

Uttar Pradesh Textile Technology Institute, Kanpur



**PROPOSED STUDY & EVALUATION SCHEME
FOR
B. TECH.
(TEXTILE ENGINEERING)
EFFECTIVE FROM 2019-20**

**ON
CHOICE BASED CREDIT SYSTEM (CBCS)**

Affiliated to

DR. APJ ABDUL KALAM TECHNICAL UNIVERSITY, LUCKNOW

Uttar Pradesh Textile Technology Institute, Kanpur

Affiliated to

Dr. APJ Abdul Kalam Technical University, Lucknow

STUDY AND EVALUATION SCHEME

B. Tech. Textile Engineering (CBCS)

4th Year VII-SEMESTER

Effective from SESSION-2019-20

S. No.	Subject Code	Subject Name	L-T-P	Th./Lab Marks	Sessional		Total	Credit
				ESE	CT	TA		
Theory								
1	ROE071/ ROE072	OPEN ELECTIVE-1: Quality Management/ Operation Research	3-0-0	70	20	10	100	3
2	RTT031/ RTT032/ RTT034	Dept Elective-3: Non Woven Technology / Functional Textiles / Theory & Design of Textile Machines	3-0-0	70	20	10	100	3
3	RTT041/ RTT042	Dept Elective 4: Theory of Textile Structure/Clothing science	3-1-0	70	20	10	100	4
4	RTT701	Knitting Technology	3-1-0	70	20	10	100	4
5	RTT702	Garment Technology	3-0-0	70	20	10	100	3
Practical								
6	RTT751	Knitting Technology Lab	0-0-2	50		50	100	1
7	RTT752	Garment Technology Lab	0-0-2	50		50	100	1
8	RTT753	Industrial Training	0-0-2			100	100	2
9	RTT754	Project -1	0-0-6			200	200	3
	TOTAL			450	100	450	1000	24

OPEN ELECTIVE-1

- 1- ROE-071 Quality Management
- 2- ROE-072 Operation Research

Departmental Elective 3

1. RTT031: Non-Woven technology/ (NPTEL/ MOOCS)
2. RTT032: Functional Textiles
3. RTT034: Theory & Design of Textile Machines

Departmental Elective 4

1. RTT041: Theory of Textile Structure
2. RTT042: Clothing Science

Uttar Pradesh Textile Technology Institute, Kanpur

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STUDY AND EVALUATION SCHEME

B. Tech. Textile Engineering (CBCS)

4th Year VIII-SEMESTER

Effective from SESSION-2019-20

S. No.	Subject Code	Subject Name	L-T-P	Th./Lab Marks	Sessional		Total	Credit
				ESE	CT	TA		
Theory								
1	ROE081/ ROE082	OPEN ELECTIVE-II: Non-Conventional Energy Resources/ Product Development	3-0-0	70	20	10	100	3
2	RTT051/ RTT052/ RTT054/ RTT055	Technical Textile (NPTEL/MOOCs)/High Perf. Fibre (NPTEL/MOOCs)/Text Mktg & Merchandizing/ Textured Yarn Technology (NPTEL/MOOCs)	3-0-0	70	20	10	100	3
3	RTT061/ RTT062/ RTT065	Process Control in Spinning & Weaving / Mill Planning & Organization / Evaluation of Textile Materials (NPTEL/MOOCs)	3-1-0	70	20	10	100	4
Practical								
4	RTT851	SEMINAR	0-0-3			100	100	2
5	RTT852	PROJECT	0-0-12	350		250	600	12
	TOTAL			560	60	380	1000	24

OPEN ELECTIVE-1

1. ROE081: Non-conventional Energy Resources,
2. ROE082: Product Development

Departmental Elective 5

1. RTT051: Technical Textiles
2. RTT052: High Performance Fibres
3. RTT054: Textile marketing & Merchandizing
4. RTT055: Textured yarn Technology (NPTEL/MOOCs)

Departmental Elective 6

1. RTT061: Process Control in Spinning & Weaving
2. RTT062: Mill Planning & Organization
3. RTT065: Evaluation of Textile Materials (NPTEL/ MOOCs)

**7th Semester B. Tech. Textile Engineering (CBCS)
(Effective from 2019-20)**

7. Open Elective- I

1.1 Quality Management (ROE-071)

UNIT-I : Quality Concepts: Evolution of Quality Control, concept change, TQM Modern concept, Quality concept in design, Review of design, Evolution of proto type.

Control on Purchased Product: Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure.

Manufacturing Quality: Methods and techniques for manufacture, inspection and control of product, quality in sales and services, guarantee, analysis of claims.

Total Lectures required =9

UNIT-II: Quality Management

Organization structure and design, quality function, decentralization, designing and fitting, organization for different type products and company, economics of quality value and contribution, quality cost, optimizing quality cost, seduction program.

Human Factor in quality: Attitude of top management, cooperation of groups, operators attitude, responsibility, causes of apparatus error and corrective methods.

Total Lectures required =9

UNIT-III: Control Charts, Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts.

Attributes of Control Chart, Defects, construction and analysis of charts, improvement by control chart, variable sample size, construction and analysis of C charts.

Total Lectures required =9

UNIT -IV : Defects diagnosis and prevention defect study, identification and analysis of defects, correcting measure, factors affecting reliability, MTTF, calculation of reliability, building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle.

Total Lectures required =9

UNIT -V: ISO-9000 and its concept of Quality Management, ISO 9000 series, Taguchi method, JIT in some details. **Total Lectures required =6**

Grand total of lectures required = 42

Text / Reference Books:

1. Lt. Gen. H. Lal, "Total Quality Management", Eastern Limited, 1990.
2. Greg Bounds, "Beyond Total Quality Management", McGraw Hill, 1994.
3. Menon, H.G, "TQM in New Product manufacturing", McGraw Hill 1992.

1.2 OPERATION RESEARCH (ROE-072)

UNIT-I: Introduction:

Definition and scope of operations research (OR), OR model, solving the OR model, art of modeling, phases of OR study.

Linear Programming: Two variable Linear Programming model and Graphical method of solution, Simplex method, Dual Simplex method, special cases of Linear Programming, duality, sensitivity analysis. **Total Lectures required =9**

UNIT-II : Transportation Problems:

Types of transportation problems, mathematical models, transportation algorithms,

Assignment: Allocation and assignment problems and models, processing of job through machines. **Total Lectures required =8**

UNIT-III : Network Techniques:

Shortest path model, minimum spanning Tree Problem, Max-Flow problem and Min-cost problem.

Project Management: Phases of project management, guidelines for network construction, CPM and PERT. **Total Lectures required =8**

UNIT-IV: Theory of Games:

Rectangular games, Minima theorem, graphical solution of $2 \times n$ or $m \times 2$ games, game with mixed strategies, reduction to linear programming model.

Quality Systems: Elements of Queuing model, generalized poisson queuing model, single server models. **Total Lectures required =9**

UNIT-V: Inventory Control,

Models of inventory, operation of inventory system, quantity discount., Replacement, Replacement models: Equipments that deteriorate with time, equipments that fail with time. **Total Lectures required =8**

Grand Total Lectures required =42

Text / Reference Books:

1. Wayne L. Winston, "Operations Research" Thomson Learning, 2003.
2. Hamdy H. Taha, "Operations Research-An Introduction" Pearson Education, 2003.
3. R. Panneer Seevam, "Operations Research" PHI Learning, 2008.
4. V.K.Khanna, "Total Quality Management" New Age International, 2008.

2.0 Open Elective from Other departments

2.1 RTT 031:- Non-Woven Technology (L T P 3-0-0-3)

Course Outcome: After completing the course student is able to:

CO1	Get the knowledge of non woven market & classification of non-woven
CO2	Understand the different methods of non woven manufacturing processes and description of non woven machines
CO3	Get the knowledge about the properties of fibres required for non-woven, structure of fibres in non-woven & non-woven fabric properties & their application

Unit 1: National and international scenario on non-woven fabric production, Concept about felts and non woven, Classification of non-woven fabrics, fibres for non-woven fabrics, Felt Manufacturing process Total Lectures Required =9

Unit 2: Various method of web formation, web characteristics and their influence on properties of non-woven fabrics, (3) Non woven fabric by Needle punch, Description of needle punching machine, effect of process variables on properties of needle punch fabric Total Lectures Required =9

Unit 3: Non-woven fabric by hydro entanglement, Description of hydro entanglement machine, effect of process variables on properties of hydro entanglement non woven fabric, Non-woven fabric by adhesive bonding, mechanical bonding, Melt blown process of non-woven fabric manufacturing Total Lectures Required =8

Unit 4: Non-woven fabric by Stitch bonding, Non-woven fabric by chemical bonding, Non-woven fabric by bonding with thermoplastic adhesives, Non-woven fabric by Spun laced, Effect of process variables on properties of stitch bonding, chemical bonding spun laced non-woven fabrics. Total Lectures Required =8

Unit 5: Flocked fabric, Laminates, latest development in non-woven industry: ultrasonic bonding, Infra-red bonding, bonding by bi-component fibres. Application of various non woven fabrics

Total Lectures Required =8

Grand total of Lectures required= 42

Reference & Text Books

1. Knitting technology: Spenser D.J., 2nd edition, Pergamon Press, 1989
2. Russel, S. J., Handbook of nonwovens, Woodhead Publishing Ltd., 2006 (Edited)
3. Chapman, R.A., "Applications of Nonwovens in Technical Textiles", The Textile Institute, 2010.
4. Horrocks A.R. and Anand S.C., "Handbook of Technical Textiles", The Textile Institute, 2000.
5. Adanur, S. "Handbook of Weaving", CRC Press, 2001
6. Russel S.J. "Handbook of Nonwoven", The Textile Institute, 2007
7. Krecma, R., Manual of Nonwovens, The Textile Trade Press, Manchester, UK, 1971.
8. Purdy, A. T., Developments in Nonwoven Fabrics, Textile Progress, Vol. 12, No. 4, The Textile Institute, Manchester, UK, 1983.

9. Neckar, B. and Das, D., Theory of structure and mechanics of fibrous assemblies, Woodhead Publishing India Ltd., New Delhi, 2011
10. Jirsak, O. and Wadsworth, L., Nonwoven Textiles, Carolina Academic Press, NC, USA, 1999.
11. Peters, R. H., Textile Chemistry, Elsevier Scientific Publishing Company, New York, 1975.
12. Hall, A. J, Textile Finishing, Haywood Books, London, 1996.
13. Journals: Nonwovens Industry, International Nonwovens Journal, Textile Research Journal, Journal of Textile Institute, Journal of Engineered Fibres and Fabrics.

2.2 RTT 032: Functional Textiles (3-0-0-3)

Course Outcome: After completing the course student is able to:

CO1	Understand, what is functional textiles, & functional finishes & their classification
CO2	Get the knowledge about protective textiles & properties of protective textiles for different applications & properties of fibres & processes required for the same
CO3	Be acquainted with medical textiles, their different areas & products used for the same along with fibres & processes required for the same
CO4	Will understand the special functional requirements for sport textiles & cosmatotextiles, & ways to improve its performance

Unit 1: Definition of functional clothing, Classification of functional clothing, Functional finishes, ways to apply functional finishes on textile surfaces, Functional clothing market review

Unit 2: Functional Protective clothing: Nuclear biological Chemical protective clothing, extreme cold clothing; design, mechanism and applications, Fire retardant clothing, approaches to achieve fire retardancy in clothing, mechanism of fire retardancy, Soft and hard body armour , shear thickening fluids (non-newtonian) for body armour, water proof breathable fabrics, ways to achieve waterproofing and breathability in textiles

Unit 3: Medical functional clothing: therapeutic and rehabilitative clothing, biosensing clothing, wound healing promoting dressings, antimicrobial sutures

Unit 4: Sportswear clothing: moisture management in sportswear, compression textiles, Aerodynamics, Spacesuit design and development, woven and knitted sportswear,

Unit 5: Cosmetotextiles: definition, classification, mechanism to develop various cosmetic effects in textiles, various cosmetoingredients, worldwide scene of cosmetotextiles, Smart Textiles, classification of smart textiles, Intelligent textiles, , mechanism of various types of smart textiles, Wearable electronics

Reference Books

1. Paul R, Functional Finishes for Textiles: Woodhead Publishing
2. Pan N, Improving Comfort, Performance and Protection, Woodhead publishing
3. G. Thilagavathi., M. Parthiban, S. Viju, Functional Textiles and Clothing, Woodhead Publishing
4. Qin Yimin, Medical textile materials, Woodhead publishing
5. R Shishoo, Textiles for sports wear, Woodhead publishing
6. L. Ashok, Kumar, C. Vigneswaran, Electronics in Textiles and Clothing: Design, Products and Applications CRC Press
7. J. McCann (Editor), David Bryson, Smart Clothes and Wearable Technology, Woodhead Publishing Series in Textiles.
8. Hu Jin Lian Active coatings for smart textiles, Woodhead publishing
9. Konker Viadan, Smart Textiles and their application, Woodhead publishing
10. Sun Ganj, Antimicrobial textiles, Woodhead publishing
11. Scott RA, Textiles for protection, Woodhead publishing

2.3 RTT 034: Theory & Design of Textile Machines (L T P 3 0 0) Credit 3

Course Outcomes: After completing the course student will be able to:

CO1	Be acquainted with design aspects of the textile machines.
CO2	Enable the students to numerical aspects of the designing of the parts of the textile machines.
CO3	Provide the students capability of coordinating the design intricacies with the working principles of the textile machines.
CO4	Enable the students with the idea how design of a textile machine is responsible for quality and quantity aspects.
CO5	Inculcate the quality in the students to have a deep understanding about the research and development of the textile machines.

Unit 1: Design of cone drums for Scutcher, principles of mixing, opening, cleaning in Blow Room line, difference in aerodynamics of lint and trash and its utilization in blow room machinery design, redesigning of openers by using different principles for better performance. Transmission of motion to various parts of carding machine, different systems of carding web collection, sliver coiling system, Inertia of carding engine, latest carding machine developments.

Total Lectures Required = 9

Unit 2: Concept of lap formation for comber, designing concept of comber cylinder, top comb, detaching system, latest machinery developments in comber frame.

Different drafting systems in draw frame, roller weighing system, roller setting, and different stop motion, Differential motions used in speed frame, design of cone drums for speed frame, Design of flyer, building motion of speed frame.

Total Lectures Required = 9

Unit 3: Design and analysis of ring frame cams, designing concept of building motion of ring frame, design of ring spindle and bolster, designing concept of various rings and travelers. Designing concepts of drum winding, designing of winding drum, traverse in different winding machines, Concepts of latest tensioners for winding, designing concept of slub catchers

Total Lectures Required = 9

Unit 4: Designing concepts of warping drums, sectional warping, designing concepts of high efficiency creels, Transmission of motion in warping machines, concept of designing of stop motions in warping, Designing concept of saw box for sizing machine, designing of drying cylinder, heating system for drying cylinder, latest machinery developments in sizing machines **Total Lectures Required = 9**

Unit 5: Principles governing the design of looms. Mechanics of basic weaving operations, Kinetics of slay, slay eccentricity, designing concepts of tappet for different twill weaves, warp tension measurement and its control, Different picking system, weft insertion system of sulzer, rapier, airjet and waterjet systems. Brief introduction of electronic Dobby and Jacquard, Designing concept of multiphase weaving, mechanism of different stop motions on shuttleless looms. Designing concept of loom for 2.5 D, 3 D fabric, and multi-axial weaving.

Total Lectures Required = 9

Grand Total of Lectures Required = 45

Text Books & Reference Books

1. Spun Yarn Technology by Eric Oxtoby
2. The technology of Short Staple Spinning- W. Klien
3. Mechanics of Spinning by R.S. Rengasamy
4. Modern development in weaving machine, by Duxburg
5. Weaving mechanism, machine and management, by Talukdar.
6. Weaving mechanism, by Robinson

Modern weaving preparation and machinery, by A. Ormerod

Departmental Elective: (3-1-0-4)

3.1KTT041: Theory of Textile Structure (3-1-0-4)

Course Outcome: After completing the course student will be able to:

CO1	Understand classification of yarns, classification of yarns, basic structural difference of yarns from different technologies
CO2	Be able to understand and apply ideal geometry of yarn & apply its knowledge to relate with yarn diameter, twist contraction.
CO3	Be apply the knowledge to estimate yarn tensile properties & make geometrical analysis for migration parameters & modelling for estimation of yarn strength
CO4	Understand basic geometry of fabric & apply it to calculate fabric thickness, cover factor, gsm, and able to estimate the possibilities of calculating max cover, threads per cm, & porosity
CO5	Understand the basic concept of fabric deformation & theoretical treatment for the same

Unit (1): Classification of yarns, Yarn geometry- idealized yarn geometry, relationship of yarn number and twist factor, packing of fibres in a yarn, ideal packing, hexagonal close packing and radial packing, packing factor and its measurement, yarn diameter, method of measurement of twist contraction. **Total Lectures required =10**

Unit (2): Fibre migration: mean fibre position, amplitude of migration and frequency of migration, mechanism of migration, spinning-in coefficient and fibre extent. estimation of strength of blended yarn **Total Lectures required =6**

Unit 3: Mechanism of staple fibre yarns, translation of fibre properties into yarn properties, twist and strength relationship, limit of twist, spinability of textile fibres, relation with end-breakage rate. **Total Lectures required =9**

Unit (4): Elements of fabric geometry, cloth setting theories, flexible and rigid thread model, Pierce’s equation and later modifications.

Total Lectures required =7

Unit (5): Relation of fabric properties to simple geometry, crimp interchange in woven fabric, crimp balance equation, Fabric cover, cover factor and their significance, relation between cover and weight per unit area of fabric, Theoretical treatment of fabric deformation in tension

Total Lectures required =10

Grand total of lectures required = 42

Text Books and Reference material:

1. Hearle J W S, Grosberg P and Backer S, “Structural Mechanics of Fibres Yarns and Fabrics”, Wiley Interscience, New York, 1969.
2. Peirce F T and Womersley J R, “Cloth Geometry”, reprint, The Textile Institute, Manchester 1978.
3. Hearle J W S, Thwaites J J and Amirbayat, “Mechanics of Flexible Fibre Assemblies”, Sijthff and Noordhoff International Publishers BV, Alphen aan den Rijn, Netherlands 1980.
4. Textile Yarns- B.C. Goswami, J.G. Martindale, F.L. Scardino,
5. Goswami B C, Martindale J G and Scardino F, “Textured yarn technology, structure and applications”, Wiley Interscience Publisher, New york, 1995.
6. Woven textile Structures by B.K. Behera & P.K. Hari, CRC Press

3.2 RTT 042: Clothing Science (3-1-0-4)

Course Outcome: After completing the course student is able to:

CO1	Understand basic concept of comfort, processes related to comfort
CO2	Understand the theory behind physiological basis for comfort & fabric properties related to this
CO3	Understand importance of thermal conductivity of fibrous materials & various parameters related to this & measurement methods for the same
CO4	Understands the importance of liquid/ moisture transport properties & its role in fabric comfort, about Instrument used for measuring the same
CO5	Understand mechanism of moisture transport & its measurement system

Unit 1: Definition of clothing comfort: importance of studying clothing comfort, various components and definition of clothing science, Brief introduction to the various processes related to comfort aspect: psychological, neurophysiological, physiological and physical, Psychology and Comfort: Psychological scaling, scales of measurement, wear trial technique, Aesthetic Comfort: General aspects, measurement of aesthetic properties, changes in aesthetic behaviour

Unit 2; Neuro-physiological basis of sensory perceptions: Perceptions of skin sensations related to Mechanical stimuli: Dynamics of wear sensation, touch and pressure, prickle, itch and inflammation, roughness and scratchiness, Perceptions of sensations related to thermal and moisture stimuli: Fabric mechanical properties and tactile- pressure sensations: Fabric prickliness, fabric itchiness, fabric stiffness, fabric softness, fabric smoothness, roughness and scratchiness, fabric hand

Unit 3: Thermal Conductivity of Fibrous Materials: Various parameters and related factors that affect the thermal conduction through fibrous materials like fibrebatts, nonwoven fabrics, pile fabrics, woven and knitted fabrics, thickness, cover factor, fibre type, yarn structure, fibre morphology and shape, effect of fabric layers etc. Transient heat transfer mechanism (the warm-cool feeling): Kawabata's theoretical proposition of thermal diffusivity as an objective parameter for evaluation of warm-cool feeling, Hess's proposition of thermal absorbtivity as a more suitable parameter for the same purpose, Kawabata's instrument,

Unit 4: Liquid Moisture Transfer through Fibrous Materials (Wicking and Water absorption): Theory of surface tension, theory of capillary action, wetting and wicking, wettability and contact angle measurement. interaction between liquid and fibrous materials, liquid spreading dynamics on a solid surface, Rayleigh instability, Lucas-Washburn theory, various theories and models on vertical and horizontal wicking through yarns, nonwoven fabrics and woven fabrics, absorption of water by a fibrous mass, objective measurement of wicking and absorption: angle of contact, droplet absorption test, vertical wicking, horizontal or transverse wicking tests

Unit 5: Transfer of moisture vapour through Fibrous Materials: Diffusion of vapour through a porous medium, various modeling approaches, moisture vapour permeability of fabrics, influence of various fabric parameters such as thickness, cover factor, etc. on the moisture vapour permeability, measurement of moisture vapour permeability, International standards.

Reference Book

1. Apurba Das, R. Alagirusamy, Science in Clothing Comfort Woodhead Publishing India Pvt Limited, 2010 - Technology & Engineering - 175 pages
2. Guowen Song, Improving Comfort in Clothing, Woodhead Publications
3. J. Williams, Textiles for Cold Weather Apparel, Woodhead Publications
4. Lyman Fourt and Norman R.S. Hollies, "Clothing Comfort and Function", Marcel Dekker, INC., New York, 1971
5. Kothari, V K, "Testing and Quality Management ", CBS Book Publishers, New Delhi, 2000.
6. Zhang Wei Yuan, "Clothing Comfort and Function",China Textile Press,2011
7. Saville B P, "Physical Testing of Textiles," The Textile Institute, Woodhead Publication Limited, Cambridge, 1999,

4. KTT701: Knitting Technology (3-1-04):

Course Outcome: After completing the course student will be able to:

CO1	Be able to understand basic concept of knitting, classification of knitting
CO2	Understand basic difference between different knitting system,
CO3	Understand mechanism of weft & warp knitting machines & principles behind warp & weft knitting
CO4	Understand the different types of structures made on different types of knitting machines
CO5	Be able to compare important properties of fabric made of it. Be able to calculate & estimate stitch density, cover & gsm of knitted fabric

Unit 1: Difference between knits and wovens, knitting terms and definitions (Course,, wale, stitch density) different type of knitting needles: bearded needle, latch needle, sinker, jack, cam arrangement, overlap, under lap, closed lap, open lap. **Total Lectures required =8**

Unit 2: Comparison of warp and weft knitting, Classification of weft knitting machine, elements of knitting machine, all type of needles, sinkers, positive feeder etc Needle numbering system, technology of loop formation, geometry of loop structure, Elements of loop structure: needle loop, sinker loop, relation between yarn count, machine gauge and stitch density. **Total Lectures required =9**

Unit 3: Classification of knit-structures, loop formation on: single jersey, Rib machines and interlock machines, socks knitting technology, sliver knitting machine, Loop formation on flat bed machine

Total Lectures required =9

Unit 4: Four primary base knitting structures: Plain knitted fabric, Rib fabric, Interlock and Purl fabric, Special knitting machines: Fabric machine, garment length machine, flat machine, circular machine fabrics and Spacer fabrics. **Total Lectures required =7**

Unit 5: Basic warp knitting machines, classification of warp knitting, Modern developments in warp knitting technique, calculations regarding production, gsm, stitch density, tightness factor etc, Causes and remedies of faults of knitted fabrics. **Total Lectures required =9**

Grand total of lectures required = 42

Reference and Text Book-

1. D Spencer; Knitting Technology, Published by Pergammon Press.
2. S Raz; Warp knitting production, Published by Melliand Textilberichte.
3. S Raz, Flat Knitting; Published by Melliand Textilberichte.
4. Sadhan C Ray, Fundamentals and Advances in Knitting Technology (Woodhead Publishing India in Textiles)
5. Prof Ajgaonkar D B, Knitting technology
6. Iyer, Mammel and Schach, Circular knitting, Published by Meissenbach GmbH.
7. Ed. K P Weber; Karl Mayer, Introduction to Warp knitting, Pulication.

5. RTT 702: Garment Technology (3-0-0-3)

Course Outcome: After completing the course student is able to:

CO1	Be able to understand concept of garment making, cutting, fusing sewing, pressing, etc
CO2	Be able to understand the important properties required for garment making, apply the importance of low stress properties, thermal properties, to garment making
CO3	Be able to understand the garment cutting, marker planning, methods of spreading etc in garment making
CO4	Be able to understand the importance of seam, stitch classification, seam formation etc.
CO5	Get the knowledge about different sewing machines, classification of sewing machines, their application etc

Unit (1): Introduction to garment manufacturing technology, Sample cutting, Fusing, Sewing, Pressing, Finishing and inspection, Line balancing concept. **Total Lectures required =8**

Unit (2): Introduction to measurement of fabric dimensional properties, fabric comfort, thermal comfort, objective evaluation of fabric, low stress fabric properties, Kawabata system, fabric assurance by sample testing, fabric defects, Fabric inspection and feedback to back process. **Total Lectures required =9**

Unit (3) Introduction to garment cutting, Marker planning, Efficiency of Marker planning, software for marker planning, methods of marker planning and marker use, spreading of the fabric, to form a lay, spreading requirements, methods of spreading, fabric packages, objective of cuttings, methods of cuttings, **Total Lectures required =9**

Unit (4): Introduction to seam, stitch, stitch classification, stitch structure, seam formation, joining material, surface characteristics, seam appearance, damages (thermal and mechanical), seam performance, seam degradation, seam failure, seam puckering and seam testing. Sewing needle and sewing thread, thread consumption, **Total Lectures required = 9**

Unit 5: Introduction of spreading machines and cutting machines- types and functions, History of sewing machines. Sewing machinery- classification according to bed types, stitch types (hook or looper) material wise (extra light to heavy weight). Major parts of sewing machinery and functions. Parts, functions and adjustments of Over Lock: Collar turning machines, folding machinery fusing and pressing machinery, Computer controlled cutting, sewing, folding machinery. Automatic piece handling system(ETONE system), SAM(standard average minute) value. **Total Lecture Required: 8**

Grand total of lectures required = 42

Text Books and Reference material:

1. T Ramchandran, Introduction to Garment Manufacturing Technology
2. T Ramchandran, Garment Manufacturing Technology
3. Mary Methews, Practical Clothing Construction Part I & II
4. Carr H and Lantham B, “The Technology of Clothing Manufacture”, Om Book Service, Delhi.
5. Mehta P V and Bhardwaj S K, “ Managing Quality in apparel industry”, Om Book Service, New Delhi.
6. Aldrich W, “Metric Pattern Cutting”, OM Book Service, New Delhi, 1998.
7. Cooklin Gerry, “Garment Technology for Fashion Designers”, OM Book Service, New Delhi, 1997.
8. Eveleyn M and Ucas, “Clothing Construction”, 2nd Edition Hughton Mifflin Co, Boston 1974.

Lab Syllabus

6.1 RTT-751: Knitting Technology Lab

To study the path of yarn through circular and flat knitting machine, different knitting elements including the cam system, driving mechanism of plain knitting machine, cloth take-up mechanism of plain knitting m/c, rib knitting m/c including arrangement of dial and cylinder needles, cam, system and driving mechanism, Interlock knitting m/c including arrangement of dial and cylinder needle, cam system and driving mechanism, Warp knitting machine constructional details and mechanism of operation.

7.1 RTT-752: Garment technology lab

As per syllabus of Garment technology

8.1 RTT-753 Industrial Training

Students shall carryout industrial training as a part of their curriculum after the completion of their 3rd year for one month. After this their performance shall be evaluated during 7th semester by taking viva of each and every student.

9.1 RTT 754 Project 1

Students will carry out minor project during seventh semester as a part of curriculum as per AKTU guidelines.

8th Semester B. Tech. Textile Engineering (CBCS) (Effective From 2019-20)

9. OPEN ELECTIVE-II

1.1 RTT-081: NON-CONVENTIONAL ENERGY RESOURCES

UNIT-I: Introduction to various non-conventional energy resources- Introduction, availability, Classification, relative merits and demerits. 3 Solar Cells: Theory of solar cells. solar cell materials, solar cell array, solar cell power plant, limitations. 4

UNIT-II: Solar Thermal Energy: Solar radiation, flat plate collectors and their materials, applications and performance, focussing of collectors and their materials, applications and performance; solar thermal power plants, thermal energy storage for solar heating and cooling, limitations. 9

UNIT-III: Geothermal Energy: Resources of geothermal energy, thermodynamics of geothermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations. 4 Magneto-hydrodynamics (MHD): Principle of working of MHD Power plant, performance and limitations. 2 Fuel Cells: Principle of working of various types of fuel cells and their working, performance and limitations. 3

UNIT-IV: Thermo-electrical and thermionic Conversions: Principle of working, performance and limitations. 2 Wind Energy: Wind power and its sources, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics. Performance and limitations of energy conversion systems. 6

UNIT-V: Bio-mass: Availability of bio-mass and its conversion theory. 2 Ocean Thermal Energy Conversion (OTEC): Availability, theory and working principle, performance and limitations. Wave and Tidal Wave: Principle of working, performance and limitations. Waste Recycling Plants. 3

Text/References Books:

1. Raja etal, "Introduction to Non-Conventional Energy Resources" Scitech Publications.
2. John Twideu and Tony Weir, "Renewal Energy Resources" BSP Publications, 2006.
3. M.V.R. Koteswara Rao, " Energy Resources: Conventional & Non-Conventional " BSP Publications,2006.
4. D.S. Chauhan,"Non-conventional Energy Resources" New Age International.
5. C.S. Solanki, "Renewal Energy Technologies: A Practical Guide for Beginners" PHI Learning. (14)

1.2 RTT 082- PRODUCT DEVELOPMENT

UNIT-1: Concept of Product, definition and scope. Design definitions, old and new design methods, design by evolution, examples such as evolution of sewing M/C, bicycle, safety razor etc., need based developments, technology based developments physical reliability & economic feasibility of design concepts.

UNIT –II: Morphology of design, divergent, transformation and convergent phases of product design, identification of need, Analysis of need. Design criteria; functional, aesthetics, ergonomics, form, shape, size, colour. Mental blocks, Removal blocs, Ideation techniques, Creativity, Check list.

UNIT –III: Transformations, Brainstorming& Synetics, Morphological techniques. Utility Concept, Utility Value, Utility Index, Decision making under Multiple Criteria. Economic aspects, Fixed and variable costs, Break-even analysis.

UNIT-IV: Reliability considerations, Bath tub curve, Reliability of systems in series and parallel, Failure rate, MTTF and MTBF, Optimum spares from Reliability considerations. Design of display and controls, Man-machine interface, Compatibility of displays and controls. Ergonomic aspects, Anthropometric data and its importance in design. Application of Computers in Product development & design.

UNIT-V: Existing techniques, such as work-study, SQC etc. for improving method & quality of product. Innovation versus Invention. Technological Forecasting. Use of Standards for Design.

Text/Reference Books:

1. A.K. Chitab& R.C. Gupta “Product design & Manufacturing” – Prentice Hall (EE)
2. R.P. Crewford, “The Technology of creation Thinking” Prentice Hall.
3. C.D. Cain, “Product Design & Decision” Bussiness Books.
4. C.D. Cain, “Engg. Product Design” Bussiness Books.

2. Departmental Elective (3-1-0-4)

2.1 RTT 051: Technical Textiles (3-1-0-4) Optionally may be done through NPTEL/MOOCs)

Course Outcomes: After completing the course student will be able to:

CO1	Be able to understand the application of different fibres in technical application, different types of technical textiles.
CO2	Be able to get the important parameters required for different types of protective textiles, the properties required for different types of technical textiles
CO3	Apply the knowledge in manufacture of protective textiles, waterproof textiles, antimicrobial textiles, NBC textiles product manufacturing
CO4	Get the knowledge about requirement of different types of medical textiles, their manufacturing process, different types of fibres & their properties required for medical textiles
CO5	Get the idea about smart textiles. About the application of different fibres in geotextiles and their manufacturing

Unit (1): Introduction to technical textile, types of technical textiles, textiles used in industry such as filtration, filter fabric construction- woven, needle felt & knitted filter fabric, finishing treatment of filter fabric, thermal and chemical properties of filter fabric, essential requirements of good filter fabric. Application of nano technology and nano materials for the improved filtration. **Total Lectures required =8**

Unit (2): Manufacture and properties of protective textiles- water proof/coated and water repellent, antimicrobial, flame retardant, chemical resistance, Nuclear and biological resistance, mechanical resistance such as bullet proof, cut prof, stab proof. **Total Lectures required =9**

Unit (3): Medical textiles, fibres used, classification of medical textiles- non-implantable material wound dressings, bandages, plasters, etc, Extra-corporal devices – Artificial kidney, liver lung, implantable material- suture, soft tissue implant, Orthopedic implants, Cardiovascular implants, Healthcare/ hygiene products, medical cost, surgical gown, face mast etc. **Total Lectures required =8**

Unit (4): Smart textiles, brief introduction of smart textiles, classification of smart textiles, passive smart textiles, active smart textiles, brief discussion of smart shirt, smart suit, musical jacket, space suit etc. automotive textiles: type cord, seat belt, air bag, seat upholstery, carpets, headliners, helmets etc, Agro textile: Shade net, green house film, Mulch net, crop cover, anti hail and bird protection net, finishing net etc. **Total Lectures required =9**

Unit (5): Introduction of geo textile, classification of geo textiles, functions of geo textile-soil reinforcement, drainage (fluid transmission), filtration, separation, erosion control/ absorption, objective of geo textiles, manufacturing of geo textile, essential properties of geo textiles-Mechanical determinants, Hydraulic determinants, durability determinants. **Total Lectures required =8**

Grand total of lectures required = 42

Text Books and Reference material:

1. A R Horrocks and S C Anand, Handbook of Technical Textiles, Woodhead Publication Ltd., Cambridge, 2000.
2. Sabit Adanaur, Wellington Sears Handbook of Industrial Textiles, Technimic Publishing Company, Inc., Pennsylvania, USA, 1995.
3. R W Sarsby, Geosynthetics in civil engineering, Woodhead Textiles Series No. 57, 2006, UK.
4. M Raheel, Marcel Dekker, Modern Textile Characterization Methods, Inc., 1996.
5. Mukhopadhyay S K and Partridge J F, “Automotive Textiles”, Textile Progress, Vol. 29, No. ½, 1999, Textile Institute, Manchester, UK.
6. Ukponmwan J. O, Mukhopadhyay A. and Chatterjee K. N., “Sewing Threads”, Textile Progress, Vol. 30, No. 3/4, 2000, Textile Institute, Manchester, UK.
7. Tao X, Smart fibre, fabrics and clothing
8. Shears handbook of industrial Textiles.

2.2 RTT-052:-High Performance Fibres (3-1-0-4) May be done through NPTEL/MOOCs)

Course Outcomes: After completing the course student will be able to:

CO1	Be able to get different types of high performance fibres and their applications
CO2	Be able to understand the manufacturing process of high performance fibres
CO3	Be able to get the manufacturing, application & uses of glass fibres, ceramic fibres, etc
CO4	Be understand the manufacturing, application & properties of gel spun fibres, thermally resistant fibres, chemically resistance fibres,
CO5	Be able to understand the development of biodegradable fibres, absorbent fibres, bi-component fibres & other high performance fibres

General Introduction and development of High Performance fibre

High Strength High Modulus Fibres: Aramids, Other rigid rod polymers such as PBZT, PBO, PBI,

Thermotropic aromatic polyesters,

Manufacturing of carbon fibres, Gel Spun fibres

Thermally resistant fibres, chemically resistant fibres

Inorganic fibres: Glass Fibres, Ceramic fibres

Other Performance fibres: Elastomeric Fibres, Lyocell fibres

Fibres for medical applications: Biodegradable fibres based on PLA, Absorbent fibres,

Smart functional Speciality Fibres: Stimuli responsive and smart textiles, Non-circular/hollow fibres, bicomponent and other speciality fibres, Electrospun fibres

Reference Books :

1. T. Hongu, New fibres, Ellis Horwood, New York 1990.
2. Lewis. E .M. Pearce, J .Preston, Hand book of fibre science and technology Vol-4, Marcel Dekkar, New York 1989.
3. Donnet J. B. Bansol R .C Carbon fibres, Marcel Dekkar, New York 1990.
4. Hearle J.W.S., High Performance Fibres, Textile Institute, Woodhead Publishing, 2001.
5. Mukhopadyay. S.K, “High Performance Fibres”, Textile progress Vol. 25, Textile Institute Manchester, 1993

2.3 RTT 054:-TEXTILE MARKETING AND MERCHANDISING

Course Outcomes: After completing the course student will be able to:

CO1	Be able to understand the textile marketing functions, concept of marketing, environment of textile marketing
CO2	Be able to grasp textile marketing strategy, Concept of textile product policy, pricing concept etc
CO3	Be able to understand and apply the concept of product management, maketing administration
CO4	Be able to understand various types of textile markets like jute, silk, wool marketing, understand sales forecasting, budgeting
CO5	Be able to understand process of planning, & controlling in merchandising

Unit 1: Introduction to Textile Marketing function; genesis, the marketing concept. Marketing, Management System: objectives, its interfaces with other functions in the organisation., Environment of Textile Marketing, Political and Economic Environment, Market segmentation, Consumer buying behaviour. Socio- cultural environment

Unit 2: Textile Marketing Strategy:- Market research, Marketing planning and Marketing programming. The concept of marketing mix, Product policy; the concept of textile product life cycle. New product decisions. Textile marketing and Pricing, Management of distribution: channels of distribution. Advertising and promotions. The concept of Unique Selling Proposition.

Unit 3: Implementation and Control. The marketing organization alternative organization structures; the concept of product management. Administration of the textile marketing programme: sales forecasting; marketing and sales budgeting; sales management; management of sales force.

Evaluation of marketing performance; sales analysis; control of marketing effort; marketing audit, 4 P model for marketing. After sales service and customer feedback

Unit 4: Jute textile sector, Silk textile sector, Man-made textile sector, Wool Textile sector, Statistics of Indian textile business (Domestic & Export) and World textile trade, Textile policy, World trade practices, norms, barriers, etc., Various pertinent prevailing issue impacting textile industry and trade, corporate social responsibility, ISO accreditation, etc., Retailing in textiles vis-a-vis consumer trends and behaviour and the challenges,

Unit 5: Textile Merchandising: Process of Planning, Purchasing, Motivating and Controlling of Materials in a optimum manner, vendor development, manufacturing, pricing, product design and development, exporting etc.

Reference Books:

1. A S Rao, Marketing Research Neha Publishers and distributors
2. Gilbert D. Harrell, Marketing: Connecting with Customers, Michigan State University ISBN-10: -9798304-7-1, Chicago Education Press, LLC.2012
3. Pocket Textile Merchandising & Marketing Expert Hardcover – 2008 by Textile Industries Media Group
4. Jeremy A. Rosenau, David L. Wilson, Apparel Merchandising: The Line Starts Here, 2nd Edition ISBN-13: 978-1563674488
5. Sapna Pradhan, Retail Merchandising Tata McGraw Hill Education Private Limited 2009

2.4 RTT055:Textured yarn Technology (L T P 3-1-0-4): May be done through NPTEL/MOOCs)

Course Outcomes: After completing the course student will be able to:

CO1	Be able to understand general principles in texturing & manufacture of textured yarn, Mechanism of bulked yarn
CO2	Be understand thermo-mechanical process of texturing, Understand the influence of process parameters on texturing
CO3	Be able to understand concept of draw texturing and its process & comparison between sequential & simultaneous draw texturing
CO4	Understand & apply concept of air texturing & principle involved in it.
CO5	Able to understand the concept of solvent texturing, texturing of spun yarns etc

Introduction to texturing, General principles involved in the manufacture of textured yarns,
 Bulked yarns, Mechanism of setting and texturing
 Thermo-mechanical texturing, Characterization and optimization, Influence of material and process parameters,
 Draw texturing, Simultaneous draw texturing with POY, Draw texturing machines and process parameters, Draw texturing: Effects of Process parameters, Draw texturing positorque system, friction draw texturing,
 Air-jet texturing, Air-jet texturing: effect of process parameters, Effect of water parameters, Air-texturing Jets
 Interlacement: Need and jet design, Bulked continuous filament yarns, Hi-bulk yarns,
 Texturing of spun yarns, solvent texturing

Text Books & Reference Books:

1. J.W.S. Hearle, L. Hollick, D.K. Wilson, Yarn Texturing Technology by Woodhead Publishing Ltd, England.
2. Goswami B.C., Martindale, J.G., Scardino F.L., Textile Yarn, Technology, Structure and Application” –, Wiley Interscience publication, 1977, U.S.A.
3. Hes L. Ursiny P., “Yarn Texturing Technology”, Eurotex, U.K., 1994.
4. M. Acar and G.R. Wray., “An analysis of the air jet yarn texturing process Part-I: A Brief history of developments in the process”, Journal of Text. Institute, Vol.77,No.1, p19-27, (1986).
5. Wilson D.K. and Kollu T., “Production of Textured Yarns by the False Twist Technique”, Textile Progress, Vol. 21, No.3, Textile Institute, Manchester, U.K.,1991.
6. Gupta V.B. (Edr.), “Winter School on Man-made Fibers – Production, Processing, Structure, Properties and Applications”, Vol. 1, 1988.

3. Department Elective 6

3.1 RTT 061: Process Control in Spinning & Weaving

Course Outcomes: After completing the course student will be able to:

CO1	Understand importance of process control, methods of controlling mixing quality & cost, ways of waste optimization in blow-room, assessment of blowrom performance
CO2	Be able to understand control mechanism for waste in card & comber, control of neps, able to calculation yarn realization
CO3	Be able to measure productivity, methods of maximizing spinning efficiency, control of yarn faults
CO4	Control of yarn quality in terms of evenness, count, strength, iperfections, count CV%, Scope of process control in preparatory
CO5	Scope & methods of control in loom, fabric defects

Unit (1): Importance of evolving a system for process control, control of mixing quality through fibre characteristics, simultaneous control of mixing cost and quality, concept of bale management. Control of waste in blow room and carding, norms for waste and cleaning efficiency in blow room & card, control of neps, assessment of performance of

blow room & card, control of comber waste, concept of yarn realization, calculation pertaining to waste & yarn realization **Total Lectures required =9**

Unit (2) Measurement and analysis of productivity, means to improve productivity, maximizing machine efficiency in ring spinning, controlling end breakage rate in ring spinning, control of soft waste and hard waste, control of yarn faults and package defects-slubs, crackers, spinner's doubles, bad piecing & slough off.

Control of yarn quality- count, strength and their variability, study of CV% (within bobbin and between bobbin), control of variability of lea strength, single yarn strength and elongation %, Control of yarn unevenness, imperfections and hairiness.

Total Lectures required =9

Unit (3): Scope of process control in weaving, systems of process control in weaving, setting norms and schedule of checks, machinery audit, optimizing quality of winding, control of quality of knot, producing good package, dressing of the beams for reducing incidence of cross ends. **Total Lectures required =9**

Unit (4): Process control in warping, minimizing end breakage in warping, quality of warping beam, control of productivity, factors responsible for loss in efficiency, control of productivity, Process control in sizing, choice recipe and size pick-up, control of size pick-up, control of yarn stretch, quality of sized beams. **Total Lectures required =9**

Unit (5): Process control in loom shed, snap study and time and motion study, control of warp and weft breakage, causes and remedies of fabric defects, factors responsible for loss in efficiency, control of productivity, process control in grey inspection, and folding sections.

Total Lectures required =9

Grand total of lectures required = 45

Reference Books

1. Machine catalogues of various machines manufacture
2. Process Control in Spinning by ATIRA
3. Process control in weaving by ATIRA
4. K.R. Salhotra, Process Control in Spinning
5. Weaving tablets by ATIRA

3.2 RTT 062:- Mill Planning & Organization

Course Outcomes: After completing the course student will be able to:

CO1	Be able to understand the concept of site selection, building, plant & machinery selection
CO2	Be able to understand the various hazards, and way to ensure safety measures in mill, understand different safety rules & their implementation mechanism
CO3	Be able to understand the machine balancing for optimum utilization & profitability
CO4	Be able to understanding product costing, selection of product mix for optimum profitability
CO5	Be able to understand & apply staffing, recruiting,, MIS systems in textile industry

Unit-I: Preparation of project—Spinning/Weaving/Processing/Composite

- I- Selection of product
- J- Site Selection (site, location, land and cost)
- K- Building (single, double and multiple)
- L- Plant and Machinery

Total lecture required 09

Unit-II: Industrial hazards: i. Fire hazards, ii. Mechanical hazards, iii. Electrical etc

Safety rules for prevention of accidents

Humidification of textile mill- humidifier and humidification

Ventilation, floor cleaning in textile mills, lightening

Air conditioning and Refrigeration system, **Total lecture required 08**

UNIT III: Balancing of machine (plant layout for machines-- balancing of machines, layout of different machines, calculation for balancing of machines for different processes—spinning, weaving): Total lecture required 07

UNIT IV: Production Costing—various terms used in costing (cost volume, profit analysis, depreciation ,cost allocation on waste, effect on cost direct , indirect

Various elements of costing- concept of estimation for costing, break-even analysis, different economic ratios, **Total lecture required 10**

UNIT V: Economic Viability, organizational structure in textile mills – daily wages, various systems, piece wages system, Recruitment, allocation and skill development, Management and information system MIS.

Total lecture required 08

Text Books & Reference Material:

1. Tarachand, Industrial Engineering, Organization & management
2. T.M. Chabra, Industrial Economics & Principle of Management
3. S. K Sharma, Industrial Economics & Principle of Management
4. Dudeja V D, “Management of Textile Industry”, Textile Trade Press, Ahmedabad, 1981.
5. Ormerod A, “Textile Project Management”, The Textile Institute, ManchesterUK, 1992.
6. Talukdar M K, Sriramulu P K and Ajgaokar D B, “Weaving – Machine, Mechanism and Management”, Mahajan Publisher Private Ltd., Ahmedabad, India, 1998.
7. Garde A R and Subramanian T A, “Process Control in Spinning”, ATIRA Ahmedabad, 3rd edition, 1987.
8. Higgins, “Handbook of Maintenance Management”, Prentice Hall New York, 1999.

4. RTT 851 Seminar (0-0-3-2)

5. RTT 852 Project (0-0-12-12)

Students will carry out major project during 8th semester as a part of curriculum as per university guidelines.