

# **SYLLABUS**

**Uttar Pradesh Textile Technology Institute, Kanpur**

**Affiliated to**

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



**PROPOSED STUDY & EVALUATION SCHEME  
FOR  
3<sup>RD</sup> B. TECH. TEXTILE ENGINEERING**

**AICTE B. Tech Model Curriculum Structure (MCS/CEP)**

**(Effective from the Session: 2024-25)**

**Study & Evaluation Scheme (MCS)**  
**3<sup>rd</sup> Year B. Tech TEXTILE ENGINEERING**  
**Uttar Pradesh Textile Technology Institute Kanpur**  
**Affiliated to**

**DR. APJ ABDUL KALAM TECHNICAL UNIVERSITY, LUCKNOW**

**3<sup>rd</sup>Year V-Semester**

**Effective from Session-2024-25**

Sl. No.	Subject Codes	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	BTT501	Textile Testing	3	1	0	30	20	50		100		150	4
2	BTT502	Fabric Structure & Design	3	1	0	30	20	50		100		150	4
3	BTT503	Chemical Processing of Textile-I	3	1	0	30	20	50		100		150	4
4	BTT051/ BTT052/ BTT053	Structure & Properties of Fibres / Multi & Long Fibre Spinning / Mechanism of Machines	3	0	0	30	20	50		100		150	3
5	BTT054/ BTT060	NonWoven Technology/Textured yarn Technology	3	0	0	30	20	50		100		150	3
6	BTT551	Textile testing Lab	0	0	2				25		25	50	1
7	BTT552	Fabric Structure & Design Lab	0	0	2				25		25	50	1
8	BTT553	Chemical Processing of Textile-I Lab	0	0	2				25		25	50	1
9	BTT554	Mini Project or Internship Assessment*	0	0	2			50				50	1
10	BTT501/ BTT502	Constitution of India, Law and Engineering/ Indian Traditions, Culture and Society	2	0	0	15	10	25		50			
11		MOOCs (Essential for Hons Degree)											
		<b>Total</b>	<b>17</b>	<b>3</b>	<b>8</b>							<b>950</b>	<b>22</b>

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

The non credit courses **AS per AKTU or** shall be conducted through NPTEL@MOOCS.

**Constitution of India and environmental governance: [https://swayam.gov.in/nd1\\_noc20\\_lw02/](https://swayam.gov.in/nd1_noc20_lw02/)**

**Study & Evaluation Scheme (MCS)**  
**3<sup>rd</sup> Year B. Tech TEXTILE ENGINEERING**  
**Uttar Pradesh Textile Technology Institute Kanpur**  
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**3<sup>rd</sup>Year VI-Semester**

**Effective from Session-2024-25**

Sl. No.	Subject Codes	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	BTT601	Yarn Manufacture-III	3	1	0	30	20	50		100		150	4
2	BTT602	Fabric manufacture-III	3	1	0	30	20	50		100		150	4
3	BTT603	Chemical Processing of Textile-II	3	1	0	30	20	50		100		150	4
4	BTT061/ BTT062/ BTT063	Theory of Textile Structure / Clothing Science / Mechanical Machine Design	3	0	0	30	20	50		100		150	3
5		Open Elective-I	3	0	0	30	20	50		100		150	3
6	BTT651	Yarn Manufacture-III Lab	0	0	2				25		25	50	1
7	BTT652	Fabric manufacture-III Lab	0	0	2				25		25	50	1
8	BTT653	Chemical Processing of Textile-II Lab	0	0	2				25		25	50	1
9	BNC601/ BNC602	Constitution of India, Law and Engineering/ Indian Traditions, Culture and Society	2	0	0	15	10	25		50			
10		MOOCs (Essential for Hons. Degree)											
		<b>Total</b>	<b>17</b>	<b>3</b>	<b>6</b>	150	100	250	75	500	75	<b>900</b>	<b>21</b>

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

**Open Elective-I: As per AKTU Lucknow**

### 3<sup>rd</sup> B. Tech (Textile Engineering) 5<sup>th</sup> Semester

#### 1. Textile Testing (BTT501 )(L TP 3 1 0) Credit4

Course Code	Course Title
BTT-501	Textile Testing
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
BTT-501.1	3	3	3	3	3				3	1		1
BTT-501.2	2	3	3	3	3				2	2		1
BTT-501.3	3	2	3	3	2				2	2		2
BTT-501.4	3	3	2	2	3				2	1		2
BTT-501.5	3	3	3	3	3				3	2		2
Avg.	3	3	3	3	3				2	2		2

**Unit 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 fibre, yarn and fabric sampling.**Fibre Testing:** Measurement of fibre length and its distribution, fineness, Trash% and strength etc. using different methods and instruments. Brief idea about advanced & high-volume fibre testing instruments

**Unit II (08 Hours):**Procedure for measurement of yarn linear density, measurement of yarn twist, Doubling effect on count and uniformity. stress-strain curve, various methods for finding of yield point, methods for finding of various modulus, estimation of tenacity Single yarn strength and Lea count strength product (CSP) and Corrected Count (CCSP). Tensile properties and - various type of measuring instruments based on CRT, CRL and CRE and their working principles.

**Unit III (08Hours):** 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 and Classifault. **Yarn hairiness:** Importance and assessment techniques.

**Unit IV (10 Hours):**Testing of fabric Dimensional Properties: **Thickness, Area density (GSM), Warp and Weft crimp, Cover factor calculations.**

**Testing of fabric mechanical 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.

**Unit V 06 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 (BTT502) (L T P 3 1 0)=4**

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

- a. Develop new weave structures.
- b. Create new structures using color and weave effect.
- c. Draw simple and compound structures.
- d. Illustrate special weaves.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>BTT-502.1</b>	3	1	3	2	1							2
<b>BTT-502.2</b>	3	2	3	2								2
<b>BTT-502.3</b>	3	1	3	2	1							2
<b>BTT-502.4</b>	2	3	3	2	1							2
Avg.	3	2	3	2	1							2

**Unit 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.

**Unit II (10 Hours) Absorbent Fabrics:** Construction of diamond, diaper, honey comb, huck-a-back and mock-leno weaves. **Crepe weave:** Construction of crepe weaves.

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

**Color and Weave Effect:** Weave and color combinations of line effect, hounds tooth, birds-eye effect, hair lines and step pattern.

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

**Unit III (08 hours):** Pile structures: **Construction of velvet and velveteen fabrics, fustians.**

**Backed fabrics:** Construction of backed fabric.

**Double Cloth:** Construction of self-stitched, center stitched and wadded double cloth.

**Unit IV (09hours):** 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.

**Unit V (8 Hrs):** Composition of design, Conditions required during ornamentation of fabrics, Colour and Weave effect, unit repeating design, construction of symmetric design, stripe & check effect, factors affecting woven design, Diamond, Ogee & diagonal waved line. Half drop and drop reverse design.

**Books Recommended:**

1. Groszicki Z J, “Watsons Textile Design and Colour”, NewnesButtersworth(1988).
2. Groszicki Z J, “Watsons Advanced Textile Design”, NewnesButtersworth(1989).
3. Klippe 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-I (BTT503) (L T P 3 1 0) Credit4**

**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
BTT-503.1	2	3	2	3	2							2
BTT-503.2	3	2	3	3	3							1
BTT-503.3	3	3	3	3	2							2
BTT-503.4	3	3	3	2	3							1
BTT-503.5	2	2	3	2	2							2
Avg.	3	3	3	3	2							2

**Unit I (08 Hours):Introduction:** Process line for pretreatment, coloration and finishing of textiles.

**Singeing &Desizing:** Objective, advantages and drawbacks. Desizing: Objectives, classification and mechanism involved in removal of size content by various methods.Desizing of natural and man-made fibres. Evaluation of desizing efficiency

**Unit 2(08 Hours) Scouring:** Objectives, mechanism involved in removal of impurities, recipe and controlling parameters involved. Scouring of natural, manmade and blended textiles. Carbonization of wool. Degumming of silk. Evaluation of scouring efficiency.

**Bleaching:** Hypochlorite, peroxide & chlorite bleaching, methods of bleaching. Bleaching of cotton, silk, wool, man-made fibres and blended textiles by suitable bleaching agents. Estimation of bleaching

**Unit III (08 Hours) Mercerization:** Objectives, concepts of mercerization. Causticization. Evaluation of mercerization

**Unit IV (08 Hours):** Concept of colour: **Visible spectrum, wavelength and blindness of colour. Additive and subtractive theories. Colour mixing, Shade, tint, Hue, chroma, color wheel. Tristimulus values of colour. Computer colour matching,**

**Unit V (10 Hours) Theory of dyeing:** 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., —Technology of Dyeing, Sevak Publisher, Bombay, 1991.

#### **4. Department Elective-I: (L T P 3 0 0) credit3**

##### **Structure and Properties of Fibres(BTT051) (L T P 3 0 0) Credit3**

- 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	PO 1	PO 2	PO 3	PO4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO1 2
KTT-011.1	3	3	3	2	2							2
KTT-011.2	3	2	3	3								2
KTT-011.3	3	3	2	3	3							2
KTT-011.4	2	3	3	2	2							2
KTT-011.5	3	3	1	1	2							1
Av g.	3	3	3	2	2							2

**Unit I:** 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 techniques. Measurement of density and crystallinity by density gradient column.

**Total Lectures Required = 8**

**Unit II:** 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. Concept of contact angle and surface energy on textile surface

**Total Lectures Required = 8**

**Unit III:** 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 IV:** Thermal behavior of textile fibres by Differential Scanning Calorimeter (DSC), Difference between Heat Flow and Heat Flux DSC, Various types of DSC and their applications, Thermo-gravimetric analysis (TGA), thermo-balance principle in TGA, Applications of TGA Analysis or Thermogravimetry, thermal mechanical analysis (TMA), and Dynamic Mechanical Analysis (DMA), Various types of DMA, Different types of loading in DMA, Application of DMA

**Total Lectures Required = 8**

**Unit V:** Optical and electron microscopy, Brief Introduction to Scanning Electron Microscope, Optical properties of fibres, Define Refractive index and dichroic ratio. Birefringence and overall orientation of fiber. Dielectric properties of Fibres, Fibre friction, Particle Size analysis, various techniques to measure particle size,

**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, TheTextile Institute, Manchester,1986.
2. Gupta V B and Kothari V K, "Manufactured Fibre Technology"1st Ed., Chapman andHall, 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 & BusinessMedia.
6. Billmeyer F W, "Textbook of polymer science", John Wiley and Sons,1984.
7. Meredith R, The Mechanical Properties of Textile Fibres, North Holland PublishingCo; Amsterdam1959.



## Multi & Long Fibre Spinning (BTT052 )(L T P 300) 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

CO	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 fibres & their influence in the choice of preparatory & spinning machinery.

**Total Lectures Required = 8**

**Unit 4:** Retting of flax, & jute, Jute & flax spinning, manufacturing of spun silk.

**Total Lectures Required = 6**

**Unit 5:** Woolen, semi-worsted & worsted systems of spinning.

**Total Lectures Required = 6**

**Grand total lectures required =36**

**Reference book: -**

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

## Mechanism of Machines (BTT053 )(L T P 3 0 0) Credit3

**Course Outcomes:** At the end of this course, student will be able to

CO1	Understand the principles of kinematic pairs, chains and their classification, DOF, inversions, equivalent chains and planar mechanisms.
CO2	Analyze the planar mechanisms for position, velocity and acceleration.
CO3	Evaluate gear tooth geometry and select appropriate gears for the required applications.
CO4	Design cams and followers for specified motion profiles, Characterize and design flywheels.
CO5	Understand free and forced vibrations of single degree freedom.
CO6	Analyze balancing problems in rotating and reciprocating machinery.

Unit	Topics	Lect ures
1.	<b>Introduction :</b> Rigid body, Mechanism and Machine, Kinematic Link, Kinematic Pair, Degrees of Freedom, Classification, Kinematic Chain, Linkage, Mechanism and Structure, Gruebler’s Criterion for degrees of freedom. <b>Inversions of mechanism:</b> Four Bar Chain mechanism, Slider- Crank mechanism, Kinematic inversions, Double slider-crank mechanism, Inversions.	8
2.	<b>Velocity Analysis:</b> Instantaneous centre method, Kennedy’s theorem, Locating instantaneous centres, Relative velocity method for slider-crank mechanism, and crank and slotted lever mechanism. <b>Acceleration Analysis :</b> Klein’s construction, slider crank mechanism, Coriolis acceleration component, Crank and slotted lever mechanism	8
3.	<b>Cam &amp; Follower :</b> Definition of cam, Classification of cams, Followers and their classification, Brief description of different types of cams and followers with simple line diagram, Simple cam profile for uniform velocity, SHM and uniform acceleration and deceleration with Flat, knife edge and roller type follower. <b>Flywheel:</b> Functions of flywheel, Kinetic Energy of rotating masses, turning moment diagram, Types of flywheels, Co-efficient of energy & speed.	8
4.	<b>Gears &amp; Gear Trains:</b> Classification of gears, Law of gearing, forms of teeth, Path of contact, Arc of contact, Interference in involute gears, Minimum number of teeth, undercutting, Differential gears, Simple gear train, Compound gear train, Reverted gear train, epicyclic gear train. Sun and planet gears. <b>Belt &amp; Chain drives:</b> Open and cross belt drives, Action of belts on pulleys, velocity ratio, slip, crowing of pulleys, power transmitted by belt drives.	9
5.	<b>Vibrations:</b> Types of vibrations, Free longitudinal vibrations, Damped vibrations, Logarithmic decrement, Forced vibrations, Forced Damped vibrations, Vibration isolation and transmissibility, Torsional vibrations. <b>Balancing:</b> Static balancing, Dynamic balancing, Balancing of masses in different planes, Balancing of reciprocating masses.	9

### Text Books:

1. Theory of Mechanisms and Machines by Ghosh and Malik.
2. Theory of Machines by S.S.Rattan.
3. Textile mechanism in spinning and weaving machines by GanapathyNagarajan

## 5. Department Elective II: Credit 3 (L T P 3 0 0)

### a) Non Woven Technology (BTT054) (3 00) 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 fibres 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 nonwoven fabric production, Concept about felts and nonwoven, 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) Nonwoven fabric by Needle punch, Description of needle punching machine, effect of process variables on properties of needle punched fabric, Application of needle punched nonwoven. **Total Lectures Required =9**

**Unit 3:** Nonwoven fabric by hydro entanglement, Description of hydro entanglement machine, Effect of process variables on properties of hydro entangled nonwoven fabric, latest development in hydro entanglement process, Application of hydro entangled nonwoven. Nonwoven fabric by chemical bonding. Effect of process variables on properties of chemical bonding **Total Lectures Required =8**

**Unit 4:** Nonwoven fabric by thermal bonding & Spunbond and melt blown processes, Effect of process variables on properties of thermal bonding, spun laid and spun bond non-woven fabrics. Application of these nonwovens. **Total Lectures Required =8**

**Unit 5:** Composite nonwoven. Classification of composite nonwoven, properties and application of composite nonwoven, Finishing of nonwovens- mechanical, chemical etc., plasma, micro encapsulation, laser etching, bio mimetic finishes, electro chemical finishes.

**Total Lectures Required =8**

**Grand total of Lectures required= 42**

### Reference & Textbooks

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.

## **5.2 Department Elective II**

### **Textured Yarn Technology (BTT060) (3-0-0 ) 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 their 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 texturizing, Methods of texturizing, Basic principles of heat setting and texturizing, 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 texturizing 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 Vaidhya
- 3.

**6 Textile Testing Lab (BTT551) ( 0 0 2) Credit1 Atleast 10 of thefollowing**

**Fibre& Yarn Testing**

1. To determine the fundle strength of cottonfibre
2. To determine the fibre fineness by air-flowmethod
3. To determine the span length of fibre&analyseit.
4. To determine the Hank and Hank C.V% of the given sliver / Determination of the within bobbinand between bobbin hank C.V % of the givenroving.
5. To determine the count of a yarn by using physical/electronicbalance.
6. To measure the Single yarn and Ply yarn twist of the given yarn sample using TwistTester.
7. To determine the Yarn count, Lea Strength and CSP of the given yarnsample.
8. To determine the single yarnstrength.
9. To Study evenness and imperfection in the given yarn and compare the results with Usterstatistics.
10. To Study the spectrogram and irregularity trace to determine type ofirregularity.
11. To prepare yarns Appearance Boards and compare with ASTMstandards.

**Fabric & garment Testing**

1. To characterize a woven fabric with respect to its dimensional properties: thread density,yarn number, crimp, weave, cover factor, weight, skewness,thickness
2. To determine the tensile strength of a woven fabric by strip test method. Draw load-elongation curve of a wovenfabric.
3. To determine the tear strength of a fabric using Elmensdorf tear tester or ballistictester.
4. To determine the bursting strength of a fabric using hydraulic burstingtester.
5. To determine the abrasion resistance of a fabric.
6. To determine the bending length and flexural rigidity of a woven fabric using the Shirleytester.
7. To determine the crease recovery of fabric and observe the effect of loading time and recoverytime on creaserecovery.
8. To determine the drape coefficient of woven and knitted fabric using the drapemeter.
9. To measure the Air permeability and Fabric Impact Strength of the givenfabric.
10. To measure the water permeability of the givenfabric.

**7. Fabric Structure & Design Practical (BTT552) ( 0 0 2) Credit1**

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

1. Plainweave
2. Plain derivative- Ribweave
3. Twillweave
4. Satin/sateenweave
5. Diamondsweave
6. Honey combweave
7. Huck-a-backweave
8. Mock lenoweave
9. Crepeweave
10. Bedford cord weaves/ weltstructure
11. Extra thread figuredweave
12. Velvet/velveteenweave
13. Doublecloth

- 8. TEXTILE CHEMICAL PROCESSING– I Lab (BTT553) L T P002 At least 10 of 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.
- 9. Mini Projector Internship Assessment (BTT554) (0 0 2 ) credit 1**
- 10. Non Credit Course:: As per AKTU**
- 11. NPTEL/ MOOCS Courses for Hons Degree:: As per AKTU**

## 3<sup>rd</sup> B. Tech (Textile Engineering) 6<sup>th</sup> Semester

### 1. Yarn Manufacture-III (BTT601) LTP 3 1 0 = Credit4 CourseOutcomes:

CO1	Explain the principles & mechanism involved in reeling & bundling.
CO2	Explain the principle involved in compact spinning/ Siro yarn spinning& understand techno-economic aspects of compact & rotor spinning.
CO3	.Explain the principle involved in open-end spinning, its manufacturing process
CO4	Explain the process of friction yarn manufacturing & mechanism of friction spinning
CO5-	Explain the process of Air-jet & Vortex spinning manufacturing& mechanism of yarn formation.

### Course Articulation Matrix of Yarn Manufacture-III:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BTT-501.1	3	3	3	3	3				3	1		1
BTT-501.2	3	3	3	3	3				2	2		2
BTT-501.3	3	3	3	3	2				3	2		2
BTT-501.4	3	2	2	2	3				2	1		1
Avg.	3	3	3	3	3				3	2		2

#### Module-I (6 Hours)

**Plying of yarns:** Objectives and principle of doubling. Study of different components of ring doubler-creel, yarn guiding roller, rings, travellers and spindle. Building motions. Concept of balanced twist in doubled yarn, direction of twist in doubled yarn and its relation to single yarn. Properties of plied yarn, Two-for-one (TFO) twister- Construction details and principle of operation.

#### Module-II (08 Hours)

**Compact spinning** - working principles of different compact spinning systems-Elitwist-Comfor twin, structure and properties of compact yarns, applications of compact yarn - Techno economics of compact spinning. **SIRO Spinning-** Principle and mechanism of SIRO spinning system, structure, properties and end use of SIRO yarn, Solo spinning system.

#### Module-III (14 Hours)

**Non-conventional spinning processes:** Causes leading to the advent of non-conventional systems of spinning.

**Rotor spinning :** Tasks of the rotor spinning machine; Mechanism of yarn formation on rotor spinning; Raw material requirements and preparation - raw materials requirements ( fibre lengths, fineness, strength, dirt & dust, foreign matter); Designing features of chief organs and their functions, sliver in-feed unit, feeding roller & guide plate, opening unit - opening roller - clothing of the opening roller, trash removal, fibre guide passage, fibre flow into the Rotor - rotor groove, rotor diameter, combination of rotor diameter and rotor groove, rotor bearing, rotor revolutions, formation of a coherent fibre strand and, back doubling, formation of the yarn, the false twist effect, wrapping fibers, yarn withdrawal and winding unit, navel, types of the navel, withdrawal tube, direction of withdrawal, package formation unit- requirements for the

package, the winding process; Effect of rotor machine variables and fibre properties on the properties of rotor spun yarns. techno-economic aspects of rotor spinning system; Limitation of rotor spinning.

**Module-IV (6 Hours)**

**Friction spinning: Operating principle;** Open and Core sheath type yarn spinning, Designing aspects of feed device, opening roller and spinning drum, classification, raw material requirements, technological interrelationships, yarn structure and characteristics, techno-economic aspect.

**Module –V (8 Hours) Air-vortex spinning:** two nozzles and single nozzle principles, comparison, Mechanism of yarn formation in air-vortex spinning; Design aspects of nozzles; Raw material requirements; Yarn structure, properties and end uses of jet spun yarns, techno-economics aspects. Properties of ring spun, rotor spun, friction spun, and air-jet spun yarn-comparison.

**Books Recommended:**

1. Klein W, “A Practical Guide to Ring Spinning “, The Textile Institute, Manchester, 1999.
2. Klein W “New Spinning Systems: Vol 5”, The Textile Institute, 1993.
3. Lawrence C A, “Fundamental of Spun Yarn Technology” CRC Press, USA, 2003.
4. Lawrence C A, “Advances in Yarn Spinning Technology” CRC Press, USA, 2010.
5. Lord P R, “Handbook of Yarn Production”, The Textile Institute, Woodhead Publication Limited, Cambridge, 2003.
6. Shaw J, “Short-staple Ring Spinning, Textile Progress”, The Textile Institute, Manchester, 1982.
7. Murty HVS, TFO- Technology & Techniques.
8. MahendraGowda R V, “New Spinning Systems”, NCUTE Publication, IIT Delhi, 200

**2. Department Core-2: Fabric Manufacture-III (L T P 3 1 0)(BTT602) credit Course Outcomes:**

CO1	Show various parts of a shuttle loom, demonstrate various motions of loom
CO2	Classify and explain shedding and picking mechanisms with their limitations and scopes.
CO3	Classify and explain let-off and take-up mechanisms with their limitations and scopes.
CO4	Demonstrate various auxiliary motions in shuttle loom.
CO5	Explain various automations in shuttle loom

**Course Articulation Matrix of Fabric Manufacture III:**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BTT-602.1	3	3	3	3	3	1			1	1		1
BTT-602.2	2	2	2	3	3				2	1		2
BTT-602.3	3	3	3	3	2				1	1		2
BTT-602.4	2	2	3	2	3	1			1	1		1
BTT-602.5	3	3	3	3	3				1	2		2
Avg.	3	3	3	3	3	1			1	1		2

**Module I (8 Hours)**

**Introduction:** Automatic loom- Pirn changing and shuttle changing loom, Automatic loom and its merit over plain shuttle loom.



**Multiple box motion:** Types of multiple box motion, working principle of multiple box motion,  
**Terry weaving:** Essential feature of terry weaving loom, various principle and mechanism of terry pile formation, structure and properties of terry fabrics.

#### **Module II (8 Hours)**

Limitation of shuttle looms, Classification of shuttle less Looms. **Projectile Loom:** Working elements and weft insertion cycle in projectile loom-Torsion bar picking mechanism-Weft selection device-Salient features of projectile loom, Weft insertion rate and production calculation. Techno economics of shuttleless weaving.Selvage and salient features of shuttle less loom.

#### **Module III (8 Hours)**

**Rapier Loom:** Classification of rapier loom: Flexible and Rigid Rapiers-Principles of tip and loop transfer- Weft insertion cycle-. Zero velocity and non-zero velocity tip transfer. Weft insertion rate and production calculation.Properties and application of rapier woven fabrics.

#### **Module IV (8 Hours)**

**Air-jet loom:** Working principle – weft insertion mechanism - types of nozzles, profile reed. Air requirements.Weft insertion rate and production calculation.

**Water-jet Loom:** Working principle - Weft insertion system – Nozzles - Water requirements – Weft insertion rate and production calculation.

#### **Module V (8 Hours)**

**Multiphase loom:** Classification, principles of operation, shedding mechanisms of weft way and warp way, supply systems for weft,

**Narrow fabric production:** Importance of narrow weaving. It's manufacturing process.

Unconventional Fabric Production: Concepts of 3D fabric production and circular loom. Different types of accumulators and its important.

#### **Books Recommended:**

1. Talukdar M K, Srirammulu P K and Ajgaokar D B, “Weaving – Machine, Mechanism and Management”, Mahajan Publisher Private Ltd., Ahmedabad, India,1998.
2. Aswani K T, “Fancy Weaving mechanism”, Mahajan Publisher Private Ltd., Ahmedabad, India 1990.
3. Ormerod&W. S. Sondhelm “Weaving – Technology and Operations,
4. R. Sengupta “Weaving Calculation”.
5. Woven Fabric Production I, II, NCUTE Publications2002.
6. Handbook of weaving, By SabitAdanur

### **3. Chemical Processing of Textile-II (BTT603) LTP 3 1**

#### **0 Credit4 CourseOutcomes:**

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.

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
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 (08 Hours)

**Identification of dyes:**

**Dyeing machineries:** Loose fibre, yarn and package dyeing machines. Jigger, winch, jet and HTHP beam dyeing machine. Padding mangle, 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, screen printing processes, screen preparation, drawback and advantage of each method. **Styles of printing:** Direct, Discharge and Resist. Printing of cotton with reactive, vat and pigment, Polyester with disperse dye and Acrylic with basic dyes. **Printing after treatments:** Steaming, curing, ageing in printing.

**Digital Printing:** Mechanism, process parameters and machinery.

### Module IV (10 Hours)

**Finishing:** Significance and classification of finishing.

**Mechanical finish:** Temporary and durable finishes, Sanforizing and their evaluation. **Chemical and functional finish:** Mechanism, process parameters and trouble shootings of Softening, anti-crease finish, waterproof and water repellent finish, flame-retardant and fireproof finish, Soil release finish; Organdi finish; Biopolishing, Stonewashing of denim, Anti-microbial finish, antistatic finish and their evaluation.

## Module V: 04 Hours

**Waste minimization:** Need for waste minimization. water conservation, energy conservation. Textile effluent management. Techniques of 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. Shenai V A and Saraf, N M, "Technology of Textile Finishing", Sevak Publications, Mumbai,1990.
4. Karmakar S. R., "Chemical Technology in the Pre-treatment Process of Textiles", Elsevier sciences,1999.
5. Cavaco-Paulo A. and Gubitz G. M., "Textile Processing with enzymes", Woodhead Publication Ltd.,2003.

## 4. Department Elective-III (L T P 3 0 0) credit3

### 4.1 Theory of Textile Structure (BTT061) (L T P 3 00)

#### 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, NewYork,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 andNoordhoff,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”. Woodheadpublishing.

### 4.2 Clothing Science (BTT062) (L T P 3 00)

#### Course Outcomes:

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

- 4.2.1 Describe thermal and non-thermal components of clothing comfort.
- 4.2.2 Explain the role of body components in maintaining body temperatures
- 4.2.3 Recognize the Principles of heat transfer to and away human body
- 4.2.4 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 waterproof; 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

### 4.3 Mechanical Machine Design (BTT063) L-T-P(3-0-0)

Unit	Topics	Lectures
I	<b>Introduction</b> Definition, Design requirements of machine elements, Design procedure, Standards in design, Selection of preferred sizes, Indian Standards designation of carbon & alloy steels, Selection of materials for static and fatigue loads. <b>Design for Static Load:</b> Modes of failure, Factor of safety, Principal stresses, Stresses due to bending and torsion, Theory of failure.	8

II	<b>Design for Fluctuating Loads:</b> Cyclic stresses, Fatigue and endurance limit, Stress concentration factor, Stress concentration factor for various machine parts, Notch sensitivity, Design for finite and infinite life, Soderberg, Goodman & Gerber criteria. <b>Riveted Joints:</b> Riveting methods, materials, Types of rivet heads, Types of riveted joints, Caulking and Fullering, Failure of riveted joint, Efficiency of riveted joint, Design of boiler joints, Eccentric loaded riveted joint.	8
III	<b>Shafts:</b> Cause of failure in shafts, Materials for shaft, Stresses in shafts, Design of shafts subjected to twisting moment, bending moment and combined twisting and bending moments, Shafts subjected to fatigue loads, Design for rigidity. <b>Keys and Couplings:</b> Types of keys, splines, Selection of square & flat keys, Strength of sunk key, Couplings, Design of rigid and flexible couplings.	8
IV	<b>Belt rope and chain drives:</b> Design of belt drives, Flat & V-belt drives, Condition for Transmission of max. Power, Selection of belt, design of rope drives, and design of chain drives with sprockets <b>Clutches:</b> Various types of clutches in use, Design of friction clutches – Disc, Multidisc, Cone and Centrifugal. <b>Brakes:</b> Various types of Brakes, Design of shoe brakes – Internal & external expanding, band brakes.	9
V	<b>Spur Gears</b> Tooth forms, System of gear teeth, contact ratio, Standard proportions of gear systems, Interference in involute gears, Backlash, Selection of gear materials, Gear manufacturing methods, Design considerations, Beam strength of gear tooth, Dynamic tooth load, Wear strength of gear tooth, Failure of gear tooth, Design of spur gears, AGMA and Indian standards. <b>Helical Gears</b> Terminology, Proportions for helical gears, Forces components on a tooth of helical gear, Virtual number of teeth, Beam strength & wear strength of helical gears, Dynamic load on helical gears, Design of helical gears.	9

#### Text Books

1. Design of Machine Elements – V.B. Bhandari – Tata McGraw Hill, New Delhi.
2. Design of machine elements-C S Sharma, Kamlesh Purohit, PHI.

**5. Open Elective-1:** As per AKTU Syllabus. The students have choice to go through course via MOOCS/NPTEL/SWAYAM

#### **6. Yarn Manufacture-III (BTT551) Practical L T P 0 0 2 credit1**

1. To study the construction details and passage of materials in Ringframe.
2. To outline the main gearing diagram of ring frame and calculate Draft Constant and Twist Constant. & Production.
3. To study the building motion in ringframe.
4. To calculate required speed, draft and twist level and produce yarn from a given roving and determine the yarn count & production.
5. To study the construction details and passage of materials in Ring doubler.
6. To study the construction details and passage of materials of TFO.
7. Production & twist calculation in TFO with 3 positions and its effect on yarn strength.
8. Study of flow of materials in Rotor spinning machine.
9. Study of different elements of Rotor spinning machine.
10. Study of draft distribution in Rotor spinning machine.

11. Study of twist level in Rotor spunyarn.
12. Calculation of production of rotor spinningmachine

**7. Fabric Manufacture-III Practical (BTT552) L T P 0 0 2 credit1**

1. Study and working of pirn changemotion.
2. Study and working of shuttle changemotion
3. Study & working of multiple boxloom
4. To study fabric formation in Terry towelloom.
5. To study the yarn passage in different shuttlelessloom
6. To study path of warp yarn in rapierloom.
7. To study picking mechanism in rapierloom.
8. To produce a fabric by changing the design in rapierloom.
9. To study path of warp yarn in air-jetloom.
10. To study picking mechanism in air-jetloom.

**8. TEXTILE CHEMICALPROCESSINGII Lab (BTT553) Credit 0 0  
2 Credit1 At least 10 of the following**

1. Dyeing of Polyester fibres/yarn/fabrics with Disperse Dye using carrierdyeing process.
2. Dyeing of Polyester fibres/yarn/fabrics with Disperse Dye using HT-HPdyeing process.
3. Dyeing of Nylon yarn/fabric with AcidDye.
4. Dyeing of poly acrylonitrile fibre with cationicdyes.
5. Dyeing of blended fabric with suitable dyes.
6. Printing of cotton fabric with direct style printing and assessment of fastness properties of printedmaterial.
7. Printing of cotton fabric with discharge style printing and assessment of fastness properties of printedmaterial.
8. Printing of cotton fabric with resist style printing and assessment of fastness properties of printedmaterial.
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 recoveryangle.
12. Assessment of shrinkage of woven and knittedfabrics.
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 wettingangle.
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 homelaundrying.
17. Determination of the colour difference and colour strength value of dyed material using computer colour matchingsystem

**9. Non Credit course: As per AKTU Guidelines**

**BNC501/BNC601: Constitution of India, Law and Engineering:L:T: P: 2: 0:0**

### **Module 1--Introduction and Basic Information about Indian Constitution:**

Meaning of the constitution law and constitutionalism, Historical Background of the Constituent Assembly, Government of India Act of 1935 and Indian Independence Act of 1947, Enforcement of the Constitution, Indian Constitution and its Salient Features, The Preamble of the Constitution, Fundamental Rights, Fundamental Duties, Directive Principles of State Policy, Parliamentary System, Federal System, Centre-State Relations, Amendment of the Constitutional Powers and Procedure, The historical perspectives of the constitutional amendments in India, Emergency Provisions: National Emergency, President Rule, Financial Emergency, and Local Self Government – Constitutional Scheme in India.

### **Module 2-Union Executive and State Executive:**

Powers of Indian Parliament Functions of Rajya Sabha, Functions of Lok Sabha, Powers and Functions of the President, Comparison of powers of Indian President with the United States, Powers and Functions of the Prime Minister, Judiciary – The Independence of the Supreme Court, Appointment of Judges, Judicial Review, Public Interest Litigation, Judicial Activism, LokPal, LokAyukta, The Lokpal and Lokayuktas Act 2013, State Executives – Powers and Functions of the Governor, Powers and Functions of the Chief Minister, Functions of State Cabinet, Functions of State Legislature, Functions of High Court and Subordinate Courts.

### **Module 3- Introduction and Basic Information about Legal System:**

The Legal System: Sources of Law and the Court Structure: Enacted law -Acts of Parliament are of primary legislation, Common Law or Case law, Principles taken from decisions of judges constitute binding legal rules. The Court System in India and Foreign Courtiers (District Court, District Consumer Forum, Tribunals, High Courts, Supreme Court). Arbitration: As an alternative to resolving disputes in the normal courts, parties who are in dispute can agree that this will instead be referred to arbitration. Contract law, Tort, Law at workplace.

### **Module 4- Intellectual Property Laws and Regulation to Information:**

Intellectual Property Laws: Introduction, Legal Aspects of Patents, Filing of Patent Applications, Rights from Patents, Infringement of Patents, Copyright and its Ownership, Infringement of Copyright, Civil Remedies for Infringement, Regulation to Information Introduction, Right to Information Act, 2005, Information Technology Act, 2000, Electronic Governance, Secure Electronic Records and Digital Signatures, Digital Signature Certificates, Cyber Regulations Appellate Tribunal, Offences, Limitations of the Information Technology Act.

### **Module 5 -Business Organizations and E-Governance:**

Sole Traders, Partnerships: Companies: The Company's Act: Introduction, Formation of a Company, Memorandum of Association, Articles of Association, Prospectus, Shares, Directors, General Meetings and Proceedings, Auditor, Winding up. E-Governance and role of engineers in E-Governance, Need for reformed engineering serving at the Union and State level, Role of I.T. professionals in Judiciary, Problem of Alienation and Secessionism in few states creating hurdles in Industrial



development.

**COURSE OBJECTIVE:**

- To acquaint the students with legacies of constitutional development in India and help those to understand the most diversified legal document of India and philosophy behind it.
- To make students aware of the theoretical and functional aspects of the Indian Parliamentary System.
- To channelize students' thinking towards basic understanding of the legal concepts and its implications for engineers.
- To acquaint students with latest intellectual property rights and innovation environment with related regulatory framework.
- To make students learn about role of engineering in business organizations and e-governance.

**COURSE OUTCOME:** At the end of the course, learners should be able to

1. Identify and explore the basic features and modalities about Indian constitution.
2. Differentiate and relate the functioning of Indian parliamentary system at the center and state level.
3. Differentiate different aspects of Indian Legal System and its related bodies.
4. Discover and apply different laws and regulations related to engineering practices.
5. Correlate role of engineers with different organizations and governance models

**Pedagogy:** Lecture, Problem based learning, Group discussions, Visual media, Films, Documentaries, Debate forums.

**Suggested Readings:**

- Brij Kishore Sharma: Introduction to the Indian Constitution, 8th Edition, PHI Learning Pvt. Ltd.
- Granville Austin: The Indian Constitution: Cornerstone of a Nation (Classic Reissue), Oxford University Press.
- Subhash C. Kashyap: Our Constitution: An Introduction to India's Constitution and constitutional Law, NBT, 2018.
- MadhavKhosla: The Indian Constitution, Oxford University Press.
- PM Bakshi: The Constitution of India, Latest Edition, Universal Law Publishing.
- V.K. Ahuja: Law Relating to Intellectual Property Rights (2007)
- Suresh T. Viswanathan: The Indian Cyber Laws, Bharat Law House, New Delhi-88
- P. Narayan: Intellectual Property Law, Eastern Law House, New Delhi
- PrabudhGanguli: Gearing up for Patents: The Indian Scenario, Orient Longman.
- BL Wadehra: Patents, Trademarks, Designs and Geographical Indications Universal Law Publishing - LexisNexis.
- Intellectual Property Rights: Law and Practice, Module III by ICSI (only relevant sections)
- Executive programme study material Company Law, Module II, by ICSI (The

Institute of Companies Secretaries of India) (Only relevant sections i.e., Study 1, 4 and 36).<https://www.icsi.edu/media/webmodules/publications/Company%20Law.pdf>

- Handbook on e-Governance Project Lifecycle, Department of Electronics & Information Technology, Government of India, [https://www.meity.gov.in/writereaddata/files/eGovernance\\_Project\\_Lifecycle\\_Participant\\_Handbook-5Day\\_CourseV1\\_20412.pdf](https://www.meity.gov.in/writereaddata/files/eGovernance_Project_Lifecycle_Participant_Handbook-5Day_CourseV1_20412.pdf)
- Companies Act, 2013 Key highlights and analysis by PWC. <https://www.pwc.in/assets/pdfs/publications/2013/companies-act-2013-key-highlightsand-analysis.pdf>

#### **Referred Case Studies:**

- KeshavanandBharati V. State of Kerala, AIR 1973 SC 1461.
  - Maneka Gandhi V. Union of India AIR, 1978 SC 597. • S.R. Bammai V. Union of India, AIR 1994 SC 1918.
  - KuldipNayyar V. Union of India, AIR 2006 SC312.
  - A.D.M. Jabalpur V. ShivkantShakla, AIR 1976 SC1207. • Remshwar Prasad V. Union of India, AIR 2006 SC980.
  - Keshav Singh in re, AIR 1965 SC 745.
  - Union of India V. Talsiram, AIR 1985 SC 1416.
  - Atiabari Tea Estate Co.V.State of Assam, AIR 1961SC232.
  - SBP & Co. Vs. Patel Engg. Ltd. 2005 (8) SCC 618.
  - Krishna BhagyaJala Nigam Ltd. Vs. G. Arischandra Reddy (2007) 2 SCC 720.
  - Oil & Natural Gas Corporation Vs. Saw Pipes Ltd. 2003 (4) SCALE 92 – 185.
- \*\* (Other relevant case studies can be consulted by the teacher as per the topic).

#### **Prescribed Legislations:**

1. Information Technology Act, 2000 with latest amendments.
2. RTI Act 2005 with latest amendments.
3. Information Technology Rules, 2000
4. Cyber Regulation Appellate Tribunal Rules, 2000

#### **Suggested aid for Students and Pedagogic purpose**

- RSTV debates on corporate law, IPR and patent issues
- NPTEL lectures on IPR and patent rights

**Episodes of 10 -part mini TV series “Samvidhan: The Making of Constitution of India” by RSTV.**

**BNC502/BNC602: INDIAN TRADITIONS, CULTURAL AND SOCIETY L:T:P: 2:0:0**

#### **Module 1- Society State and Polity in India State in Ancient India:**

Evolutionary Theory, Force Theory, Mystical Theory Contract Theory, Stages of State Formation in Ancient India, Kingship , Council of Ministers Administration Political Ideals in Ancient India Conditions’ of the Welfare of Societies, The Seven Limbs of the State, Society in Ancient India, Purusārtha, Varnāshrama System, Āshrama or the

Stages of Life, Marriage, Understanding Gender as a social category, The representation of Women in Historical traditions, Challenges faced by Women. Four-class Classification, Slavery.

### **Module 2- Indian Literature, Culture, Tradition, and Practices**

Evolution of script and languages in India: Harappan Script and Brahmi Script. The Vedas, the Upanishads, the Ramayana and the Mahabharata, Puranas, Buddhist And Jain Literature in Pali, Prakrit And Sanskrit, Kautilya's Arthashastra, Famous Sanskrit Authors, Telugu Literature, Kannada Literature, Malayalam Literature, Sangama Literature Northern Indian Languages & Literature, Persian And Urdu, Hindi Literature

### **Module 3- Indian Religion, Philosophy, and Practices**

Pre-Vedic and Vedic Religion, Buddhism, Jainism, Six System Indian Philosophy, Shankaracharya, Various Philosophical Doctrines, Other Heterodox Sects, Bhakti Movement, Sufi movement, Socio religious reform movement of 19th century, Modern religious practices.

### **Module 4- Science, Management and Indian Knowledge System**

Astronomy in India, Chemistry in India, Mathematics in India, Physics in India, Agriculture in India, Medicine in India, Metallurgy in India, Geography, Biology, Harappan Technologies, Water Management in India, Textile Technology in India, Writing Technology in India Pyrotechnics in India Trade in Ancient India, India's Dominance up to Pre-colonial Times

### **Module 5- Cultural Heritage and Performing Arts**

Indian Architect, Engineering and Architecture in Ancient India, Sculptures, Seals, coins, Pottery, Puppetry, Dance, Music, Theatre, drama, Painting, Martial Arts Traditions, Fairs and Festivals, Current developments in Arts and Cultural, Indian's Cultural Contribution to the World. Indian Cinema.

### **COURSE OBJECTIVES:**

- The course aims at imparting basic principles of thought process, reasoning and inference to identify the roots and details of some of the contemporary issues faced by our nation and try to locate possible solutions to these challenges by digging deep into our past.
- To enable the students to understand the importance of our surroundings and encourage the students to contribute towards sustainable development.
- To sensitize students towards issues related to 'Indian' culture, tradition and its composite character.
- To make students aware of holistic life styles of Yogic-science and wisdom capsules in Sanskrit literature that are important in modern society with rapid technological advancements and societal disruptions.
- To acquaint students with Indian Knowledge System, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic health care system.

**COURSE OUTCOMES:** Ability to understand, connect up and explain basics of Indian Traditional knowledge modern scientific perspective.

### **Suggested Pedagogy for Teachers**

- Project based learning
- Case studies
- Group discussion
- Presentations

### **Suggested Text & Reference Books**

1. V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, BharatiyaVidyaBhavan, Mumbai, 5th Edition, 2014
  2. S. Baliyan, Indian Art and Culture, Oxford University Press, India
  3. Swami Jitatmanand, Modern Physics and Vedant, BharatiyaVidyaBhavan
  4. RomilaThapar, Readings In Early Indian History Oxford University Press , India
  5. Fritz of Capra, Tao of Physics
  6. Fritz of Capra, The wave of Life
  7. V N Jha (English Translation), Tarkasangraha of Annam Bhatta, InernationalChinmayFoundation, Velliarnad, Amaku, am
  8. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta
  9. GN Jha (Eng. Trans.) Ed. R N Jha, Yoga-darshanam with VyasaBhashya, VidyanidhiPrakasham, Delhi, 2016
  10. RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, VidyanidhiPrakasham, Delhi, 2016
  11. P R Sharma ( English translation), ShodashangHridayam
  12. Basham, A.L., The Wonder that was India (34th impression), New Delhi, Rupa& co
  13. Sharma, R.S., Aspects of Political Ideas and Institutions in Ancient India(fourth edition), Delhi, MotilalBanarsidass,
- 10. MOOCS (Essential for Honors degree)**