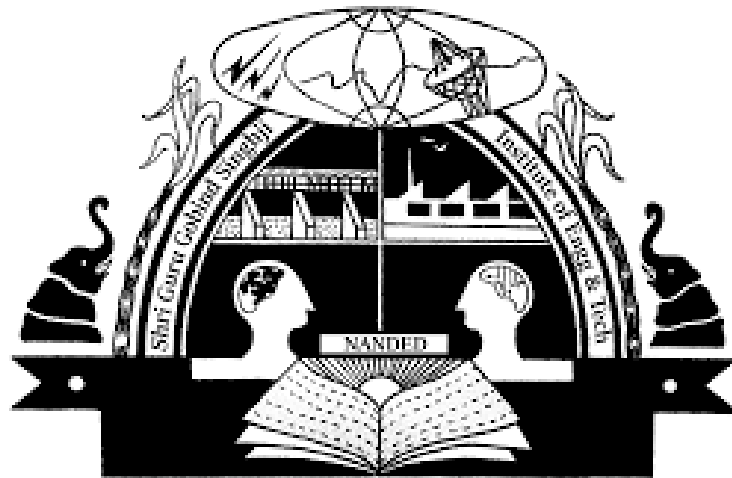


# Shri Guru Gobind Singhji Institute of Engineering & Technology, Nanded

(An Autonomous Institute of Government of Maharashtra)



## Department of Textile Technology

**Curriculum**  
**Final Year B. Tech. (Textile Technology)**  
**Academic year 2021-22**



**Shri Guru Gobind Singhji Institute of Engineering & Technology, Nanded.**  
(An Autonomous Institute of Government of Maharashtra)

**DEPARTMENT OF TEXTILE TECHNOLOGY**

**Curriculum Structure: Final Year B. Tech. (Textile Technology) with effective from 2021-22**

<b>Semester I (Both Structure A and Structure B)</b>						
Course Code	Name of the Course	L	T	P	Credit	
					Th	Pr
PCC-TT401	Technical Textiles-I	4	--	2	4	1
PCC-TT402	Knitting and Nonwoven	4	--	2	4	1
PCC-TT403	Production Management	3	--	--	3	0
PRJ-TT404	Mini project	0	2	4	2	2
<i>All below are Elective Courses:</i>						
<i>**Structure A: Elective III (any one)</i>						
<i>#Structure B: Elective III, and IV (if not already opted for Elective III, otherwise only Elective IV)</i>						
PEC-TT405	Statistical Process Control in Spinning	3	--	2	3	1
PEC-TT406	Smart Textiles	3	--	2	3	1
PEC-TT407	Merchandizing and Supply Chain Management	4	--	0	4	--
HMC471	Employability Skills	4	--	0	4	--
	<b>Total</b>	14/15	2	10/12	21	
<b>Semester II (Structure-A)</b>						
Course Code	Name of the Course	L	T	P	Credit	
					Th	Pr
PRJ-TT410	Project Work*	--	2	12	--	8
SEM-TT411	Seminar	--	2	--	--	2
SII-TT412	Winter/Summer Internship <sup>s</sup>	--	--	4	--	2
<i>All below are Elective Courses: Any two</i>						
PEC-TT413	Technical Textiles-II	4	--	--	4	--
PEC-TT414	Process Control in Weaving	3	--	2	3	1
PEC-TT415	Textile Finishing	3	--	2	3	1
PEC-TT416	Economics and Business Law	4	--	--	4	--
	<b>Total</b>	6/7/8	--	0/2/4	20	
<b>Semester II (Structure-B)</b>						
Course Code	Name of the Course	L	T	P	Credit	
					Th	Pr
PRJ-TT417	Project Work <sup>#</sup>	--	--	24	--	12
PCC-TT418	A Case Study	--	--	4	--	2
SII-TT419	Internship in Industry <sup>@</sup>	--	--	4	--	2
	<b>Total</b>	--	--	32	16	

*L-No. of Lecture Hours/week, T-No. of Tutorial Hours/week, P-No. of Practical Hours/week*

**Semester I: Common** for both Structure A and Structure B, only difference in opting for no. of electives, if any

**Semester II: Different** for Structure A and Structure B.

B. Tech (TEXT)	Contact Hours	Credits
TOTAL (Structure-A)	61	41
TOTAL (Structure-B)	61	37/41

#### \*Structure A:

\*Students in this category remain in **institute for Project work** and other courses in **the LAST SEMESTER of FINAL year**.

§Final year students must undergo internship program in the break between Third year and Final year or between two semesters of final year, but evaluation will be done during second semester of Final year.

#### \*\*Structure B:

#Students in this category go to **an industry/ research organization for Project work** and remain there in the **LAST SEMESTER of FINAL year**. As they remain absent at the institute in the last semester, they will be falling short of 4 credits compared to the other category of students. To compensate the total credit requirements, a **Structure-B** student must take **one more Elective either in TY Semester II or in B Tech Semester I**.

@In this category final year students will undergo In-house internship program during LAST semester of final year at the industry/ research organization where he/ she is carrying out the project work.

### VISION

Committed to excel in high quality education, research and extension services in the field of textiles.

### MISSIONS

- 1 Imparting quality textile education and creating conducive teaching and learning environment
- 2 Strengthening research, innovation activities and extension services
- 3 Networking with premier industries, institutions, research organizations and alumni
- 4 Improving professional, ethical and leadership attitude of learners

### PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

- |   |                        |   |
|---|------------------------|---|
| 1 | Core Competency        | Graduates of the program will have core knowledge of textiles covering technology and production of fibres, yarns and fabrics   |
| 2 | Analytical Proficiency | Graduates of the program will be competent enough to pursue higher studies and research, work in interdisciplinary environment  |
| 3 | Managerial Skills      | Graduates of the program will have the capability to demonstrate leadership, managerial and professional skills in their career |
| 4 | Social Skills          | The program also provides extension services and skill development programs for the industry and society                        |

**B. Tech Textile Technology- Programme Articulation matrix**

PO/ PSO → PEO ↓	Engine ering knowle dge	Prob lem anal ysis	Design/ develop ment of solution s	Conduc t investig ations of complex problem s	Mod ern tool usag e	The engi neer and socie ty	Environ ment and sustaina bility	Eth ics	Indivi dual and team work	Communi cation	Project manag ement and finance	Lif e- long learn ing
	(PO1)	(PO2)	(PO3)	(PO4)	(PO5)	(PO6)	(PO7)	(PO8)	(PO9)	(PO10)	(PO11)	(PO12)
<b>I.</b> Core Compe tency	√	√	√	√	√	√			√	√		√
<b>II.</b> Analyti cal Profici ency	√	√	√	√	√				√	√		√
<b>III.</b> Manag erial Skills						√	√	√	√	√	√	√
<b>IV.</b> Social Skills						√	√	√	√	√	√	√

**Semester I****PCC-TT401: Technical Textiles - I****(L4-T0-P2): 5 Credit****Course Objectives:**

1. To develop core knowledge of technical textiles to serve industry.
2. Develop research attitudes for innovation activities.
3. Develop skills in interdisciplinary areas.
4. Develop a lifelong learning attitude
5. Design of unconventional things which can help the society as per needs.

**Course Outcomes:**

- CO1 Students will be able to learn and remember the basics of technical textiles, manufacturing methods and application areas of technical textiles
- CO2 Students will understand the different finishing and coating techniques used to manufacture technical textiles.
- CO3 Students will be able to apply the knowledge of technical yarns and technical sewing threads used in different applications of technical textiles in the industry
- CO4 This course will enable the students to analyze the different fibres, fabrics and manufacturing methods used for the development of technical textiles.
- CO5 Students will be able to evaluate the different test methods used for the assessment of technical textiles
- CO6 Students will be competent enough to design different technical textile products such as air-bag, belts, tyre cords, automotive textiles, filter fabric, geotextiles etc.

**Course Articulation Matrix:**

Program Outcome (PO)→ Course Outcome (CO)↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2					1		2	1	1	2
CO2	3	2					1		2	1	1	2
CO3	3	2					1		2	1	1	2
CO4	3	2					1		2	1	1	2
CO5	3	2					1		2	1	1	2
CO6	3	2	3				1		2	1	1	2

**Course Content:****1. Introduction to Technical Textiles:**

What are Technical textiles? Application areas, Fibres that are used for Technical textiles, Use of Technical textiles globally

**2. Technical textile yarns and sewing threads:**

Filament technical yarns such as glass fibres and yarns carbon fibres and yarn, ceramic fibres and yarns, HPPE fibres and yarns, Aramid fibres and yarns, Ultra-fine and Novelty fibre. Introduction to sewing threads, apparel sewing threads, industrial sewing threads, types and structure of industrial threads, thread finishing, thread numbering, sizes of threads and fabrics, general properties of fibres used for sewing threads.

**3. Finishing and coating of technical textiles:**

Finishing processes like mechanical processes, Calendaring, Raising, Cropping, Compressive shrinkage, Heat setting. Chemistry of coated textiles, PVC, PVDC, PTFE, Rubber- various type, Polyurethanes, Coating techniques: Knife coating, roller coating, nip coating, dip coating, cast coating, extrusion coating, spray coating, foam coating, U-V Cured coating, powder coating, Rotary screen coating, Hot melt coating, Transfer coating, fusible interlinings.

**4. Belts:**

Conveyer belts, Physical and mechanical properties, construction of belts, power transmission belts

**5. Automotive textiles:**

Introduction, Major fibres/ fabrics used, textiles used as Seating area, Headliners/ hood fabrics, Side panels, Carpets, Trunks, Door trim, Dash mat.

**6. Seat Belt:**

Introduction, requirements, specifications, manufacturing of seat belt

**7. Airbags:**

Introduction, requirements of airbag fibres, fabric types, finishing of airbag fabric, garmenting of airbag.

**8. Tyre cords and fabrics:**

Requirements of tyre cords, Textile components in a tyre, tyre structure and design, cord processing and tyre manufacturing, good cord properties vs tyre performance, physical and mechanical property requirements for tyre

**9. Filtration:**

Introduction, Principle of filtration, dust collection theory, filtrations and textiles, applications, yarn type and fabric construction, finishing treatments, water Purification by some specific fibres. Separation of oil and water, air-purification, fabric test procedure.

**10. Film yarn:**

Basic polymers required, manufacturing techniques, their uses in fabrics, twines and ropes and Artificial turf.

**11. Geotextiles:**

Introduction, important characteristics of geotextiles, fibres used, types of geotextiles, functions of geotextiles, geotextiles uses in separation, filtration, drainage, reinforcement, sealing of roads, railway tracks etc

**Practical Work:**

1. Determine the Tensile strength including grab test and strip test of geotextile.
2. Determine the Air-permeability of geotextile.
3. Determine the porosity of non-woven/ woven fabrics.
4. Determine the water permeability of a geotextile.
5. Determine the compressional and relaxation behaviour of geotextile.
6. Determine the Puncture Resistance of a geotextile.
7. Determine the Shear behaviour of soil using direct shear tester.
8. Determine the inter frictional properties of geotextile with soil.
9. Determine the Transmissivity of geotextile.
10. Determine the Grain size of soil using sieve shaker.

**Reference Books:**

1. A. R. Horrocks & S. C. Anand, Handbook of technical textiles, The Textile Institute, Wood Head Publication Ltd., 2007
2. R. Alagiruswami and A. Das, Technical Textile yarns, The Textile Institute, Wood Head Publication Ltd., 2010
3. Geotextiles Handbook by T. S. Ingold & K. S. Miller
4. Wellington Sears Handbook of Industrial Textiles by Sabit Adanur, Technomic Publishing Co. INC, Lancaster, Basel, 1995
5. Industrial Applications of Textile by R. S. Goy & J. A. Jenkins, Textile progress, 1970, March, Vol. II No. 1
6. Industrial Applications of Textiles by K. L. Floyd & H. M. Taylor, Textile progress, 1970, Vol. VI, No. 2
7. High performance fibres by P. Bajaj and A. K. Sengupta, The Textile Institute
8. Industrial Applications of Textiles: Textiles for Filtration and Coated Fabrics, P. Bajaj and A. K. Sengupta, The Textile Institute, Textile Progress, Vol 14, No.1
9. Automotive Textiles by S. K. Mukhopadhyay and J. F. Partridge, The Textile Institute, Textile Progress, Vol 29, No. 1/2

**PCC-TT402: Knitting and Nonwoven****(L4-T0-P2): 5 Credit****Course Objectives:**

1. To learn the technology of weft and warp knitting.
2. To compare the properties of nonwoven and knitted fabrics.
3. Representation of knitted structures.
4. To practice knitting on different machines
5. To understand the technology of manufacturing nonwoven
6. To know the different uses of knitting and non-woven fabrics.

**Course Outcomes:**

- CO1 Learning knowledge about fabric manufacturing process other than weaving, knitting & nonwoven.
- CO2 Apply knowledge nonwovens & knitted fabrics in end use application of knitting & nonwoven fabrics.
- CO3 Learning different types of knitting & nonwoven machines and their manufacturing.
- CO4 Explore a new idea for making knitted structures.
- CO5 Ability to compare the properties of woven, knitted & nonwoven fabrics.
- CO6 Analyze knitted fabrics from design point of view.

**Course Articulation Matrix:**

Program Outcome (PO)→ Course Outcome (CO)↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3						1			
CO2	3	2	3						1			
CO3	3	3	2						1			
CO4	3	3	2						1			
CO5	2	2	1						1			
CO6	2	2	1						1			

**Course Content:****Knitting Technology:**

1. Introduction: history, growth of knitting industry in India, comparison of weaving & knitting, Basic concepts, Classification, comparison between warp & weft knitting
2. Weft knitting: types of needles, knitting elements, knitting actions, single and double jersey structures, machine, process and structures of plain, rib, interlock & purl knitting. Design & elements: pattern wheel, pegged drum, multiple cam track, Jacquard. Quality aspects, faults in knitted fabrics, products, market, machinery details, calculations.
3. Warp knitting: knitting elements, Raschel & Tricot knitting machines & their knitting cycle, principles of loop formation, warp knitted structures, developments in warp knitting, yarn selection, fabric defects, calculations, products, market, machinery details, quality aspects ~~Air-Jet Looms: Different systems of air-jet weaving, Different phases of insertion, and traverse aids for maintaining of air flow (STRESS ON CONFUSER DESIGN), Relay jets, Methods of air-jet control. Air requirements, factors affecting pneumatic weft propulsion, Motion of weft, Nozzle design, Weft flight through the shed, automatic weft repair, nozzle design and different factors involved in it, factors affecting pneumatic weft propulsion, Fabric defects, quality produced, electronic controls on machine.~~

**Nonwoven Technology:**

4. Introduction, Definition, Basic nonwoven processes, raw material, fibre preparation processes, mixing & blending, Staple fibre web formation processes, carding process
5. Web stacking processes, parallel-laid, cross-laid, perpendicular-laid, Wet-lay Process, fabric defects, Critical material characteristics and process factors, applications
6. Web bonding processes, mechanical bonding, details of needle loom, factors affecting fabrics properties, major application of needled fabrics, thermal bonding processes, raw materials, calendar bonding process, critical process parameters, chemical bonding processes, chemical binders, methods of binder application

7. Polymer-extrusion based technologies, spun-bond technology, raw materials, process sequence, production systems, key process factors, applications, melt-blown technology, spun-bond versus melt-blown
8. Finishing Processes: Mechanical finishing, Chemical finishing, Unconventional finishing
9. Braiding: Introduction, types, production technology, products, properties & end uses

### **Practical Work:**

1. Study of different knitting machines like Circular Sinker Bed, Flat Bed hand knitting, V-Bed knitting, socks knitting, Interlock knitting & jacquard knitting machine:
2. Study of knitting elements, stop motions, Knitting m/c speed, stitch length setting & fabric take-up,
3. Running of knitting m/c. & problems encountered
4. Preparation of few knitting samples on the above machines
5. sample preparation on different machines
6. Analysis of few knitted samples and reproduction of samples on the respective Machine, calculations
7. Visit to non-woven industry
8. Study & preparation of different knit braided structures

### **Reference Books:**

1. <https://nptel.ac.in/courses/116/102/116102008/>
2. <https://nptel.ac.in/courses/116/102/116102014/>
3. Fundamentals & advances in knitting technology, S C Ray, Woodhead Publishing Ltd, 2016
4. Knitting Technology by David J. Spencer – Pergarman Press, Oxford 1993
5. Knitting Technology by D.B. Ajgoankar, Universal Publishing Corporation, Mumbai.
6. Advances in Braiding Technology: Specialized Techniques and Applications, Yordan Kyosev, Woodhead Publishing

## **PCC-TT403: Production Management**

**(L3-T0-P0): 3 Credit**

### **Course Objectives:**

1. To know the functions of Production and Operations Management, PPC & its implementation in Textile Industry
2. To learn the aspects of TQM, thoughts of quality management scientist and new management concepts like six sigma, five S, Kaizen & supply chain management
3. To study basic concepts of plant layout and material handling
4. To understand concepts of PPC and machinery maintenance
5. To understand and use concepts of inventory management
6. To prepare practical production plans for spinning and weaving

### **Course Outcomes:**

- CO1 Perform functions of Production Engineer
- CO2 Apply principles of production planning and control (PPC)
- CO3 Install good layout and material handling system
- CO4 Apply quality management tools and techniques
- CO5 Solve sales forecasting and inventory management related problems
- CO6 Prepare spinning and weaving production plans



**Course Articulation Matrix:**

Program Outcome (PO)→ Course Outcome (CO)↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		1	1			1		3	2	1		1
CO2		2	1								1	1
CO3	2	3	2			2						1
CO4		2	2	1		2	1					1
CO5		3	2	1								1
CO6		2	2									1

**Course Content:**

1. Definitions of Production & Operations Managements, Functions of POM
2. **Plant layout:**  
Features, Basic Principles, Costs, Basic Types of Layout, Their Merits and Demerits, Layouts & Buildings Used in Textile Industries
3. **Material handling:**  
The Principles, Classification of Material Handling Equipments, Automation, Material Handling Equipments used in Ginning, Spinning, Weaving & Processing, Garment Industry.
4. **Quality management:**  
Quality as a Corporate Strategy, What is Quality?, New Quality Concepts, Quality Circles, Kaizen, Contributions of Deming, Total Quality Management, Roadmap for TQM, Implementation of TQM, ISO 9000, Kaizen, Zero defects, Six Sigma, Five “S”
5. **Production planning and control:**  
Functions of PPC, ERP, Application of PPC in Textile Industry, Forecasting Purpose and Methods, Plant capability, Monthly Production Plan, Day-wise plan, Customer order, Manpower plan, Delivery schedule, monitoring.
6. **Materials management:**  
Inventory, Relevant Costs, Economic Order Quantity, The management of supply chains, Distribution, Integration, supply chain and competitive advantage, marketing and logistics interface, principles of logistics costing, lead time management, Information Technology – A supply chain enablers, Suppliers, outsourcing, Measuring supply chain performances. Warehousing, VMI, Role of Internet in Supply chain and Outsourcing related to Textiles (B. P. O.), Theory of Constraints,
7. **Production planning in spinning and weaving:**  
Spin Plans for various Counts and Yarns, Production Rates, Waste, Efficiency level of Spinning Machines, Estimation of number of machines for the given production of yarn, Balancing of Machines. Production Rates, Efficiency etc. of Preparatory and Weaving Shed, Estimation of number of machines in Preparatory and Weaving, Preparation of Weaving Plan.
8. **Machinery maintenance:**  
Methods of machinery maintenance related to Preventive and Breakdown, MMS and Machinery Audit
9. **Mill humidification:**  
Air Conditioning, Humidification and Ventilation for a Textile Mill, Different Systems of Humidification and their efficiency, Temperature, Relative Humidity and Ventilation requirement for different Sections of a Textile Mill, Dust extraction in Textile Mills, Methods and equipments used in dust extraction

**10. Safety:**

Personal protective equipments, Lighting requirements and fittings, illumination standards and measurements.

**Reference Books:**

1. Production and Operations Management – IInd Edition by S. N. Chary, published by Tata McGraw Hill
2. Production and Operation Management by N. G. Nair, published by Tata McGraw Hill
3. Production and Operation Management: Manufacturing and Services, VIII<sup>th</sup> Edition by Chase, Aquilano and Jacobs, published by Irwin McGraw Hill
4. Operations Management: Strategy and Analysis, Vth Edition by Lee J Krajewski, Ritzman, P. Larry, published by Addison Wesley Publishing Co., Inc.
5. Humidification in Textile Mills, Textile Engineering Tablet II by S. P. Patel, published by ATIRA, Ahmedabad
6. Modern Textile Management by J. B. Rattan, Abhishek Publications, Chandigarh
7. Textile Manufacturing by M. G. Kulkarni
8. Production Planning & Inventory Control, Narasimhan, Mcleavey, Billington,

**PRJ-TT404: Mini Project**  
**(L0-T2-P4): 4 Credit**

**Course Objectives:**

1. To help students to work in a team for a common goal
2. To help students to start to think some research oriented work
3. To help students to find out a research problem
4. To help students to plan and execute literature survey for a definite problem

**Course Outcomes:**

- CO1 Students should learn to work as an individual & in a team efficiently.
- CO2 Students should learn to design & develop solutions for engineering problems.
- CO3 Students should learn to use research based knowledge and methods for analyzing & synthesis of engineering problems.
- CO4 Students should learn to manage a project by utilizing different tools and knowledge.

**Course Articulation Matrix:**

Program Outcome (PO)→	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Course Outcome (CO)↓												
CO1	3	3	1	1					3			2
CO2	3	3	1	1					3			2
CO3	2	1	1						1			1
CO4	2	1							1			1

**Course Content:**

Every student will be allotted a project work (in a group) under a supervisor(s) at the beginning of 1st term of Final Year B. Tech. Every group is supposed to finalize the project work in consultation with the project supervisor(s). They have to complete the review of literature, plan

the experimental work and should initiate the actual project work in this semester. At the end of the semester, each student (in the group) should present his/her work along with hard bound copy before the panel of examiners as a part of examination. 50% marks will be awarded by the supervisor and remaining 50% by the other examiners. The evaluation will be done on the basis of completion of the above mentioned activities, presentation and viva-voce performance.

### Elective Courses:

**\*\*Structure A: Elective III (any one)**

**#Structure B: Elective III, and IV (if not already opted for Elective III, otherwise only Elective IV)**

## PEC-TT405: Statistical Process Control in Spinning (L3-T0-P2): 4 Credit

### Course Objectives:

1. Students will learn the fundamentals of Statistics, its application and the use of statistical tools for process control in general.
2. This course will make students learn particularly about the steps, methods and overall controlling of spinning process.
3. After completing this course students will have adequate theoretical and practical knowledge to be able to detect and solve problems (trouble- shooting) encountered during spinning process in a factory

### Course Outcomes:

- CO1 Students will learn the fundamentals of Statistics, the use of basic statistical tools for making inferences and its applications.
- CO2 This course will highlight an in-depth and critical analysis of overall controlling of spun yarn manufacturing process.
- CO3 This course will enable students to exercise controls over the process of yarn manufacturing and the quality aspects for spun yarns.
- CO4 This course will enable students to conduct experiments, analyze and evaluate spun yarns.
- CO5 After completing this course along with other prerequisites, students will be competent enough to handle the process of yarn manufacturing of a factory and to detect and solve problems related to it.

### Course Articulation Matrix:

Program Outcome (PO)→ Course Outcome (CO)↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2			2							2
CO2	2	2			2							2
CO3	3	3	3	2	2							1
CO4	3	3	3	2								
CO5	3	3	2									

### Course Content:

1. Collection of data, Representation of data, Frequency distribution, Mean and Standard Deviation
2. Use of standard deviation, Random variable, Normal distribution- fundamental concepts and applications, Central Limit Theorem

3. Confidence Level and confidence interval, Interval estimation, Hypothesis testing of mean(s), proportion and variances- both small and large samples, Applications in spinning and textiles
4. Control Charts Importance and Applications
5. Concept of process control in spinning, need of it, Steps to implement process control in spinning, Fibre characteristics,
6. Control of mixing cost and quality-Linear programming method
7. Control of waste and cleaning in blowroom, carding and comber technological considerations and norms
8. Snap study and end-breakage study in ring spinning
9. Control of yarn quality, Causes and control of within and between bobbin variations, Methods of routine checking, Controlling count CV%
10. Causes and control of yarn strength variation
11. Causes and control of mass variations and imperfections in yarns, Uster spectrograph and periodic faults and their analysis & Uster diagram-analysis: application in spinning process
12. Yarn realization and control, Productivity and means to improve it
13. Yarn faults and package defects
14. Machinery audit, Machine conditions and yarn quality, Instruments for machinery audit

**Practical:**

1. Prepare a yarn of given count with a given twist multiplier from a given roving hank. Make the necessary arrangements in the ring frame for the required draft and twist.
2. Prepare another yarn sample of same count and twist multiplier but with only one change in process parameter (say different front top roller pressure or spacer) from a given roving hank. Test the single yarn strength of the above two samples. Take at least 30 readings for each type of yarns. Find the means and standard deviations of the two sets of readings. Perform the significance testing of the mean yarn strengths. Is there any significant difference between the yarn strengths at 5% significance level?
3. Introduce a periodic fault in any one of the above-mentioned yarns/ Detect a periodic fault from a given yarn. Using Evenness tester, generate the spectrogram of the same yarn and find out the wave length of the fault. Also correlate it from the known source.
4. Test the yarn CV%<sub>s</sub> in Evenness tester for the original yarn as well as the yarn with deliberately introduced periodic fault. Take 5 readings for each type of yarns. Find the means and standard deviations of the two sets of readings. Perform the significance testing of the mean yarn mass variation. Is there any significant mass variation between the two yarns at 5% significance level?
5. Perform the snap study in a ring spinning shed. Find the snap efficiency.
6. Perform the end-breakage study in a ring spinning shed. Find the end breakage rate.
7. Find the within and between bobbin variations of yarn samples taken from a ring frame. Give your comments.

**Reference Books:**

1. Statistics for Engineers by Irwin R. Miller, John E. Friend and Richard Johnson, Prentice Hall of India Pvt. Ltd.
2. Practical Statistics for the Textile Industry: Part I by GAV Leaf, The Textile Institute
3. Practical Statistics for the Textile Industry: Part II by GAV Leaf, The Textile Institute
4. Principles of Textile Testing by J. E. Booth, Butterworth Co.
5. Process Control in Spinning by A. R. Garde and T. A. Subramaniam, Ahmedabad Textile Research Association
6. Handbook of Textile Testing and Quality Control by E. B. Grover and D. S. Hamby, Wiley Eastern Limited
7. Evenness Testing in Yarn production Part I by R. Furter, The Textile Institute

**PEC-TT406: Smart Textiles****(L4-T0-P0): 4 Credit****Course Objectives:**

1. This course deals with the introduction to smart textiles and understand how it is different from the normal textiles
2. Students will learn about the use of electrically active polymers, thermally sensitive textiles, polymeric membranes and fibre gratings used in smart textiles
3. Students will get exposure in the design technology, standardization of smart clothing and evaluation of wearable computing
4. Students will learn about the bioprocessing of textiles using natural fibres, enzymes and application of plasma technology for the textile processing
5. Students will elaborately learn about the smart textiles used in medical applications such as biomedical applications, drug release textiles, textile sensors used in health care, tissue engineering, scaffolds, nanofibers in electrospinning, shape memory materials etc.

**Course Outcomes:**

- CO1 Students can learn and remember about the smart textiles and how it is different from conventional textiles
- CO2 Student can understand the need for smart textiles and the difference between active and passive smart textiles
- CO3 Students can apply the knowledge of electrically active polymers and thermally sensitive textiles to develop smart textiles
- CO4 This course can enable the students to analyze the various fibres, polymers used in the development of smart textiles
- CO5 Students can be able to evaluate the smart textiles through the learning of various methods, standardization, evaluation used for the developing smart textiles
- CO6 Students can be competent enough to design and develop the smart textile through the interdisciplinary knowledge obtained from this course.

**Course Articulation Matrix:**

Program Outcome (PO)→ Course Outcome (CO)↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2					1		2	1	1	2
CO2	3	2					1		2	1	1	2
CO3	3	2					1		2	1	1	2
CO4	3	2					1		2	1	1	2
CO5	3	2					1		2	1	1	2
CO6	3	2	3				1		2	1	1	2

**Course Content:**

1. **Introduction to smart textiles:** Need of smart textiles, difference between passive, smart and active smart textiles, human aspects, technology aspects, applications.
2. **Electrically active polymers and thermally sensitive textiles:** Polymer gel as actuators, non-ionic polymer gel, applications, electroactive elastomer. Basics of heat storage, manufacture of thermally sensitive fibers and clothing by using phase change materials etc., properties
3. **Polymeric membranes and Fiber Bragg gratings:** Polyvinyl alcohol (PVA) and poly (acrylamide-co-butyl-methacrylate) (PAAc) network, polymers prepared by plasma and radiation grafting, polymers for gas separation. Fabrication of grating, mechanical properties,

optical response under various deformations, polymeric optical fibers, integration of optical fibers in textiles, applications.

4. **Designing Technology for smart clothing:** Design process for smart clothing, wearable motherboard manufacture, properties and applications like snow clothing, army uniforms.
5. **Bioprocessing and plasma technology:** Drawbacks in conventional textile processing, enzyme technology, enzymes used, bioprocessing of natural fibers like wool, cotton and silk, synthetic fibers like polyesters and polyamides. Plasma technology: Basics of plasma, plasma applications for textile processing and altering surface characteristics.
6. **Medical textiles:** Polymers for biomedical applications, drug release textiles, textile sensors for healthcare, applications for children and patients. Tissue engineering: Ideal scaffold system, scaffold materials, scaffold making, use of embroidery and its applications, nanofibers by electrospinning. Shape memory materials: Polymers and gel, effect of temperature, applications in biomedical field.
7. **Standardization for smart clothing technology:** Methods, effects of standardization, evaluation for wearable computing.

### Reference Books:

1. Smart fibers, fabrics and clothing, Edited by Xiaomiag Tao, The Textile Institute, published by Woodhead publishing Ltd.
2. Textiles for protection Edited by Richard A. Scott, The Textile Institute, published by Woodhead publishing Ltd.
3. Smart clothing technology and applications, Edited by Gilsoo Cho, published by CRC press
4. Intelligent textiles and clothing, Edited by H. R. Mattila, published by Woodhead publishing Ltd.
5. Smart textiles for medicine and healthcare Edited by L. Van Langenhove, published by Woodhead publishing Ltd.
6. Bioprocessing of textiles Edited by C. Vigneswaran M. Ananthasubramanian and P. Kandhavadi, published by Woodhead publishing Ltd.
7. Medical textiles and biomaterials for healthcare Edited by S. C. Anand, J. F. Kennedy, M. Miraftab and S. Rajendran, published by Woodhead publishing Ltd.
8. Nanofibers and nanotechnology in textiles Edited by P. J. Brown and K. Stevens, published by Woodhead publishing Ltd.
9. Plasma technologies for textile and apparel, Edited by S. K. Nema and P. B. Jhala, published by Woodhead publishing Ltd.
10. Smart textiles and their applications, Edited by Vladan Koncar, published by Woodhead publishing Ltd.
11. Handbook of smart textiles, Edited by Xiaomiag Tao, published by Springer

## PEC-TT407: Merchandizing and Supply Chain Management

(L4-T0-P0): 4 Credit

### Course Objectives:

At the beginning of the course, student will understand the concept of:

1. To elucidate the management of the Garment business
2. To illustrate the fashion marketing and merchandising process.
3. To depict Retailing and Global Sourcing Strategies, Supply Chain and demand chain analysis
4. To make a distinction between principle and supplementary documents.

**Course Outcomes:**

At the end of the course students will be able to

CO1 Give details of the organization of the Garment business

CO2 Illustrate the Fashion marketing and merchandising process.

CO3 Express retailing and Global Sourcing Strategies, Supply Chain and demand chain analysis

CO4 Decide between principle and supplementary documents.

**Course Articulation Matrix:**

Program Outcome (PO)→ Course Outcome (CO)↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2						2			
CO2	3	2	1						2			
CO3	2	1							1			
CO4	2	1							1			

**Course Content:**

1. Introduction to Garment industry: Apparel supply chain. The Garment manufacturing process- Apparel production process flow, order booking, pre-production meeting, production planning and control, cutting, sewing, finishing, quality control, printing process, embroidery process, sub-contracting work. Various sections of garment division- marketing, designing, merchandising, patternmaking, sampling, fabric & trim store, testing, cutting, sewing, finishing, industrial engineering, maintenance, quality control, account, human resource, electronic data processing.
2. Promotion: Fashion marketing, size and structure of fashion market, marketing evolution, selling vs marketing, marketing environment, marketing research, marketing objectives and strategies, marketing mix, fashion marketing planning, fashion market sourcing, domestic, export manufacturing, retailers/wholesalers/co-operative, buying agencies/offices, direct exporting.
3. Merchandising: Definition of Merchandising and role of Merchandiser: Definition and role of merchandiser, Buying indication, Market structure in export markets Design buying influences. Merchandising Plan: Market planning process, merchandising plan, merchandising calendar plan (ladder), Elements in a merchandise line and the planning process, Product Development, CAD for apparel
4. Merchandising and Range Development: Fashion forecast for Europe and USA, elements of design, Interpretation of forecast for brands in color, silhouette and fabrics. General range development and specific buyer range developments, Colors: International interpretation of colors
5. Apparel Fabrics: International textile and apparel trade, Global scenario. Technical and design specification to buy fabrics, fabric scouring for export markets, Trims and embellishment scouring
6. Market Research: Buyer behaviour, apparel brand management, advertising & promotion, Retail management Pricing, Approaches for global markets: Effect on Global Economy Analysis of effect of international production and distribution of textiles and apparel goods on the global economy, Cost-plus and backward pricing, Elements of cost plus approach & cost sheet, Merchandise line pricing

7. Out sourcing: Need, Resource Planning – Global Sourcing Strategies, Supply Chain and demand chain analysis, Supply chain management and its importance. JIT technology, Buying house –Its function and role in garment industry.
8. Export records: Types of export papers, pre-shipment & post -shipment certification, Terms of sale, payment, shipment etc. Export incentives: Duty drawback, DEPB, I / E license - exchange control regulation – (FEMA) foreign exchange management acts - export management risk - export finance.

### Reference Books:

1. Fashion Buying, Elaine Stone.
2. Principles of Fashion Merchandising, Sidney Packard
3. Marketing Management by Philip Kotler. 15th edition Pearson Education. ISBN: 978-9332557185
4. Cooklin's Garment Technology for Fashion Designers, 2nd Edition by Gerry Cooklin, Steven Hayes, John McLoughlin, Dorothy Fairclough, Blackwell Publications, ISBN: 978-1-4051-9974-2
5. Garment Manufacturing: Processes, Practices and Technology by Prasanta Sarkar, Online Clothing Study. ISBN: 978-9383701759
6. Fashion Buying by Elaine Stone. McGraw-Hill In publication ISBN: 978- 0070617469
7. Apparel Merchandising by kumar .Abhishek Publications, ISBN: 978- 8182473010
8. Fashion Marketing by Mike Easey .john Wiley & Sons publication. ISBN: 978- 0632034598

## HMC471: Employability Skills

(L4-T0-P0): 4 Credit

### Course Objectives:

1. Students will learn the fundamentals of mathematics, verbal & nonverbal reasoning and English to get prepared to face campus written exams
2. This course will enable the students to solve the data interpretation in a very short span of time through the learning of speed math's and quantitative aptitude.
3. This course will enable the students to build their vocabulary, enrich the grammar, so that students will be able to read, write, speak English fluently
4. Students will understand and become effective in oral and written communication to confidently speak during the group discussion and also during the letter and essay writing respectively
5. This course will enable the students to acquire better reasoning abilities, cognitive and problem-solving skills through the practice of verbal and nonverbal reasoning questions

### Course Outcomes:

- CO1 Students will be able to learn and remember the basics of mathematics learned during schools to solve the numerical and mathematical calculations in campus written exams
- CO2 Students will understand the different verbal and nonverbal reasoning concepts to acquire reasoning skills which help them to think critically for problem solving
- CO3 Students will be able to apply the knowledge of maths to interpret data in various forms such as bar, pie, graphs to solve numerical in data interpretation
- CO4 This course will enable the students to analyze the long passages in reading comprehension and make them to answer the questions in a short time
- CO5 Students will be able to evaluate the statements in data sufficiency and will be able to solve the questions
- CO6 The knowledge obtained from this course will enable the students to clear the campus interview written tests and other competitive exams for the employment



**Course Articulation Matrix:**

Program Outcome (PO)→ Course Outcome (CO)↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2									2
CO2	2	2	2									2
CO3	3	2	1									
CO4	3	3	1									
CO5	3	3										
CO6	3	3										

**Course Content:**

1. Quantitative aptitude: Speed maths, Number systems, Ratio proportion and variations, Profit and loss, Partnerships, Simple Interest, Compound Interest, Boats and streams, Average mixtures and allegations, Speed, Time and work, Time and distance, Work and wages, Geometry and mensuration, LCM and HCF, Percentages, Arithmetic and geometric progressions, Pipes and cisterns, Problems on train, Sets and venn diagrams, Algebra, Problems on age, Permutation and combination, Probability, Coordinate geometry, Inequalities, Functions, Logarithm, Quadratic equations, Surds indices and dies.
2. Verbal reasoning Mental ability: Analogy, Classification, Series completion, Coding-decoding, Blood relations, Puzzle test, Sequential output racing, Direction sense test, Logical venn diagrams, Alphabet test, Number ranking & time sequence test, Mathematical operations, Logical sequence of words, Arithmetical reasoning, Inserting the missing character, Data sufficiency, Decision making, Assertion and reason, Situation reaction test, Verification of truth of statement, Data interpretation – table charts, graphs, pie charts, bar graphs, line graphs, caselets, combined data sets. Logical reasoning: Logic, Statements – arguments, Statements – assumptions, Statements – courses of action, Statements – conclusions, Deriving conclusions from passages, Theme detection, Question-Statements, Miscellaneous statements.
3. Nonverbal reasoning Series, Analogy, Classification, Analytical reasoning, Mirror images, Water images, Embedded figures, Completion of incomplete pattern, Figure matrix, Paper folding, Paper cutting, Rule detection, Group of identical figures, Cubes and dice, Dot detection, Construction of squares and triangles, Figure formation & analysis.
4. Verbal ability and reading comprehension Fill in the blanks, Verbal reasoning, Sentence completion, Grammar, Syllogisms, Jumbled paragraphs, Parts of speech, Phrases modifiers, Para completion and inference, Subject-verb agreement, Foreign language words in English, Reading comprehension, Analogies, Sentence correction, Preposition, Errors in tenses, Verbal logic, Para jumbles, Parajumbles, Different usage of the same word, Idioms and phrases, Synonyms, Antonyms, One word substitution, Types of clauses, Articles usages, Letter writing, Essay writing.
5. Group discussion Definition of group discussion (G.D), difference between debate and group discussion, Main areas of evaluation of G.D – Subject knowledge, oral communication skills, listening skills, clarity of thought and expression, apt language, proper nonverbal clues, team behaviour, leadership skills and team management. Advantages of G.D, Roles in a structured G.D, Expectation of the panel, Phases In G.D, Dos and Don'ts in G.D.

**Note:** For subject knowledge, students must equip themselves by reading daily newspapers, good magazines, national and international journals, watch news bulletins and informative programmes on the television and internet.

**Reference Books:**

1. Mathematics books set from 6<sup>th</sup> to 10<sup>th</sup> by National Council of Education Research and Training (NCERT), SchoolWaale Publishers, Edition:2019
2. Quantitative Aptitude for Competitive Examinations by R.S. Aggarwal, S. Chand Publishing New Delhi, ISBN: 9789352534029, 9789352534029, Edition: Revised & Enlarged Edition, 2020
3. A Modern Approach to Verbal & Non-Verbal Reasoning by R.S. Aggarwal, S Chand Publishing New Delhi, ISBN: 9789352832163, Edition: 2020.
4. Word Power Made Easy by Norman Lewis, Penguin Publishers, ISBN: 9780143424680, Edition: 2015
5. High School English Grammar and Composition by P. C. Wren and H. Martin Revised by Dr. N.D.V Prasada Rao, S. Chand & Company Pvt. Ltd publishers, New Delhi, ISBN: 9789352530083, 935253008X, Edition:2015
6. Aptipedia Aptitude Encyclopedia by Wiley Publishers, ISBN: 9788126569502, 8126569506, Second Edition: 2017

**Semester II (Structure-A)****PRJ-TT410: Project Work\*****(L0-T2-P12): 8 Credit****Course Objectives:**

1. To help students to work in a team for a common goal
2. To help students to start to think some research-oriented work
3. To help students to find out a research problem
4. To help students to plan and execute literature survey for a definite problem

**Course Outcomes:**

- CO1 Students should learn to work as an individual & in a team efficiently.
- CO2 Students should learn to design & develop solutions for engineering problems.
- CO3 Students should learn to use research-based knowledge and methods for analysing & synthesis of engineering problems.
- CO4 Students should learn to manage a project by utilizing different tools and knowledge.

**Course Articulation Matrix:**

Program Outcome (PO)→ Course Outcome (CO)↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	1	1				2			1
CO2	2	2	1	1	1				2			1
CO3	3	3	3	3					3			3
CO4	3	3	3	3					3			3

**Course Content:**

1. Project A is preferably the continuation of the Mini Project. The project which is undertaken by a group of students (generally a group consists of 3-4 students) shall be completed within this semester. A student (in a group) is expected to perform his/ her project work in the institute along with other course works. However he/ she may be permitted to carry out a part of project work in an industry/ research organization, if required.
2. Every group is required to present their work in front of a panel of examiners once internally as mid-term examination and next in presence of an external examiner during the end-term examination. A hard bound copy of report containing the project work is to be submitted (in the prescribed format) at the time of end term examination.

- The marks will be awarded by supervisor(s) and internal / external examiners in equal proportions. The evaluation by internal and external examinations will be based on the basis of merit of project selection, quality of work, content of report, presentation of project work and performance in viva-voce.

### **SEM-TT411: Seminar** **(L0-T2-P0): 2 Credit**

#### **Course Objectives:**

- To improve the managerial, communication and leadership skills.
- To give exposure to students about latest technological updates.
- To prepare for independent and life-long learning in the context of technological change.

#### **Course Outcomes:**

- CO1 Students will be efficient in communicating engineering problems.
- CO2 Students should feel confident to work effectively as an individual, and as a leader in diverse teams, and in multidisciplinary settings.
- CO3 Students will learn to review the literature of latest issues and prepare a report for presentation.

#### **Course Articulation Matrix:**

Program Outcome (PO)→ Course Outcome (CO)↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3				2			2			1
CO2	3	3				2			2			2
CO3	3	2				1			2			2

#### **Course Content:**

- Seminar should be based on the literature survey on any topic relevant to Textile Technology. Each student has to prepare a write up of about 15-20 pages of “A4” size sheets and submit it in duplicate as the term work. The student has to deliver a seminar talk in front of the faculty members of the department during mid and semester. The faculty members based on the quality of the report, preparation, understanding of related topic and performance in viva-voce shall do an assessment of the seminar internally – jointly.

### **SII-TT412: Winter/Summer Internship<sup>\$</sup>** **(L0-T0-P4): 2 Credit**

#### **Course Objectives:**

- To give a exposure to students about technological & managerial aspects
- To enhance the analytical and logical skills based on basic textile engineering knowledge
- To improve the managerial, communication and leadership skills.
- To prepare the mindset of the students to work in the industry

#### **Course Outcomes:**

- CO1 Students will be efficient in communicating engineering problems.
- CO2 Students will be able to correlate theory with practice
- CO3 Students will be able to experiment with machines and process parameters.
- CO4 Students will be gradually feel confident to handle the actual real life factory problems.

**Course Articulation Matrix:**

Program Outcome (PO)→ Course Outcome (CO)↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2				2	1		2			1
CO2	2	2				2	1		2			1
CO3	3	3				1			1			1
CO4	3	3				1			1			1

**Course Content:**

1. Every Final year student must undergo 2 weeks' internship program in the break between third year and final year or between two semesters of final year, but evaluation will be done during second semester of final year.
2. A bound hard copy of report containing the work done during the internship program must be submitted. The work also needs to be presented in front of examiner (s) during the semester or may need appear in viva-voce examination or both as per requirements.

**Elective Courses:**

**PEC-TT413: Technical Textiles-II**  
(L4-T0-P0): 4 Credit

**Course Objectives:**

1. This course deals with different application areas of technical textiles such as heat and flame protection, chemical protective clothing, mechanical protective clothing, safety and protective textiles, medical textiles, sport textiles and comfort properties of textiles.
2. This course will enable the students to learn the different types of fibres, fabrics and manufacturing methods, processes used to develop technical textiles
3. Students will understand and experiment on various processes and test methods used in the technical textiles
4. Students will acquire the core knowledge of technical textiles to serve industry.

**Course Outcomes:**

- CO1 Students will learn and remember the fundamental science of technical textiles.
- CO2 Students will be able to understand the mechanism of flame retardancy, chemical protection, ballistic protection, electrostatic protection etc
- CO3 Students can apply the knowledge of manufacturing process and testing of technical textiles practically when they are employed in the technical textile industries
- CO4 This course will enable the students to analyze the fibres, yarns, fabrics and manufacturing methods used for the development of technical textiles
- CO5 Students will be able to test and evaluate the performance of technical textiles
- CO6 This course will enable the students to design different technical textile products such as flame-retardant fabrics, chemical protective clothing, sports clothing, medical textiles etc to become a professional technical textile engineer.

**Course Articulation Matrix:**

Program Outcome (PO)→ Course Outcome (CO)↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3						1		1	1		2
CO2	3	2					1		1	1		2
CO3	3	2					1		1	1		2
CO4	3	2					1		1	1		2
CO5	3	2					1		1	1		2
CO6	3	2	3				1		1	1		2

**Course Content:****1. Heat and flame protection:**

Introduction, Thermal behavior of fibres, LOI, Different high temperature fibres including inorganic fibres, fire retardant finishes for cellulose, polyester, wool and their blends. Fire fighter's protective clothing, Military flame-retardant, heat protective textiles, military flame and heat threat, criteria for protection of individual, toxic fumes and smoke, thermoplastic melt hazards.

**2. Chemical protective clothing:**

Introduction, chemical hazards, Different types of protective materials, components of chemical protective garments, levels of protection, chemical protective clothing materials, protection from liquid, toxic fumes and gases, Performance evaluation of chemical protective clothing, chemical, biological and radiation hazards and their prevention.

**3. Mechanical protective clothing and military textiles:**

Introduction, materials used, gloves, chain saw clothing, Physical requirements for military textiles, underwear materials, thermal insulation, water vapour permeable/waterproof materials, camouflage textiles, Bullet proof fabrics principles, mechanics of ballistic impact, textile materials used for ballistic protection, design of ballistic vests and helmets, ballistic testing and evaluation.

**4. Safety and Protective Textiles:**

Electrostatic protection, clean room textiles, radiation protection, protection from cold, high visibility textiles, metalized fabrics, Protective clothing for space.

**5. Medical textiles:**

Introduction, textile materials used-category wise, fibre used, wound care, bandages, extracorporeal devices, implantable materials, sutures, soft tissue implants, orthopedic implants, cardiovascular implants, healthcare and hygiene products.

**6. Textiles in sports:**

Introduction, fibres and fabrics used, types of sportswear, functional requirements, application in performance sportswear, biomimicry. Functional fit of sport footwear, biomechanics of the foot, functional materials and components in sport footwear.

**7. Comfort properties of textiles:**

Introduction to water proof breathable (W.P.B) fabrics, Types of W.P.B fabrics, coatings, biomimetics, assessment techniques, performance of water proof breathable fabrics.

**Reference Books:**

1. A. R. Horrocks & S. C. Anand, Handbook of technical textiles, The Textile Institute, Wood Head Publication Ltd., 2007

2. R. Alagirusami and A. Das, Technical Textile yarns, The Textile Institute, Wood Head Publication Ltd., 2010
3. Handbook of Industrial Textiles by Sabit Adanur, Technomic Publishing Co. INC, Wellington Sears Lancaster, Basel, 1995
4. Industrial Applications of Textile by R. S. Goy & J. A. Jenkins, Textile progress, 1970, March Vol. II No.1
5. Industrial Applications of Textiles by K. L. Floyd & H. M. Taylor, Textile progress, 1970, Vol.VI, No.2
6. High performance fibres by P. Bajaj and A. K. Sengupta, The Textile Institute
7. Textiles in Sports by R Shishoo, Wood Head Publications, The Textile Institute, 2005

## PEC-TT414: Process Control in Weaving (L3-T0-P2): 4 Credit

### Course Objectives:

1. To provide a complete knowledge on entire weaving preparatory and weaving process.
2. Motivate the students to learn about the actual industrial methods and control systems of weaving process.
3. To encounter a real problem with sufficient theoretical knowledge.

### Course Outcomes:

- CO1 Student will able to apply knowledge to control weaving process.
- CO2 Student will able to perform quality control studies independently.
- CO3 Student will able to identify, formulate and solve process problems.
- CO4 Student will able to use tools necessary for textile manufacturing practices

### Course Articulation Matrix:

Program Outcome (PO)→ Course Outcome (CO)↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1						1			
CO2	3	3	1						1			
CO3	2	2	1									
CO4	2	2	1									

### Course Content:

1. Introduction: Scopes of process control, approach to process control, setting norms and schedule of checks, machinery audit
2. Winding: Scopes, approach, knotting, splicing, package faults and its causes, yarn clearing, tension variations causes & remedies, control of tension in automatic winders, antipatterning devices, uniform build of a package, winding parameters & their effect on yarn quality, recording of yarn breaks in winding, production and efficiency calculations, production records, control of hard waste
3. Warping: Approach to process control, minimize end breaks in warping, uniformity of yarn tension across the warp sheet, quality of warping beam, production and efficiency calculations, control of hard waste
4. Sizing: Scope, approach to process control, preparation of standard recipe, control of sizing

parameters and conditions, quality of sized beam, control of productivity, production and efficiency calculations, control of waste in sizing

5. Weft winding: Minimizing end breaks, productivity, hard waste, production calculations
6. Loom shed: Scopes, control of loom speed, control of loom efficiency, factors affecting loom efficiency, stops due to end breaks & their control, Stops due to weft breaks, end breakage study, snap study, productions calculations, control of waste in weaving, fabric defects & remedies, Management of loom shed

**Practical:**

1. Measurement of winding tension on different winding machine
2. Warp breakage study on winding machine
3. Calculation of the machine efficiency and operative efficiency of a given winding machine
4. Warp breakage study on warping machine
5. Calculation of machine efficiency and operative efficiency on warping machine
6. Preparation of a good quality pirn with different package characteristics
7. Study of end breaks and stops in loomshed
8. Snap study for determination of loom efficiency
9. Preparation of a project report of a loomshed

**Reference Books:**

1. Process Control in Weaving by ATIRA
2. BTRA Monograph series in Warping Winding & Sizing, Bombay Textile Research Association, Edited by S. M. Betrabet, 1986
3. Weaving machines, mechanisms, management by M. K. Talukdar, P. K. Sriramulu and D. B. Ajgaonkar

**PEC-TT415: Textile Finishing**  
**(L3-T0-P2): 4 Credit**

**Course Objectives:**

1. At the beginning of the course, student will understand the concept of:
2. To educate basic knowledge of procedures, machinery & chemistry of different finishing of textile materials.
3. To educate basic science & technology of woolen fabric finishing.
4. To expose different machineries involved for finishing of textiles.

**Course Outcomes:**

- CO1 Student developed understanding of engineering knowledge in different finishing operation & technology for textile fabrics.
- CO2 Student developed understanding of problem analysis skills in identifying different types of finishes applied in textile & their quality evaluation.
- CO3 Student developed understanding of modern tools & machines required for different finishes application in fabrics.
- CO4 Students developed understanding to work as individual & team work through conducting different individual & group assignment & practical job work.
- CO5 Students developed understanding in effective communication through repeated written and oral test & assignment of the subject

**Course Articulation Matrix:**

Program Outcome (PO)→ Course Outcome (CO)↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2		2							1
CO2	3	3	2									1
CO3	2	2			2							
CO4	2	2										
CO5	2											

**Course Content:****1. Introduction to Finishes:**

Purpose of finishing, Types of Finishing- Temporary, semi-permanent, Permanent, mechanical & chemical.

**2. Finishing machinery & developments:**

Different types of Padding Mangle, Pad-dry-cure system. Calculations related to add-on %, pick-up% & concentration% of chemicals. Different types of applicators and their function. Different types of drying machines, Tenter frames & functions. Coaters & Coating machine. Other latest trends in finishing machines.

**3. Finishing of cotton synthetics and blended fabrics:**

Raising & Shearing, Sanforizing, Anticrease, Wash & Wear and Durable Press Finish, Perchmentising, Hand building, Softening and Stiffening, Delustering, Optical Whitening, Water repellent, Water Proofing, Flame Proofing finishes, Anti Pilling, Anti-Static and Soil Release Finish, U.V Protection finish, Antimicrobial Finishes, Denim Finishes, BioFinish, Fragrance Finish, Coated textiles. Latest trends in Finishing.

**4. Finishing of Woollen/Worsted fabrics:**

Setting & Decatising, Milling and Shrink Proofing of Wool, Mildew Proofing, Rot Proofing & Moth Proofing.

**Practical:**

1. Fabric resin treatment
2. Fabric starch/PVA treatment
3. Coating of fabric with suitable materials
4. Carbonisation/Perchmentisation of cotton fabrics
5. Antipilling treatment of P/C blended fabric
6. Fabric flame retardant treatment

**Reference Books:**

1. Chemical finishing of Textiles by Prof. Wolfgang D. Schindler & Prof. Peter J. Hauser, Woodhead Publishing Ltd. in association with The Textile Institute, England, 2004
2. Textile Finishing by R. S. Prayag
3. Technology of Textile Finishing, Vol. X, by Dr. V. A. Shenai, Sevak Publishers, Mumbai
4. Chemistry & Technology of Fabric Preparation & Finishing, by Tomasino Charles, North Carolina State University, 1992
5. Dyeing and Chemical Technology of Textile Fibres by E. R. Trotman



**PEC-TT416: Economics and Business Law****(L4-T0-P0): 4 Credit****Course Objectives:**

At the beginning of the course, student will understand:

1. Sectors of Indian Textiles and Clothing Industry
2. Understanding about raw material, production and import & export of textiles
3. Details of different Central and state government schemes & investments
4. Industrial Relations, Acts and Entrepreneurship

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

- CO1 Do SWOT analysis of Indian textile industry  
 CO2 Updating knowledge related to raw material, production, import & export etc.  
 CO3 Apply concepts related to Government schemes & policies  
 CO4 Write Concept of Industrial Relations, Acts and Entrepreneurship

**Course Articulation Matrix:**

Program Outcome (PO)→ Course Outcome (CO)↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		3	2			1						1
CO2		1	1									1
CO3		1	1							1	1	1
CO4		1	1			1		2	2			1
CO5		3	2			1						1

**Course Content:**

1. The Structure of Textiles and Clothing Industries: Mill sector, spinning sector, weaving sector, made-ups, processing activity, knitted and crocheted products, technical textiles, manufacture of wearing apparel, textile machine manufacturers, synthetic industry, wool, silk, jute, power loom, handloom sector
2. Raw material production: Natural and synthetic fibres, yarn, fabrics, made ups, varieties, cost, availability
3. Production of textiles & clothing in industry sector: Production trends in all sectors, installed capacity, capacity utilization
4. Exports and Import of Textiles and Clothing: Exports and import of fibre, yarn, fabric, garments, made up, technical textiles from India to the rest of the world, import of all above products by India from world, trends in import & export
5. Domestic Demand Pattern of Textiles and Clothing: Trends in consumption, expenditure and price, retailing, value chain analysis
6. Schemes and investments: Investment pattern, foreign direct investment, different government policies, SWOT analysis of India's textile & clothing industry, Textiles Research Associations (TRAs), educational institutes, job opportunities in government & private sector
7. Industrial relations & Acts : Definitions & objectives of industrial relation, charge procedure, punishment & appeal, collective bargaining, employee grievances -nature, grievance handling procedure, workers participation in management, Industrial Disputes Act 1947, The Factories Act 1948, The Wages Act 1956, The Minimum Wages Act 1948, Workmen's Compensation Act 1923, The Gratuity Act 1972

8. Prospectives on entrepreneurship, elements, types of entrepreneurship, entrepreneurial behaviors, psychological makeup, entrepreneurship training and education, resources and finance, predictors of success, success stories.

### Reference Books:

1. Bedi, D. S. (2009), "Assessing the Prospectus of India's Textile and Clothing Sector", Ministry of Textiles, Government of India, available at: <http://texmin.nic.in>
2. Ministry of Textiles, Annual Reports, Government of India, available at: <http://texmin.nic.in>
3. Compendium of Schemes, Ministry Of Textiles, Government Of India, <http://texmin.nic.inz>
4. Labour & Industrial Law by S. K. Mishra
5. Industrial & Business Management by Martand T. Telsang
6. Winkipedia.org

## Semester II (Structure-B)

**PRJ-TT417: Project Work – B#:**  
**(L0-T2-P24): Credit**

### Course Objectives:

1. To help students to work in a team for a common goal
2. To help students to start to think some research oriented work
3. To help students to find out a research problem
4. To help students to plan and execute literature survey for a definite problem

### Course Outcomes:

- CO1 Students should learn to work as an individual & in a team efficiently.
- CO2 Students should learn to design & develop solutions for engineering problems.
- CO3 Students should learn to use research based knowledge and methods for analyzing & synthesis of engineering problems.
- CO4 Students should learn to manage a project by utilizing different tools and knowledge.

### Course Articulation Matrix:

Program Outcome (PO)→ Course Outcome (CO)↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	1	1				2			1
CO2	2	2	1	1	1				2			1
CO3	3	3	3	3					3			3
CO4	3	3	3	3					3			3

### Course Content:

1. Project B is to be performed in industry/ research organization and the student (s) is/are supposed to work there 4 months or so. A student is not required to be present during this period in the institute except at the time of mid and end term examinations. A student or group of students is/are required to find an industry where he/she/they will be allowed to undergo the project work. Similarly, a senior officer is also to be identified who is capable and ready to guide the student (s) during the project work. A faculty from the institute will also work in coordination with the assigned external officer for the project work of the student (s). The officer assigned from industry/ research organization will be treated as supervisor of the student.

- Every group is required to present their work in front of a panel of examiners once internally as mid-term examination and next in presence of an external examiner during the end-term examination. A hard bound copy of report containing the project work is to be submitted (in the prescribed format) at the time of end term examination.
- The marks will be awarded by supervisor(s) and internal / external examiners in equal proportions. The evaluation by internal and external examinations will be based on the basis of merit of project selection, quality of work, content of report, presentation of project work and performance in viva-voce.

## PCC-TT418: A Case Study

(L0-T0-P4): 2 Credit

### Course Objectives:

- To improve the managerial, communication and leadership skills.
- To give exposure to students about latest technological updates.
- To prepare for independent and life-long learning in the context of technological change.

### Course Outcomes:

- CO1 Students should experience investigations for real problems using research-based tools & knowledge.
- CO2 Students will understand the impact of the professional engineering solutions in societal and environmental contexts.
- CO3 Students will be able to analyse different factors/ variables in a system
- CO4 Students will be able to evaluate process and system

### Course Articulation Matrix:

Program Outcome (PO)→ Course Outcome (CO)↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1			2			2			1
CO2	3	3	2			2			2			2
CO3	3	2	2			1			2			2
CO4	3	3	2									

### Course Content:

Every Structure B student needs to undertake a Case Study along with Project B during stay in industry. Case study should be based on the topics relevant to textile technology in the field of fiber, yarn, fabric, garment technology and management related to area. Product development, troubleshooting problems, best practices of the organization can be studied. This is to be carried out in industry/ research organization along with Project B. A report containing 15-20 pages on “A4” size sheets is to be prepared and submitted in the department. A student is required to present the same to a faculty member/ examiners for evaluation during mid and end term examination.

## SII-TT419: Internship in Industry<sup>@</sup>

(L0-T0-P4): 2 Credit

### Course Objectives:

- To give a exposure to students about technological & managerial aspects
- To enhance the analytical and logical skills based on basic textile engineering knowledge
- To improve the managerial, communication and leadership skills.
- To prepare the mindset of the students to work in the industry

**Course Outcomes:**

- CO1 Students will be efficient in communicating engineering problems.  
 CO2 Students will be able to correlate theory with practice  
 CO3 Students will be able to experiment with machines and process parameters.

**Course Articulation Matrix:**

Program Outcome (PO)→ Course Outcome (CO)↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2				2	1		2			1
CO2	2	2				2	1		2			1
CO3	3	3				1			1			1
CO4	3	3				1			1			1

**Course Content:**

1. Every Structure B student needs to undertake Internship in Industry along with Project B and A Case Study during stay in industry. They can undergo the training in the same period of project B but evaluation will be done during mid and end semester examinations.
2. A bound hard copy of report containing the work done during the internship program must be submitted. The work also needs to be presented in front of examiner (s) during the semester or may need appear in viva-voce examination or both as per requirements.