.

UNIT-IV (16 Hrs.)

Statistical Techniques: Concept of reproducibility and repeatability, methods pertaining to fibre, yarn and fabric testing, concept of quality, quality assurance, textile product leveling, international quality parameters and standards like Uster standards and ASTM.

Recommended Books:
1. B.P. Saville, 'Physical Testing of Textiles', <u>Woodhead Publishing Ltd., Cambridge</u>, **2002**.
2. J.E. Booth, 'Principles of Textile Testing', <u>CBS Publishers and Distributors, New Delhi</u>,**1999**.
3. P. Angappan and R. Gopalakrishnan, 'Textile Testing', <u>SSM Institute of Textile Technology,Komarapalayam</u>, **2002**.
4. A. Basu, 'Textile Testing', <u>SITRA, Coimbatore</u>, **2002**.
5. V.K. Kothari, 'Textile Fibers: Developments and Innovations', <u>IAFL Publications, NewDelhi</u>, **2000**.
6. V.K. Kothari, 'Progress in Textile: Science & Technology', Vol. 1, <u>Testing &QualityControl, IAFL Publications, New Delhi</u>, **1999**.

5. A. Basu, 'Textile Testing', <u>SITRA Coimbatore</u>, **2002**.
6. V.K. Kothari, 'Progress in Textile: Science & Technology', Vol. 1, <u>Testing & Quality control, IAFL Publications, New Delhi</u>, **1999**.

QUALITY MANAGEMENT IN TEXTILE INDUSTRY

Subject Code: BTEXS1-605   **LT P C 3 1 0 4**   **Duration: 60 Hrs.**

Course Objectives:
1. To develop understanding about various concepts and approaches to Quality Management
2. To impart knowledge about procedures of Inferential statistics based on Hypothesis testing
3. to Provide skill to statistically analyze discrete and ranking data
4. To elaborate decision making procedures through Control charts, ANOVA and Regression analysis

Course Outcomes:
At the end of the course students will be able to
1. orient their thinking and demonstrate understanding in line with TQM concepts
2. apply procedures of statistics related to frequency distribution and hypothesis testing
3. analyze problems related with discrete functions and ranking data
4. Develop and analyze control charts and ANOVA & Regression techniques for decision making

UNIT-I (15 Hrs.)

Quality Management: Definition of quality and its importance, different approaches to quality, Description of Deming's fourteen points and Ishikawa's seven tools of quality, utility of statistical method for quality control and improvement, concept of Total Quality Management (TQM), ISO 9000 Standards, Quality Function Deployment (QFD) and Quality Costs.

UNIT-II (15 Hrs.)

Basic Approaches to Statistical Quality Control: Population and sample, descriptive and inductive statistics, discrete and continuous variables, subjective tests, collection and classification of data, frequency distributions, measures of central tendency, measures of dispersion, random variables and probability distribution, differences and applications of normal, binomial, Poisson's and other form of distribution.

Statistical Analysis for Continuous Function: Population and sampling distribution of mean, statistical estimation theory, points estimates, concept of single tail and double tail test, Student's t distribution, confidence limit, statistical decision theory, tests of hypotheses and significances, type I and type II errors, difference between two sample means. Test for single variance, Chi-square test, the F distribution, test for the difference between two variances, confidence limits for variance and ratio of two variances, choice of sample size.

UNIT-III (15 Hrs.)

Statistical Analysis for Discrete Function: Application of binomial and Poisson's distribution, normal approximation, test for a single proportion and difference between two proportions, application of $\chi 2$ distribution, contingency table.

Subjective Tests: Rank correlation, tied rank, coefficient of concordance.

UNIT-IV (15 Hrs.)

Acceptance Sampling: Basic idea about acceptance sampling, OC curve, producer's risk and customer's risk.

Control Charts: Advantages using quality control charts, random and assignable causes, action and warning limits, X, R, p, n p and c chart, Process Capability Ratio (CP and CPK), concept of 6 sigma process control, brief idea about CUSUM and EWMA chart.

ANOVA and Regression: Some basic concept of Analysis of Variance, method of least squares, Curve fitting, linear regression methodology, Karl Pearson correlation and standard error.

Recommended Books:
1. G.A.V. Leaf, 'Practical Statistics for the Textile Industry', Part I & II, The Textile Institute, UK,**1987**.
2. D.C. Montgomery, 'Introduction to Statistical Quality Control', John Wiley & Sons Publications, **2002**.
3. B.S. Dhillon, 'Applied Reliability and Quality: Fundamentals', Methods and Procedures,Springer, London, **2007**

KNITTING TECHNOLOGY LAB.

Subject Code: BTEXS1-606   **LT P C**   **0 0 2 1**   **Duration-20 Hrs.**

At least 10 experiments are to be performed by each student
List of Experiments.

1. To study the path of yarn through plain knitting machine.
2. To study the different knitting elements including the cam system.
3. To study the driving mechanism of Circular Knitting Machine.
4. To study the cloth take-down mechanism of Circular Knitting Machine.
5. To study the rib knitting m/c including arrangement of dial and cylinder needles, cam system and driving mechanism.
6. To study the Interlock knitting m/c including arrangement of dial and cylinder needles, cam system & driving mechanism.
7. To study cam system of V - bed Flat Knitting Machine.
8. To study passage of yarn of Hand Operated V - bed Flat Knitting Machine.
9. Preparation of Fabric samples (rib, circular, half cardigan and full cardigan in V-bed rib knitting machine.
10. To study the effect on loop length with the change in cam setting in Single Feeder Circular Knitting Machine.
11. To study the Positive Feed Device (IRO) on a Circular Knitting Machine.
12. To analyze plain, rib and Interlock knitted fabrics and their derivatives (course per inch, wales per inch, loop length, GSM & needle diagram).

TEXTILE TESTING II LAB

Subject Code: BTEXS1-607   **LT P C**   **0 0 2 1**   **Duration-20 Hrs.**

At least 10 experiments are to be performed by each student
1. Classmate fault analysis (yarn fault classifying system)
2. Determine coefficient of friction of a spun yarn and see the effect of waxing on coefficient of friction.
3. Characterize a woven fabric with respect to its dimensional properties.
   a) thread density
   b) yarn number
   c) yarn crimp
   d) weave
   e) cover factor
   f) Areal density
   g) skewness
   h) Thickness
4. Determine the tensile strength and elongation of a woven fabric and compare the Load-elongation curve with Non-woven and knitted fabric.
5. Determine the tear resistance of a fabric using Elmendorf Tear Tester.
6. Determine the bursting strength of a fabric on a hydraulic bursting tester.
7. Determine the abrasion resistance of a fabric.
8. Determine the pilling propensity of a fabric.
9. Determine the crease recovery of fabric and observe effect of loading time & recovery time

on crease recovery.
10. Determine the Drape coefficient of a fabric sample.
11. Determine the compression property of a fabric (thickness).
12. Determine the Air permeability, water permeability and water repellency of a fabric.
13. Determine the stiffness of a fabric, knitability of hosiery yarn.