

SYLLABUS

Uttar Pradesh Textile Technology Institute, Kanpur

Affiliated to

DR. A.P.J ABDUL KALAM TECHNICAL UNIVERSITY, LUCKNOW



**PROPOSED STUDY & EVALUATION SCHEME
FOR
3RD B. TECH. MAN MADE FIBRE TECHNOLOGY**

On

AICTE B.Tech Model Curriculum Structure (MCS)

(Effective from the Session: 2019-20)

Study & Evaluation Scheme (MCS)
3rd Year B. Tech Man Made Fibre Technology
Uttar Pradesh Textile Technology Institute Kanpur
Affiliated to
DR. APJ ABDUL KALAM TECHNICAL UNIVERSITY, LUCKNOW

3rd Year V-Semester

Effective from Session-2020-21

Sl. No.	Subject Codes	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	KTT508	Post Spinning Operation	3	1	0	30	20	50		100		150	4
2	KTT509	Polymer Science	3	1	0	30	20	50		100		150	4
3	KTT503	Chemical Processing of Textile-I	3	1	0	30	20	50		100		150	4
4	KTT051/KTT052/KTT059	Structure & Properties of Fibres/ Multi & Long Fibre Spinning/ Spinning of Manmade fibres & Blend	3	0	0	30	20	50		100		150	3
5	KTT054/KTT060	Non Woven Technology/Textured yarn Technology	3	0	0	30	20	50		100		150	3
6	KTT558	Post Spinning Operation Lab	0	0	2					25	25	50	1
7	KTT559	Polymer Science Lab	0	0	2					25	25	50	1
8	KTT553	Chemical Processing of Textile-I Lab	0	0	2					25	25	50	1
9	KTT554	Mini Project or Internship Assessment*	0	0	2			50				50	1
10	KNC501/ KNV502	Essence of Indian Traditional Knowledge/Constitution of India	2	0	0	15	10	25		50			
11		MOOCs (Essential for HonsDegree)											
		Total	17	3	8							950	22

*The Mini Project or internship (3-4 weeks) conducted during summer break after II semester and will be assessed during III semester.

Essence of Indian Traditional Knowledge/Constitution of India, shall be done by online courses

Study & Evaluation Scheme (MCS)
3rd Year B. Tech Man Made Fibre Technology
Uttar Pradesh Textile Technology Institute Kanpur

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3rd Year VI-Semester

Effective from Session-2020-21

Sl. No.	Subject Codes	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	KTT604	Physical Testing of Textiles	3	1	0	30	20	50		100		150	4
2	KTT607	Fabric Structure & Design	3	1	0	30	20	50		100		150	4
3	KTT603	Chemical Processing of Textile-II	3	1	0	30	20	50		100		150	4
4	KTT061/ KTT062	Theory of Textile Structure/ Clothing Science	3	0	0	30	20	50		100		150	3
5	EOE061-066	Open Elective-I	3	0	0	30	20	50		100		150	3
6	KTT654	Physical testing of textile Lab	0	0	2				25		25	50	1
7	KTT657	Fabric Structure & Design Lab	0	0	2				25		25	50	1
8	KTT653	Chemical Processing of Textile-II Lab	0	0	2				25		25	50	1
9	KNC601/ KNC602	Essence of Indian Traditional Knowledge/Constitution of India	2	0	0	15	10	25		50			
10		MOOCs (Essential for Hons. Degree)											
		Total	17	3	6							900	21

Essence of Indian Traditional Knowledge/Constitution of India shall be conducted through NPTEL (MOOCs)

Open Elective-I: As per AKTU Syllabus

SYLLABUS

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**PROPOSED STUDY & EVALUATION SCHEME
FOR
3RD B. TECH. TEXTILE TECHNOLOGY**

On

AICTE B.Tech Model Curriculum Structure (MCS)

(Effective from the Session: 2020-21)

3rd B. Tech (Textile Technology) 5th Semester

1. Post Spinning Operation KTT 508 (L T P: 3 1 0) Credit 4

CO1	Define and explain different fundamental terminologies related to post spinning operations for synthetic filament yarns.
CO2	Describe principles drawing operations and functioning of the machines and different methods, explain effect of drawing on fibre properties.
CO3	Analyse effect of heat setting on properties of the fibre, classify different techniques and differentiate them.
CO4	State objectives of crimping and stretching, Explain and compare various operation of stretch breaking tow to conversions crimping elaborate their importance in textile processing.
CO5	Describe principles of twist setting; explain importance of process variable and means to control quality and evaluation using several characterising techniques.

Course Articulation Matrix of Post Spinning Operation:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
KMMFT 508.1	3	3	3	3	2							2
KMMFT 508.2	3	2	3	3	3	2						2
KMMFT 508.3	2	3	2	3	2						1	1
KMMFT 508.4	2	3	2	2	3							1
KMMFT 508.5	3	2	3	3	2	2						2
Avg.	3	3	3	3	2	2						2

Unit (1): Concept of drawing, drawing unit Factors influencing draw ability, Influence of drawing on structure and properties of fibres. Methods used for orientation stretching- single stage, multi stage, drawing of melt spun filaments, drawing of as-spun fibres through neck formation. **Total of lectures required=9**

Unit (2); Heat setting ,nature of heat set, Influence of heat setting variables on structures & properties of fibres, Temporary, semi-permanent and permanent heat setting, heat –setting equipment. **Total of lectures required=9**

Unit (3): Tow to top conversion, stretch breaking, cutting method, Sydel stretch breaking, Pacific tow to top cutting system, Effect of process variables in Pacific system, Turbo stapler. **Total of lectures required=9**

Unit (4): Need for crimping, crimping methods, manufacture of high and variable shrink fibres, twisting of continuous filaments, up twisters and two for one twister. Developments in Twisters **Total of lectures required=8**

Unit (5): Twist setting, Systems used conversion of fibres in to yarn, influence of fibre and process variables on properties of blended and multifilament yarns.

Total of lectures required=7

Grand total lectures required =42

Text Books & Reference book:-

1. Manufactured fibre technology by V.B.Gupta&V.K.Kothari.
2. Synthetic fibre by Vaidhya
3. Textile fibre part-II by V.K.Kothari.
4. Textured yarn technology by J.W.S.Hearle.
5. Man-made fibres – C W Moncrieff.

2. KTT-509 Polymer Chemistry (L T P 3 1 0) Credits4

Unit (1) Scope of Polymer Chemistry, definition of monomers,Degree of polymerization, Classification of Polymers, , macromolecule, Chemistry of important monomers , Thermo sets , Thermoplastic. Essential and desirable properties for fibre forming polymers.

Total Lectures Required = 10

Unit (2) Condensation polymerizations with special reference to Textile based Polymers,Types, Mechanism, Essential requirements, Importance of condensation polymerization. Bulk, Solution, Emulsion and Suspension polymerization, Comparison of condensation and addition polymerization.

Total Lectures Required = 8

Unit (3): Addition polymerization with special reference to Textile based Polymers, (b) Type of addition polymerization, (c) Radical polymerization with special reference to PAN, cationic and anionic polymerization (d) Mechanism and kinetics of polymerization, Essential requirements, Importance of Addition polymerization. **Total Lectures Required = 8**

Unit (4): Total Lectures Required = 8

Copolymerization, Stereo-Regular polymerization, Block and Graft polymerization. Gel polymerization, Hypothetical models related to textile fibres (Like Shiesh-Kebab, fringed fibrillar, fringed micellar models etc, Elastomers.

Unit (5): Polymer molecular weight characterization. Functionality, End-Group analysis method, Viscosity measurement methods, Gel permeable chromatography (GPC) Techniques.Light scattering method, Mass spectroscopy, Gas spectroscopy, Raman Spectroscopy, FTIR techniques, Elemental analysis using Inductively coupled Plasma Spectroscopy and Atomic absorption spectroscopy.

Total Lectures Required = 8

Grand Total Lectures required = 42

Text Books & Reference Books:

1. Text Book of Polymer science by **F.W. Bill Meyer**

2. Text book of Polymer, Vol. I, II, III by **M.S. Bhatnagar**
3. Polymer science by **Gawaskar, Vishwanathan, Sreedhar and Jaydev**
4. Polymer chemistry by **B.K. Sharma**
5. Polymers and their properties by **J.W.S. Hearle**
6. Applied polymer science by **Flory**
7. Principles of Polymerisation by **George Odian**

3. Chemical Processing of Textile-I (KTT 503) Credit 4

Course Outcomes:

After successful completion of this course, the students should be able to:

CO1	Explain various mechanical and chemical pre-treatment processes, Discuss methods of singeing, desizing and scouring. Evaluate efficiency of desizing and scouring
CO2	Explain and compare various bleaching processes for various textile fibres, and evaluate efficiency of bleaching.
CO3	Describe mercerization of yarns and fabrics of cellulosic materials, compare various methods, evaluate degree of mercerization.
CO4	Discuss and compare various mechanical finishing such as Sanforizing, callendering, raising, milling, stentering etc. with suitable machineries.
CO5	Explain utility and application methods of various physical and chemical finishes such as resin finishing, anti-crease, wash-n-wear, durable press, Heat setting, weight reduction, soil release, water repellent and flame retardant finishes.

Course Articulation Matrix of Chemical Processing of Textile-II:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
KTT-503.1	2	3	2	3	2							2
KTT-503.2	3	2	3	3	3							1
KTT-503.3	3	3	3	3	2							2
KTT-503.4	3	3	3	2	3							1
KTT-503.5	2	2	3	2	2							2
Avg.	3	3	3	3	2							2

Module I (10 Hours)

Introduction: Process line for pretreatment, coloration and finishing of textiles.

Singeing: Objective, classification of singeing methods, advantages and drawbacks. Process and quality control aspects involved.

Desizing: Objectives, classification and mechanism involved in removal of size content in various methods. Desizing of natural and man-made fibres. Evaluation of desizing efficiency

Scouring: Objectives, mechanism involved in removal of impurities, recipe and controlling parameters involved. Scouring of natural, manmade and blended textiles. Carbonisation of wool. Degumming of silk. Evaluation of scouring efficiency.

Module II (10 Hours)

Bleaching: Objectives of bleaching, hypochlorite, peroxide, chlorite and peracetic acid bleaching methods of bleaching. Mechanism involved in each type of bleaching with

controlling parameters. Bleaching of cotton, silk, wool, man-made fibres and blended textiles by suitable bleaching agents. Optical whitening of cotton. Tests for bleaching

Mercerization: Objectives, mechanism and process parameters of hot and cold mercerization. Causticization. Brief idea of ammonia mercerization. Evaluation of mercerization

Heat setting : Objectives, mechanism and methods of heat-setting. Effectiveness of heat setting on various man made textiles and blends. Heat setting conditions and controls. Heat setting of polyester, nylon, acetate and their blends. Evaluation of degree of heat setting.

Module III (10 Hours)

Concept of colour: Visible spectrum, wavelength and blindness of colour. Metamerism/isomerism. Additive and subtractive theories. Primary, secondary, tertiary, complementary and contrasting colors, shade, tint, Hue, chroma, color wheel. Tristimulus values of colour. Computer colour matching, Kubelka-Munk equation, reflectance factor, colour-coordinates, CIELAB values.

Theory of dyeing: Introduction to thermodynamics and kinetics of dyeing. Classification of dyes. Basic characteristic and chemical structure of dyes. Dye-fibre interaction

Dyeing of textiles Cellulosic and Protein fibres: Application of Direct, Reactive, Vat, Solubilized vat, Sulphur, Azoic dyes on cellulose fibres. Application of Acid, Basic and Metal complex dyes on wool and silk. Auxiliaries used in dyeing. Eco friendly chemicals and banned dyes.

Books Recommended:

1. Karmakar S.R., —Chemical Technology in the pretreatment processing of textiles, Textile Science & Technology, Elsevier Publication, 1999.
2. Trotman, E.R., —Dyeing and Chemical Technology of Textile Fibres, Charles Griffin and Co. Ltd., London, 1991.
3. Shenai, V.A. —Technology of Bleaching and Mercerizing - Vol. III, Sevak Publications Chennai, 1991.
4. Bhagwat R.S —Handbook of Textile Processing, Colour Publication, Mumbai, 1999.
5. Shenai, V.A., —Principle and Practice of Dyeing, Sevak Publisher, Bombay, 1991.
6. T.L.Vigo, —Textile Processing and Properties, Elsevier, New York, 1994.

Department Elective I:

4.1 Structure and Properties of Fibres (KTT051) (L T P 3 0 0) Credit 3

Course Outcomes: after completion of course students will be able to

CO1	Describe various models of physical structure of fibre and Analyse structure–property relationship.
CO2	Explain various properties of fibres.
CO3	Characterize and measure various physical and chemical structure of fibres by using instrumental techniques.
CO4	Derive various mathematical models of fibre structures and properties.
CO5	Determine the effects of different factors influencing fibre properties.

Course Articulation Matrix of Structure and Properties of fibers:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
KTT-051.1	3	3	3	2	2							2
KTT-051.2	3	2	3	3								2
KTT-051.3	3	3	2	3	3							2
KTT-051.4	2	3	3	2	2							2
KTT-051.5	3	3	1	1	2							1
Avg.	3	3	3	2	2							2

Unit (1):

Physical and chemical structure of cotton, wool, silk, and manmade textile fibres, models of fine structure of fibre, Methods of investigation of physical structure by IR spectroscopy, FTIR, and X-ray diffraction. Measurement of density and crystallinity by density gradient column.

Total Lectures Required = 8

Unit (2):

Moisture regain and content. Significance of moisture in textiles. Relation between regain and relative humidity, hysteresis of moisture absorption, effect of various factors on moisture regain. Difficulties involved in drying of textile specimen. Heat of sorption and heat of wetting, their relationship, swelling of fibres, Quantitative theory of moisture absorption.

Total Lectures Required = 8

Unit (3):

Tensile properties of fibre, Factors affecting results of tensile experiment, experimental methods; effect of variability and weak-link theory, Elastic recovery, Effect various factors on recovery, Cyclic loading and fatigue, Fibre fracture. Time effect, Creep and stress relaxation. Dynamic testing. Concept of viscoelastic effects, Kelvin and Maxwell model. Bending and torsional rigidity of fibre.

Total Lectures Required = 8

Unit (4):

Thermal behavior of textile fibres by Differential Scanning Calorimeter (DSC), Thermogravimetric analysis (TGA), thermal mechanical analysis (TMA), and Dynamic Mechanical Analysis (DMA), Optical and electron microscopy

Total Lectures Required = 8

Unit (5):

Optical properties of fibres, Define Refractive index and dichroic ratio. Birefringence and orientation of fiber. Reflection and lustre. Electrical and dielectric properties, fibre friction, Measurement of fibre to fibre, yarn to yarn friction. Generation of static charge in textiles, various effects of static charge, measurement and control.

Total Lectures Required = 8

Grand Total of lectures required = 40

Reference Book: -

1. Morton W E and Hearle J W S, Physical Properties of Textile Fibres, 1st reprint, The Textile Institute, Manchester, 1986.
2. Gupta V B and Kothari V K, “Manufactured Fibre Technology”1st Ed., Chapman and Hall, London, 1997.
3. Hearle JWS, Polymers and their properties, Vol. I, John Wiley and Sons, NY, 1982.
4. Turi E A “Thermal characterization of polymeric materials”, Vol I and II, Academic Press, 1997.
5. Gedde, U. L. F. (1995). Polymer physics. Springer Science & Business Media.
6. Billmeyer F W, “Text book of polymer science”, John Wiley and Sons, 1984.
7. Meredith R, The Mechanical Properties of Textile Fibres, North Holland Publishing Co; Amsterdam 1959.

4.2 Multi & Long Fibre Spinning (KTT 052) (L T P 3-0-0= 3) Credit 3

Course Outcomes:

After this course students will be able to

CO1: Explain the critical parameter difference in processing of long fibres

CO2: Explain the process condition & need for dyed fibres processing

CO3: Explain the machine used for spinning wool fibres & blends using woolen & worsted system

CO4: Explain the process sequence for jute fibre processing.

CO5: Apply measures for process control during jute, wool & other long fibre spinning

Course Articulation Matrix for Multi & Long Fibre Spinning

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
KTT-012.1	3	3	3	2	2							2
KTT-012.2	3	2	3	3								2
KTT-012.3	3	3	2	3	3							2
KTT-012.4	2	3	3	2	2							2
KTT-012.5	3	3	1	1	2							1
Avg.	3	3	3	2	2							2

Unit 1: Characteristics of manmade fibres, Spinnability, blending, and its objectives, Spinnability, blending & its objectives, processing of Man- made fibres & blends on short, medium and long staple spinning systems.

Total Lectures Required = 8

Unit 2: Spinning of dyed fibres, estimation of blends intimacy, factors affecting the blend irregularity, structural properties of blended yarns.

Total Lectures Required = 8

Unit 3: Production of bulked yarn, characteristic difference in the physical & mechanical properties of various long staple fibers & their influence in the choice of preparatory & spinning machinery.

Total Lectures Required = 8

Unit 4: Retting of flax, & jute, Jute & flax spinning processes, production of spun silk, varieties, technology and applications.

Total Lectures Required = 6

Unit 5: Woollen, semi-worsted & worsted systems of spinning. Technology involved and comparison, varieties, applications and end uses.

Total Lectures Required = 6

Grand total lectures required = 36

Reference book:-

1. Wool Spinning by Vickerman, Abhishek Publication
2. Principle of woollen spinning by Priestman
3. Woollen & Worsted yarn manufacture by J. W. Redcliff
4. Jute Spinning Calculation by Andrew Smith
5. Worsted Drawing & Spinning by Miles

4.3 Spinning of Manmade Fibres and Blends (KTT 059) L T P 3 0 0 Credit 3

Unit 1: Introduction to spinning systems, Overview and classification of manmade fibres, blending and mixing, conditioning, toppling, Migration of fibres, Mechanisms of Blending.

No. of lectures required: 9

Unit 2: Properties of manmade fibres, effect on spinning, spinning of short, medium and long fibres, general settings of machines at different stages, factors affecting processing of dyed fibres.

No. of lectures required: 9

Unit 3: Processing of synthetic fibres in different spinning systems such as Ring, Rotor and Airjet etc. effect of process parameters and comparison of different yarn quality parameters, properties of ring spun blended yarns.

No. of lectures required: 10

Unit 4: Spinning of manmade fibres on woollen and worsted systems, introduction to woollen, worsted, semi worsted spinning systems, tow to top conversion, scouring, gilling, roller cards,

combing etc.

No. of lectures required: 6

Unit 5: Sewing threads, requirement of sewing threads, processing of microfibers, and production of fancy yarns and recent developments in the industry.

No. of lectures required: 6

References:

1. Spinning of Manmades and Blends on Cotton System. – K R Salhotra.
2. Spun Yarn Technology. - Eric Oxtoby.
3. Fundamentals of Spun Yarn Technology. - Carl A. Lawrence.
4. Textile Yarns Technology, Structure, and Applications. – Bhuvnesh Chandra Goswami, J. G. Martindale, F. L. Scardino.
5. Wool science by W H Simpson and G H Crawshaw.

Department Elective II:

5.1 Non Woven Technology KTT 054 (3 0 0) Credit 3

After successful completion of this course, the students should be able to;

CO1 Describe on woven market & classification of non-woven

CO2 Explain the different methods of non-woven manufacturing processes and description of non-woven machines.

CO3 Explain properties of fibres required for non-woven, structure of fibers in non-woven & non-woven fabric properties & their application

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	3	3	2	2							2
2	3	2	3	2								2
3	3	3	2	2	2							2
Avg.	3	3	3	2	2							2

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

Department Elective II:

5.2 Textured Yarn Technology KTT 060 (3-0-0=3) (NPTL/MOOCs) Credit 3

CO1: Explain the need for texturing of thermoplastic filament yarn for apparel & other uses.

CO2: Explain the influence of raw material & process parameters on textured yarn quality

CO3: Explain the development of different texturing system and there merits

CO4: Decide selection of texturing methods based on raw material characteristics

CO5: Explain the bulking quality by different bulking methods.

Unit (1): Importance of texturising, Methods of texturising, Basic principles of heat setting and texturising, False twisting, Process variables, developments of false twist texturing machines.

Total Lectures Required = 7

Unit (2): Structural geometry of textured yarn, characterization of textured yarn, Stuffer box

crimping, Edge crimping & other methods of texturing thermoplastic yarns.

Total Lectures Required = 7

Unit (3): Textured yarn properties and fabric characteristics, principles of draw texturing, Draw texturing machines, and properties of draw textured yarn, Effect of process variables, time, temperature, twist and tension on properties of textured yarn.

Total Lectures Required = 8

Unit (4): Principles of air bulking and properties of air bulked yarn, Texturing of non thermoplastic yarns cross linking and effect of process variables on properties of textured yarn, Texturing with the aid of solvent.

Total Lectures Required = 7

Unit (5): Yarn characteristics, Morphological changes induced by mechano-thermal forms of texturing and their effect on properties of textured yarns.

Total Lectures Required = 7

Grand total lectures required =36

Reference book:-

1. Textured yarn Technology by J.W.S.Hearle
2. Synthetic fibre by A A Vaidhya.

6. TEXTILE CHEMICAL PROCESSING– I Lab (KTT553) L T P 002 Credit 1

At least 10 Practicals from the following

1. Desizing of grey cotton yarn/fabric using chemicals/enzyme and determine the desizing efficiency.
2. Scouring of desized cotton yarn/fabric and determine the scouring loss%, drop absorbency and degree of impurities.
3. Scouring of P/C blended fabrics.
4. Bleaching of scoured cotton yarn/fabric with hypochlorite agent and measurement of the whiteness index, and change in mechanical properties.
5. Bleaching of cotton fabric with hydrogen peroxide agent and measurement of the whiteness index, and change in mechanical properties.
6. Cold and Hot mercerization of cotton yarn and measurement of the BAN, and change in mechanical properties.
7. Scouring and Bleaching of Wool.
8. Degumming of Silk.
9. Dyeing of cotton yarn/fabric using direct dyes and studying the influence of temperature, Time and Electrolyte on dye adsorption and fastness properties.
10. Dyeing of cotton yarn/fabric using vat dyes and assessment of fastness properties of dyed material.
11. Dyeing of cotton yarn/fabric using hot and cold brand reactive dyes and assessment of

dye exhaustion % on dye bath and fastness properties.

12. Dyeing of cotton yarn/fabric using azoic dyes and assessment of fastness properties of dyed material.
13. Dyeing of cotton yarn/fabric using sulphur dyes and assessment of fastness properties of dyed material.
14. Dyeing of Wool fibres with Acid and metal complex dyes and assessment of fastness properties of dyed material.
15. Dyeing of Silk yarn / fabric with Acid dyes and direct dyes and assessment of fastness properties of dyed material.

7. Post Spinning Operation Lab (KTT 558) (L T P 0 0 2) Credit 1

As per given in theory syllabus.

8. Polymer Science Lab (KTT 559) (L T P 0 0 2) Credit 1

As per given in theory syllabus.

9. MOOCs (Essential for Hons. Degree)

10. Mini project / Internship - Credit 1

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3rd Year VI-Semester

Effective from Session-2020-21

Sl. No.	Subject Codes	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	KTT604	Physical Testing of Textiles	3	1	0	30	20	50		100		150	4
2	KTT607	Fabric Structure & Design	3	1	0	30	20	50		100		150	4
3	KTT603	Chemical Processing of Textile-II	3	1	0	30	20	50		100		150	4
4	KTT061/ KTT062	Theory of Textile Structure/ Clothing Science	3	0	0	30	20	50		100		150	3
5	EOE061-066	Open Elective-I	3	0	0	30	20	50		100		150	3
6	KTT654	Physical testing of textile Lab	0	0	2				25		25	50	1
7	KTT657	Fabric Structure & Design Lab	0	0	2				25		25	50	1
8	KTT653	Chemical Processing of Textile-II Lab	0	0	2				25		25	50	1
9	KNC601/ KNC602	Essence of Indian Traditional Knowledge/Constitution of India	2	0	0	15	10	25		50			
10		MOOCs (Essential for Hons. Degree)											
		Total	17	3	6							900	21
Essence of Indian Traditional Knowledge/Constitution of India shall be conducted through NPTEL (MOOCs)													

Open Elective-I: As per AKTU Syllabus

3rd B. Tech (Textile Technology) 6th Semester

1. Physical Testing of Textiles KTT604 (3 1 0) Credit 4

Course Code	Course Title
KTT-601	Physical Testing of Textiles
Course Outcomes	
CO1	Determine various tensile properties of yarns and fabrics
CO2	Explain various instruments for measurement tensile strength of fibre, yarn and fabrics.
CO3	Evaluate evenness of fibre, yarn and other textile strands and interpret the results of spectrogram, diagram, and classimat.
CO4	Test bursting strength, tearing strength, pilling, air permeability, crimp, thickness, EPI, PPI, weight and cover factor of fabrics.
CO5	Measure water repellency, shrinkage, measurement of fastness to light and rubbing, thermal transmission, of fabrics, and evaluate low stress mechanical properties by FAST and KAWABATA.

Course Articulation Matrix of Textile Testing -II:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
KTT-601.1	3	3	3	3	3				3	1		1
KTT-601.2	2	3	3	3	3				2	2		1
KTT-601.3	3	2	3	3	2				2	2		2
KTT-601.4	3	3	2	2	3				2	1		2
KTT-601.5	3	3	3	3	3				3	2		2
Avg.	3	3	3	3	3				2	2		2

Module I (10 Hours)

Introduction to Textile testing: Importance of testing, Quality, Relative humidity and standard condition for testing. Moisture content moisture regains, Selection of sample for testing. Different technique for yarn and fabric sampling.

Module II (10 Hours)

Yarn Testing: Count, Twist, Doubling effect on count and uniformity. Single yarn strength and Lea count strength product (CSP) and Corrected Count (CCSP). factors affecting tensile properties. Tensile properties and - various type of measuring instruments based on CRT, CRL and CRE and their working principles, bending rigidity of Yarn by heart-loop test. **Yarn Surface quality:** Nature and causes of irregularities, principles of evenness testing: optical and capacitance methods, evaluations and interpretation of evenness results, concept of index of irregularity. Variance - length curves and spectrogram analysis, yarn imperfections, yarn faults classification, UsterClassimat andClassifault.

Yarn hairiness: Importance and assessment techniques.

Module III (10 Hours)

Testing of fabric Dimensional Properties: Thickness, Area density (GSM), Warp and Weft crimp, Cover factor calculations.

Testing of fabric Properties: Tensile, Tear, compression and shear, Fabric Abrasion, Pilling, Bursting, flexural rigidity; Drape-ability, Crease recovery.

Transmission behavior of fabrics: Measurement of Air, water, heat and static charge transmission. Wicking: vertical and horizontal transportation of liquid.

Module IV 10 Hours)

Garment Testing:

Sewability: Seam strength, Seam slippage, Seam pucker, Needle Cutting Index Low stress Mechanical Properties of Fabric, Primary and total hand value.

Books Recommended:

1. J.E. Booth, Principle of Textile Testing
2. V K Kothari, Testing and quality management Vol-1
3. GAV Leaf, Practical Statistics For The Textile Industry: Part I, The Textile Institute, 1984.
4. Saville B P, Physical Testing of Textiles, Woodhead publishing -UK, 2004.
5. Jinlian H U, Fabric Testing, Woodhead Publishing, 2008.
6. Arindam Basu, Textile Testing (Fibre, Yarn and Fabric), SITRA, Coimbatore, 2001.
7. Somasundar S, Application of Statistical Methods in Textile Industry, SITRA, Coimbatore, 1998.

2. Fabric Structure & Design KTT607 (3 1 0) Credit 4

After successful completion of this course, the students should be able to;

1. Develop new weave structures.
2. Create new structures using color and weave effect.
3. Draw simple and compound structures.
4. Illustrate special weaves.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	1	3	2	1							2
2	3	2	3	2								2
3	3	1	3	2	1							2
4	2	3	3	2	1							2
Avg.	3	2	3	2	1							2

Module I (10 Hrs)

Introduction: Basic concepts of yarn count, thread density, crimp and cover factor of fabric, classification of fabrics, concept of designing through fabric structure, importance of fabric structure analysis, representation of weave repeat, draft plan and peg plan, use of point paper.

Elementary Weaves: Construction of plain, twill, satin and sateen weaves and their derivatives.

Absorbent Fabrics: Construction of diamond, diaper, honey comb, huck-a-back and mock-leno weaves.

Crepe weave: Construction of crepe weaves.

Module II (10 hours)

Cord Structures: Bedford cord, whip cord and welt with wadded structures.

Color and Weave Effect: Weave and color combinations of line effect, hounds tooth, birdseye, crows foot, hair lines and step pattern.

Extra thread figuring: Figuring with extra threads with single and two colors.

Module III (10 hours)

Pile structures: Construction of velvet and velveteen fabrics, fustians.**Backed fabrics:** Construction of backed fabric.**Double Cloth:** Construction of self stitched, centre stitched and wadded double cloth.

Module IV (10 hours)

Special Weave: Gauze and net leno fabrics, damasks, brocades, tapestry, tissue, lappet, swivel figured structures.**Calculations:** Raw material calculations to produce different weaves and their technical specifications.

Books Recommended:

1. Groszicki Z J, "Watsons Textile Design and Colour", Newnes Butterworth (1988).
2. Groszicki Z J, "Watsons Advanced Textile Design", Newnes Butterworth(1989).
3. Klibbe J W, "Structural Fabric Design", Revised Edition, 1965, North Carolina State University.
4. Nisbeth H, "Grammar of Textile Design", Tarapore Wala sons and Co.(1994).
5. Gokarneshan N, "Fabric Structure and Design", New Age International, New Delhi (2004).

3. Chemical Processing of Textile-II KTT603 (3 1 0) Credit 4

Course Outcomes:

After successful completion of this course, the students should be able to;

1. Perform dyeing of textiles made up synthetic fibres and their blends.
2. Control process parameters and use of dyeing machines for dyeing of textile materials.
3. Select the dyes and recipe for preparation of printing paste for printing of textile materials.
4. Explain finishing treatment process and treat the fabric with different finishing agent.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2	3	1								1
2	3	2	2	2								1
3	3	2	3	1								1
4	3	2	3	1								1

5	2	2	2	1								1
Avg.	3	2	3	1								1

Module I (10 Hours)

Dyeing of synthetic fibres: Dyeing of polyester with disperse dye. Dyeing of Nylon with acid dye. Dyeing of acrylic with cationic dye.

Dyeing of blends: Classification of blends and shades, Methods for dyeing of blends. Suitability of each method for dyeing of specific blend- P/C, P/V, P/W. W/A.

Module II (10 Hours)

Identification of dyes: Identification of dye on dyed natural and man made textiles

Carbonisation: Objectives, selection of chemical, process parameters, trouble shoots, precautionary measures and efficiency of carbonisation.

Dyeing machineries: J-box, kier, mercerizing machinery, loose fibre, yarn and package dyeing machines. Jigger, winch, jet and HTHP beam dyeing machine. Padding mangle, Continuous bleaching range, Continuous dyeing range.

Module III (10 Hours)

Printing: Objective, Difference between dyeing and printing, Characteristics of printing paste ingredients, classification and mechanism of thickeners.

Printing methods: Hand block, roller and screen printing processes. Working of roller printing machine, photoelectric method of screen preparation. Drawback and advantage of each method.

Styles of printing: Direct, Discharge and Resist. Printing of cotton with reactive, vat and azoic dyes and pigment, Silk with acid dyes, Polyester with disperse dye and Acrylic with basic dyes.

Printing after treatments: Steaming, curing, ageing in printing.

Transfer Printing: Types, mechanism and machineries of transfer printing.

Digital Printing: Mechanism, process parameters and machinery.

Module IV (10 Hours)

Finishing: Significance and classification of finishing.

Mechanical finish: Mechanism of Softening, calendaring, Sanforizing and their evaluation.

Chemical and functional finish: Mechanism, process parameters and troubleshooting's of Softening, anti-crease finish, water proof and water repellent finish, flame-retardant and fire proof finish, moth proof and insect repellent finish, Soil release finish; Organdi finish; Biopolishing, Stonewashing of denim, Anti-microbial finish, UV finish, antistatic finish, non-slip finish and their evaluation.

Waste minimization: Need for waste minimization. Brief idea about chemical and auxiliary's conservation, water conservation, energy conservation. Textile effluent management. Techniques of effluent treatment. Flow chart of primary, secondary and tertiary effluent treatment.

Books Recommended:

1. Miles L W C, "Textile Printing", Dyers Company Publication Trust, Bradford, England, 1981.
2. Shenai V A, "Technology of Printing", Sevak Publications, Mumbai, 1990.
3. Hall A J, "Textile Finishing", Haywood Books, London, 1996.
4. Shenai V A and Saraf, N M, "Technology of Textile Finishing", Sevak Publications,

- Mumbai,1990.
5. Karmakar S. R., "Chemical Technology in the Pre-treatment Process of Textiles", Elsevier sciences,1999.
 6. Schindler W. D. and Hauser P. J., "Chemical finishing of textiles", Woodhead Publishing Ltd.,2004.
 7. Cavaco-Paulo A. and Gubitz G. M., "Textile Processing with enzymes", Woodhead Publication Ltd.,2003

Department Elective

4.1 Theory of Textile Structure KTT 061 (LTP 3 0 0) Credit 3

Course Outcomes:

After successful completion of this course, the students should be able to;

1. Explain ideal helical model of yarn and different structural parameters.
2. Illustrate method of measuring structural parameters.
3. Determine effect of different parameters affecting the structure of yarn and on its properties.
4. Illustrate structural characteristics of knitted and nonwovens and design the fabric to get the desired property

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2	3	1								1
2	3	2	2	2								1
3	3	2	3	1								1
4	3	2	3	1								1
Avg.	3	2	3	1								1

Module I (10 Hours)

Geometry of twisted yarn: Idealized helical yarn structure; yarn count and twist factors, twist contraction; Limits of twist.

Packing of fibres in yarn: Idealized packing; measurement of packing density and radial packing density of yarn; Packing in actual yarns; Specific volume of yarns; Equation of yarn diameter.

Fibre Migration: Ideal migration, tracer fiber technique, characterization of migration behavior, migration in spun yarns, mechanisms of migration, effect of various parameters on migration behavior.

Module II (10 Hours)

Structural Mechanics: Translation of fiber properties into yarn properties; Extension of continuous filament yarn for small strains and large strains; Prediction of breakage, Nature of rupture for continuous filament yarn. Extension and breakage of spun yarn, Blended yarn structure, Structure property relationship of ring, rotor, air-jet, friction spun yarn, Extension of continuous filament yarn.

Module III (10 Hours)

Fabric Geometry: Engineering approach to the analysis of fabric, Pierce geometrical model, flexible thread model and rigid thread model, Square fabric, Jammed Structure, square and jammed fabric, Crimp interchange, Maximum possible cover factor. Yarn cross sections in the fabric, Pierce elastic thread model. Geometry of weft and warp knitted structures.

Module IV (10 Hours)

Fabric deformation under tensile stress; prediction of modulus; tensile properties in bias direction. Other fabric deformation: compression, shear, bending and buckling; fabric handle; Structure of felts and stitch bonded fabric; Basic of braided fabric structure.

Books Recommended:

1. Hearle J. W. S., “Structural Mechanics of Fibers, Yarns and Fabrics”, Wiley-Interscience, New York, 1969.
2. Goswami B. C., “Textile Yarns: Technology, Structure and Applications”, Wiley-Interscience, New York, 1977.
3. Jinlian Hu., “Structure and Mechanics of Woven Fabrics”, Woodhead Publishing Ltd., 2004.
4. Hearle J. W. S., John J., Thwaites. And Jafargholi Amirbayat., “Mechanics of Flexible Fibre Assemblies”, Sijthoff and Noordhoff, 1980.
5. Hassan M. Berery., “Effect of Mechanical and Physical Properties on Fabrics Hand”, Wood head publishing Ltd., 2005.
6. Behera BK, Hari PK, “Woven Textile Structure: Theory and Applications”. Woodhead publishing.

Department Elective

4.2 Clothing Science KTT062 (L T P 3 0 0) Credit 3

Course Outcomes:

After successful completion of this course, the students should be able to;

1. Describe thermal and non-thermal components of clothing comfort.
2. Explain the role of body components in maintaining body temperatures
3. Recognize the Principles of heat transfer to and away human body
4. Explain various aspects of thermal & skin sensational clothing comfort

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	1	3	2	1							2
2	3	2	3	2								2
3	3	1	3	2	1							2
4	2	3	3	2	1							2
Avg.	3	2	3	2	1							2

Module I (10 Hours)

Introduction: Concept of selection of fabrics for clothing purpose. Types of fabric required for apparel use for different age group, occasions, purpose. Fabric properties and performance for

apparel use.

Serviceability of Fabrics: Abrasion resistance - flat abrasion, flex abrasion, edge abrasion, Pilling - mechanism of pilling formation, anti-pilling techniques, Snagging, Strength, Tearing strength - Tensile strength - Bursting strength, seam strength and seam slippage.

Tailorability of fabrics : tailorability of woven and knitted garments, Tailorability of leather garments and fur garments

Module II (10 Hours)

Aesthetic properties: Drape, Crease and Wrinkle recovery - Lustre. Yarn unevenness: neps, thick place, thin place, periodic fault, Scroopiness, Colour- Colour fastness: to light, washing, perspiration, rubbing, dry cleaning.

Dimensional Stability of Fabrics: Hygral expansion, Relaxation shrinkage, Swelling shrinkage, Felting shrinkage. Mechanism of fabric shrinkage- Relationship between Hygral Expansion, Relaxation shrinkage and extensibility - Knitting Process Parameters and fabric stability. Methods of measuring dimensional stability to dry cleaning and dry heat.

Fabric Hand : smoothness, fullness and stiffness, subjective hand judgment, objective evaluation of fabric hand and its applications.

Module III (10 Hours)

Clothing Comfort: Definition of comfort - Human clothing system - Physical, Physiological and psychological aspects of comfort. Tactile and pressure sensation aspects. Applications of clothing comfort research.

Thermal Comfort: Introduction. Thermal transfer processes. Dry heat transfer and Rapid heat transfer. Function of Textiles in enhancing thermal comfort. Comparison of thermal comfort properties for different textile structures.

Module IV (10 Hours)

Functional Properties: Elasticity: elastic recovery, residual strain; Thermal insulation. Water repellence, water resistance and water proof; Wicking: vertical and horizontal transportation of liquid; Water absorbency; UV protection; Soil release

Safety: Toxicity - residual dye stuff and other finishing agent ; Flammability

Books Recommended :

1. Kothari, V K, "Testing and Quality Management", CBS Book Publishers, New Delhi, 2000.
2. Li. Y, "The Science of Clothing Comfort", Textile Progress, Volume: 31, No. 1/2, Textile Institute.
3. Saville B P, "Physical Testing of Textiles", The Textile Institute, Woodhead publication limited, Cambridge.
4. Billie J Collier and Helen H Epps, "Textile Testing and Analysis", Prentice- Hall Inc., New Jersey.
5. Lyman Fourt & Norman R.S. Hollies, "Clothing: Comfort & Functions", Marcel Dekker, Inc, New York.
6. G.Song, "Improving Comfort in Clothing", Woodhead Publication.
7. A.Das, R.Alagirusamy, "Science in Clothing Comfort", Woodhead Publication

5. Open Elective-I: The student may also have choice to go through course via MOOCS/NPTEL

6. Textile Testing Lab KTT654 (0 0 2) Credit 1

At least 10 Practical of the following

Yarn Testing

1. To determine the Hank and Hank C.V% of the given sliver / Determination of the within bobbin and between bobbin hank C.V % of the given roving.
2. To determine the count of a yarn by using physical/electronic balance.
3. To measure the Single yarn and Ply yarn twist of the given yarn sample using Twist Tester.
4. To determine the Yarn count, Lea Strength and CSP of the given yarn sample.
5. To determine the single yarn strength.
6. To Study evenness and imperfection in the given yarn and compare the results with Uster statistics.
7. To Study the spectrogram and irregularity trace to determine type of irregularity.
8. To Prepare yarns Appearance Boards and compare with ASTM standards.

Fabric Testing

9. To characterize a woven fabric with respect to its dimensional properties: thread density, yarn number, crimp, weave, cover factor, weight, skewness, thickness
10. To determine the tensile strength of a woven fabric by strip test method. Draw load-elongation curve of a woven fabric.
11. To determine the tear strength of a fabric using Elmendorf tear tester or ballistic tester.
12. To determine the bursting strength of a fabric using hydraulic bursting tester.
13. To determine the abrasion resistance of a fabric.
14. To determine the bending length and flexural rigidity of a woven fabric using the Shirley tester.
15. To determine the crease recovery of fabric and observe the effect of loading time and recovery time on crease recovery.
16. To determine the drape coefficient of woven and knitted fabric using the drape meter.
17. To measure the Air permeability and Fabric Impact Strength of the given fabric.
18. To measure the water permeability of the given fabric.

7. Fabric Structure & Design Practical KTT657 (L T P: 0 0 2) Credit 1

Analysis of the fabric in respect to yarn and fabric parameters and their weave representation with draft and peg plan:

1. Plain weave
2. Plain derivative- Rib weave
3. Twill weave
4. Satin/sateen weave
5. Diamonds weave
6. Honey comb weave
7. Huck-a-back weave

8. Mock leno weave
9. Crepe weave
10. Bedford cord weaves/ welt structure
11. Extra thread figured weave
12. Velvet/velveteen weave
13. Double cloth

8. Textile Chemical processing II Lab KTT653 (0 0 2) Credit 1

At least 10 Practical of the following

1. Dyeing of Polyester fibres/yarn/fabrics with Disperse Dye using carrier dyeing process.
 2. Dyeing of Polyester fibres/yarn/fabrics with Disperse Dye using HT-HP dyeing process.
 3. Dyeing of Nylon yarn/fabric with Acid Dye.
 4. Dyeing of polyacrylonitrile fibre with cationic dyes.
 5. Dyeing of blended fabric with suitable dyes.
 6. Printing of cotton fabric with direct style printing and assessment of fastness properties of printed material.
 7. Printing of cotton fabric with discharge style printing and assessment of fastness properties of printed material.
 8. Printing of cotton fabric with resist style printing and assessment of fastness properties of printed material.
 9. Finishing of cotton fabric using starch and evaluation of stiffness and add-on%.
 10. Finishing of cotton fabric using softeners and evaluation of drape and add-on%.
 11. Crease Proofing of cotton fabric and evaluation of crease recovery angle.
 12. Assessment of shrinkage of woven and knitted fabrics.
 13. Finishing of cotton fabric with anti-pilling finish and evaluation of pilling.
 14. Finishing of cotton fabric with water repellent finish and evaluation of wetting angle.
 15. Finishing of cotton fabric with flame retardant finish and evaluation of LOI.
 16. Finishing of cotton fabric with soil release finish and measure the ability of fabric to release oily stains during home laundering.
 17. Determination of the colour difference and colour strength value of dyed material using computer colour matching system.
- 9. Essence of Indian Traditional Knowledge/Constitution of India shall be conducted through NPTEL (MOOCS)**