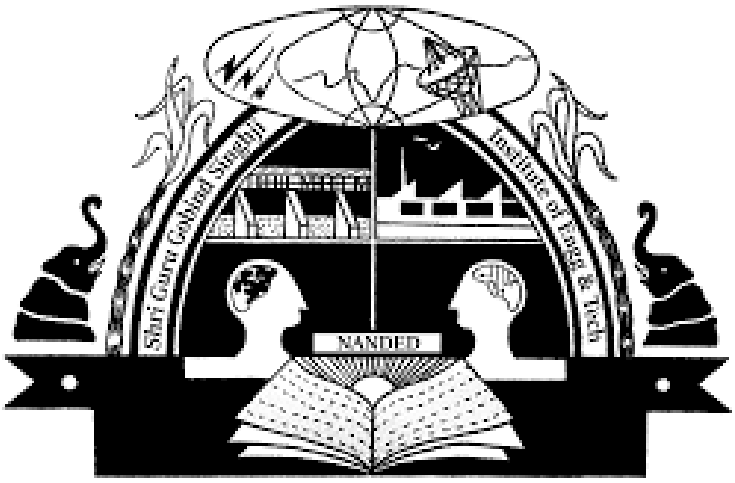
# Shri Guru Gobind Singhji Institute of Engineering & Technology, Nanded

(An Autonomous Institute of Government of Maharashtra)




## Department of Textile Technology

**Curriculum**
**Third Year B. Tech. (Textile Technology)**
**Academic year 2020-21**

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

**DEPARTMENT OF TEXTILE TECHNOLOGY**

**Curriculum Structure: T.Y. B. Tech. (Textile Technology)**
*(with effect from 2020-21)*

| **Semester I** | | | | | | |
|---|---|---|---|---|---|---|
| **Course Code** | **Name of the Course** | **L** | **T** | **P** | **Credit** | |
| | | | | | **Th** | **Pr** |
| PCC-TT301 | Spun Yarn Technology - II | 3 | -- | 2 | 3 | 1 |
| PCC-TT302 | Fabric Forming Technology - III | 3 | -- | 2 | 3 | 1 |
| PCC-TT303 | Man Made Fibres | 3 | -- | 2 | 3 | 1 |
| ESC385 | C++ and Computer Graphics | 3 | -- | 2 | 3 | 1 |
| BSC371 | Mathematics IV: Numerical and Statistical Methods | 3 | -- | -- | 3 | -- |
| | **Total** | 15 | -- | 8 | 19 | |
| **Semester II** | | | | | | |
| **Course Code** | **Name of the Course** | **L** | **T** | **P** | **Credit** | |
| | | | | | **Th** | **Pr** |
| PCC-TT304 | Spun Yarn Technology - III | 3 | -- | 2 | 3 | 1 |
| PCC-TT305 | Post Spinning and Texturing | 3 | -- | 2 | 3 | 1 |
| HMC391 | Costing and Financial Management | 3 | -- | -- | 3 | 0 |
| SII-TT306 | Winter/Summer Internship[$] | -- | -- | 2 | -- | 1 |
| *Elective Courses:*<br>**Structure A: Elective I and II (any two)*<br>*[#]Structure B: Elective I, II, and III (may opt for any three)* | | | | | | |
| PEC-TT307 | Fibres for Composites | 4 | -- | -- | 4 | 0 |
| PEC-TT308 | Theory of Textile Structures | 4 | -- | -- | 4 | 0 |
| PEC-TT309 | Garment Technology | 3 | -- | 2 | 3 | 1 |
| PEC-TT310 | Data Science with Python | 3 | -- | 2 | 3 | 1 |
| | | | | | | |
| | **Total** | 15/16/17 | -- | 6/8/10 | 20/24 | |

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

[$]Third year students may undergo internship program in the break between second year and third year or between two semesters of third year, but evaluation will be done during second semester of third year

***Structure A:** Students in this category remain in the institute for project work and other courses in **the LAST SEMESTER of FINAL year**

**[#]Structure B: Students in this category go to an industry for project work and remain there in the LAST SEMESTER of FINAL year. Thus, they will be falling short of 4 credits compared to the other category of students.** To compensate the total credit requirement**, Structure B** must take **one more Elective** either in *TY Semester II* **or** in *B Tech Semester I*.

## 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 ⬇ | Engineering knowledge | Problem analysis | Design/ development of solutions | Conduct investigations of complex problems | Modern tool usage | The engineer and society | Environment and sustainability | Ethics | Individual and team work | Communication | Project management and finance | Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (PO1) | (PO2) | (PO3) | (PO4) | (PO5) | (PO6) | (PO7) | (PO8) | (PO9) | (PO10) | (PO11) | (PO12) |
| **I.** Core Competency | √ | √ | √ | √ | √ | √ | | | √ | √ | | √ |
| **II.** Analytical Proficiency | √ | √ | √ | √ | √ | | | | √ | √ | | √ |
| **III**. Managerial Skills | | | | | | √ | √ | √ | √ | √ | √ | √ |
| **IV**. Social Skills | | | | | | √ | √ | √ | √ | √ | √ | √ |

# Semester I

## PCC-TT301: Spun Yarn Technology - II

**(L3-T0-P2): 4 Credit**

**Course Objectives:**

1. This course deals with technology and working mechanisms of Draw frame, Combing and Speed frame machines
2. Students will also learn the effect of different processes and machine parameters on sliver and roving manufacturing and their quality
3. Students will understand and experiment on various aspects of processes and their performances
4. Students will learn to design and manufacture intermediate products such as draw frame sliver, combed sliver and roving required for yarn production.

**Course Outcomes:**

CO1/ CO2 Students will learn and understand the design features and working of draw frame, comber and speed frame machines.

CO3 Students will analyze various process and machine parameters and their influence on respective output materials.

CO4 This course will make the students competent to evaluate the process and conduct experiment related to the process and its performances

CO5 This course will enable students to design and manufacture corresponding intermediate products required for yarn production.

**Course Articulation Metrix:**

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

## Course Content:

Draw frame:

1. Objects, working of draw frame, Drive of draw frame, draft and production calculation. Role of different components/ parameters in a drafting system, Concept of ideal drafting, Draft and drafting force.
2. Doubling, Law of doubling, Law of addition of irregularity, Causes and control of irregularity of a drafted textile strand, Roller lapping- cause and remedies, Close and open loop auto-levellers in draw frame.

Comber:

3. Theory of lap preparation and its importance, Pre-comber draft and doubling, Construction and working of Sliver lapper, Ribbon lapper and Super lapper/ Lap former machines
4. The object and principle of combing, Details of working and construction of combing machine, Draft and production calculation, Different combing actions and their mechanisms- Nipping, Feeding, Piecing and Detaching, Combing cycle and timing diagram.
5. Noil and its measurement, Theory of noil extraction, Forward and backward feeding, Influence of machine settings and other parameters on combing, Settings in comber, Design features of modern combers.

Speed frame:

6. Functions of Speed frame, Principle of winding and twisting- flyer leading and bobbin leading, Design of different flyers, Construction and working of speed frame, Drive in speed frame, Draft and production calculation.
7. Fundamentals of differential gearing, Differential motions in speed frame and related calculations, Theory and design of cone-drums, Working of building mechanism- adjustments and related calculations, Design features of modern speed frames.
8. Importance and influence of various components/parts and parameters on drafting process, Details of construction and working of different spring-loaded and pneumatic drafting systems in speed frame, Stop motions

## Practical Work:

1. Study of draw frame and its drive. Calculate the speeds of the rollers of the drafting system and also the speeds of other moving parts. Also calculate the production of the machine.
2. Study of the drafting system of draw frame. Calculate the draft and draft constant of the drafting system.
3. Study of gearing diagram of the speed frame. Calculate the spindle speed, top cone drum speed. Also calculate the bottom cone drum speeds at various diameters
4. Study the building mechanism. Calculate the bobbin rail speeds at various bottom cone drum speeds and corresponding time required to complete one complete traverse.
5. Study the differential mechanism of speed frame and calculate the bobbin speeds at various bottom cone drum speeds.
6. Study the drafting system of speed frame. Calculate the draft and draft constant of the system
7. Study of combing machine and gearing.
8. Calculate the actual draft and mechanical draft of and production a combing machine.
9. Find out the noil percentage of a given comber

## Reference Books:

1 A Practical Guide to Combing and Drawing, Short Staple Spinning Series, Vol.-3 by W. Klein, (The Textile Institute)
2 Man-made Fibres and their Processing, Short Staple Spinning Series, Vol.-6 by W. Klein, (The Textile Institute)
3 Fundamentals of Spun Yarn Technology by Carl A. Lawrence, (CRC Press)

4 Textile Mathematics, Vol.-2 by J. E. Booth, (The Textile Institute)
5 The Draw frame, Comber and Speed frame, Vol. IV, Part-II by Frank Charnley, (The Textile Institute, Manchester)
6 Contemporary Textile Engg. by F. Happy, (Academic Press)

## PCC-TT302: Fabric Forming Technology - III

**(L3-T0-P2): 4 Credit**

**Course Objectives:**

The course aims to:

1. To understand basic concepts, principles and motions of automatic and modern weaving systems
2. To learn more about advance weaving e.g. shuttle-less and multiphase weaving and fabric faults etc.
3. To study techno economics of available weaving systems.
4. To compare available weaving technologies for appropriate selection and use.

**Course Outcomes:**

Upon successful completion of this course, the student will be able to:

CO 1 Understand conventional and new weaving technologies.
CO 2 Write about features, principle motions of automatic and modern weaving systems
CO 3 Apply knowledge of advance weaving systems in product manufacturing etc.
CO 4 Compare the weaving technologies for appropriate selection.

**Course Articulation Metrix:**

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

## Course Content:

1. Automatic Weaving: Comparison with shuttle loom, Classification, Under-pick mechanism, Pirn changing mechanism of Cimmco loom, Semi positive let-off motion, basic requirements, Roper let-off motion etc.
2. Unconventional Weaving: Its necessity, warp and weft requirements, building floor, humidification, control of dust, fibre fly and humidity, machinery maintenance and training, Selvedge formation on unconventional looms, Weft accumulator, its importance- different types of weft measuring systems.
3. Rapier Looms: Classification of rapier looms, different systems of weft insertion, Positioning of weft insertion mechanism, Rapier driving, Weft selection mechanism, Density & quality of fabric, different electronic controls on machine.

4. 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.
5. Water Jet Looms: Principles of water jet picking, Working of pump, pump details, The nozzle details. Quality of water and related aspects, Necessity of protection of machine parts, Water consumption, Cloth drying mechanisms, Timing diagram. New developments, Quality of woven fabrics & fabric faults.
6. Gripper Projectile Loom: Classification of projectile loom, Main features, advantages, transfer of weft from feeder to the projectile, Different phases of weft insertion, picking mechanism, beat-up mechanism, Power of picking, Projectile monitoring, Energy utilization. Mechanism for multi-colour weft insertion.
7. Multiphase Weaving Machines: Introduction, Advantages and disadvantages of multiphase weaving, Classification, warp way multiphase weaving machine, weft way phase difference weaving machines, shedding, picking and beat-up mechanisms. Principles of working Sulzer, Ruti M8300 multiphase weaving machine.
8. Carpets: Basic features and manufacturing process of hand/machine knotted, woven (Brussel, Wilton, Axminster) and Tufted carpet.
9. Triaxial Weaving: - Structure and Properties of triaxial woven fabrics, applications, weaving equipment for triaxial weaving.
10. Narrow Fabric Weaving:- Introduction, Scope of narrow fabric weaving, applications b. Preparation – Machines and processes for assembling warps, various warping processes used, weft preparation. Technology of narrow fabric weaving – Machine construction, Shuttle looms, needle looms, warp feed systems from beams, creel for elastomeric yarns. Labels.
11. Braiding: - Introduction, classification (rounds and flat braids), applications, raw material used for braids, machines used for braiding (drive, yarn supply, Braiding technology, take up.)
12. Techno -Economics of Shuttle less Weaving: Introduction, Scenario, value rating of different technologies, economic aspect, conclusion.

## Practical Work:

1. Setting of Automatic cop changing mechanism of CIMMCO Loom
2. Weft feeler mechanism of CIMMCO Loom
3. Let-off motion on CIMMCO Loom
4. Setting of (a) Shuttle Box, (b) Weft cutter, (c) Dagger on CIMMCO Loom
5. Study of Rapier loom for its
   a. Shedding b. Weft Accumulator c. Rapier Centering d. Let-off e. Selvedge formation mechanism
6. Working on CAD, create dobby /jacquard designs (01 samples) along with their draft,
7. lifting plan on computer.

## Reference Books:


1. Shuttless Wvg. Machines by Oldrich Talavasek and Vladimir Svaty.
2. Principles of Weaving - by Mark & Robinson
3. Weaving Mechanism by Banerjee N.N.
4. Technology of H.S.Wvg. Machines & their design - ISTE Winter School Programme 3rd - 15th Dec. 90 PSG College of Technology, Coimbtore.
5. Automatic Weaving by Tairo.
6. Modern weaving preparation by By Ormerod
7. Weaving machines, mechanisms, management by M.K. Talukdar, P.K.Sriramulu, .B.Ajgaonkar, Publisher -Mahajan publishers
8. NCUTE - Pilot Programme - Weaving-II, Shuttleless Loom. October, 7-9,1999 IIT, Delhi.
9. Handbook of Weaving by Sabit Adnur.


# PCC-TT303: Man Made Fibres

**(L3-T0-P2): 4 Credit**

**Course Objectives:**

*The student should learn:*

1. Basic methods of filament manufacturing
2. Synthesis of polymers and fibers like viscose, polyester, nylon, acrylic
3. Physical and chemical properties of above fibers
4. Manufacture and properties of high-performance fibers like Kevlar, glass, carbon
5. Spin finish composition and purpose
6. Structural and thermal characterization of fibers

**Course Outcomes:**

*Upon successful completion of this course, the student will be able to:*

CO1 Determine suitable method and parameters for spinning of a filament
CO2 Determine process temperature looking to thermal behavior of a fiber
CO3 Compare properties of various fibers for probable application
CO4 Select suitable spin finish for a fiber and process
CO5 Select high performance fiber for special applications
CO6 Determine thermal effect on fiber properties and structure

**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 | | 1 | 1 | 2 | | | | |
| CO2 | 3 | 2 | | 2 | | 1 | 1 | 2 | | | | |
| CO3 | 3 | 2 | 1 | 1 | | 1 | 1 | 1 | 1 | | | |
| CO4 | 3 | 2 | | 1 | | 1 | 1 | | 1 | | | |
| CO5 | 3 | 1 | 1 | 1 | | | | | | | | |
| CO6 | 3 | 2 | 1 | 1 | | | | | | | | |

## Course Content:

1. Fundamentals of fluid flow and spinning, Methods of fiber spinning and their comparison
2. Fundamentals of melt spinning, Components, Melt spinning variables and their impact, Calculations for throughput rate.
3. Synthesis of Polyethylene Terephthalate, Nylon 6, Nylon 6, 6 & Acrylic fibers, their Properties and Applications.
4. Brief overview about synthesis of Polyethylene, Polypropylene Properties and Applications
5. Synthesis of Viscose Rayon and brief overview of derivatives of viscose rayon, Properties and Applications.
6. Brief overview about synthesis of Aramids, Carbon, Glass fibers, Properties and Applications.
7. Spin Finish Composition, Methods of applications, Role in spinning,
8. Structure of Manmade Fibers, Tg, Tm and factors influencing them.
9. Characterization Methods: Brief overview of X-ray, Infra-red spectroscopy, Density Meter, Polarization microscope, DSC, TMA, TGA, SEM, TEM.
10. Developments in Manmade Fibers: Microfilaments, Bicomponent Fibers.

## Practical Work:

1. Synthesis of a Homo-Polymer.
2. Synthesis of a Co-Polymer.
3. Synthesis of a thermo-Sett Resin.
4. Determination of Viscosity Average molecular weight of any polymer.
5. Determination of molecular weight by End Group Analysis and find degree of
6. Polymerization.
7. To find Denier & DPF of different POY, DY & Textured yarns.
8. To determine BWS% of POY, DY & Textured yarns.
9. To determine spin finish of a filament.
10. Draw a POY in table model drawing machine.
11. To determine Tg and Tm using DSC.
12. Find density of a polymer by density gradient column method.
13. To determine birefringence by polarized microscope.
14. To determine crystallinity of a polymer by X-ray.

## Reference Books:

1. Winter School Notes on Manmade Fibers, by V B Gupta and V K Kothari, Department of Textile Technology, IIT Delhi, 1988
2. Manufactured fibre technology, by V B Gupta & V K Kothari, (Eds.). Springer Science & Business Media, 2012.
3. Synthetic Fibers: Machines and Equipment, Manufacture, Properties: Handbook for Plant Engineering, Machine Design, and Operation, by F Fourné, Hanser, 1999.
4. Handbook of Textile Fibres, Man-Made Fibres, by J G Cook, A Volume in Woodhead Publishing Series in Textiles, 1984
5. Carbon Fibers, by S J Park & Soo Jin, Dordrecht: Springer, 2015.

6. Introduction to Polymers, by R J Young & Lovel P A, Chapman & Hall, 2011
7. Production of Synthetic fibres, by A A Vaidya, Prentice-Hall of India Private Limited, 1988
8. Textile Fibres, by V A Shenai, Sevak publications, 1971.
9. High speed fibre Spinning-science & engineering aspects, by A Ziabiki & H Kawai, Wiley-interscience, 1985.
10. Textile Engineering- Manufactured fibre technology - NPTEL, IIT Delhi, Retrieved from https://nptel.ac.in/courses/116/102/116102010

## ESC385: C++ and Computer Graphics

**(L3-T0-P2): 4 Credit**

**Course Objectives:**

*The student should learn:*

1. Describe the procedural and object-oriented paradigm with concepts of streams, classes, functions, data and objects
2. Understand dynamic memory management techniques using pointers, constructors, destructors, etc.
3. Describe the concept of function overloading, operator overloading, virtual functions and polymorphism
4. Classify inheritance with the understanding of early and late binding, usage of exception handling, generic programming.
5. Demonstrate the use of various OOPs concepts with the help of programs.
6. This course is designed to provide a comprehensive introduction to computer graphics leading to the ability to understand contemporary terminology, progress, issues, and trends.

**Course Outcomes:**

*Upon successful completion of this course, the student will be able to:*

CO1 Students will be able to understand the basics of object-oriented programming programming and computer graphics
CO2 It will enable students to comprehend C++ programming and graphics designs
CO3 Students will apply and analyze C++ programming and graphics designs
CO4 Students will be able write, evaluate and test more complicated programming
CO5 They can develop C++ programming graphic designs for their professional application

**Course Articulation Metrix:**

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

## Course Content:

1. Overview of C & Introduction to C++, Structured versus object-oriented development, Elements of OOP, objects, classes, Encapsulation, Inheritance, polymorphism, message communication.
2. Classes and Objects: Class specification, class objects, member access, defining member functions, constructors and destructors, passing and returning objects as arguments, friend functions.
3. Polymorphism and Inheritance: Method, function, and operator overloading; Derived class declaration, forms of inheritance, inheritance and member accessibility
4. Graphics: Graphics library of Turbo C/C+: preliminaries- display adapters, graphic mapping, resolution, coordinates etc; text in graphics mode, drawing graphics- line, circle, arc, polygon etc. Bit images, animation

## Practical Work:

Minimum Eight experiments based on above syllabus

## Reference Books:

1. Object oriented programming with C + + - by E. Balguruswamy
2. K. R. Venugopal et al; Mastering C++, Tata Mcgraw Hill Pub.
3. Herbert Schildt, Teach Yorself C++, Tata Mc Graw Hill Pub.
4. Mastering Turbo C, Stan Kelly- Bootte, BPB Pub

# BSC371: Mathematics –IV- Numerical and Statistical Methods

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

**Course Objectives:**

1. To understand Number representation and errors. Locating roots of polynomial and transcendental equations.
2. To understand the interpolation and approximation, Numerical differentiation and numerical integration.
3. To learn various numerical techniques to solve differential equations.
4. To provide students with the foundations of probabilistic and statistical analysis mostly used in varied applications in engineering and science
5. To understand probability distributions and their properties

**Course Outcomes:**

*After successful completion of this course student will be able to:*

CO1 Students will develop the numerical skills for error analysis

CO2 Find roots of polynomial and transcendental equations using numerical techniques

CO3 Evaluate numerical integration and differentiation

CO4 To use numerical methods to solve ordinary and partial differential equations and other engineering problems

CO5 To develop techniques of data interpretation, calculate probabilities, describe the properties of discrete and continuous distribution functions

**Course Articulation Metrix:**

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

## Course Content:

Unit 1: Numerical Methods – 1 (10 hours)

Round-off Error, Truncation Error, Errors in Scientific and Engineering Computation, Solution of polynomial and transcendental equations – Bisection method, Newton-Raphson method and Regula-Falsi method, Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Lagrange's formula. Numerical Differentiation, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules.

Unit 2: Numerical Methods – 2 (10 hours)

Ordinary differential equations: Taylor's series, Euler and modified Euler's methods. Runge-Kutta method of fourth order for solving first and second order equations. Milne's and Adam's predicator-corrector methods.

Unit 3: Analysis of Statistical Data (10 hours)

Frequency distribution; Frequency curve and histogram, pie charts, ; Measures of central tendency; mean, mode, median; Measures of dispersion: standard deviation, variance, coefficient of variance; quartiles, percentiles, skewness, kurtosis.

Unit 4: Probability (07 hours)

Basic concepts of probability, conditional probability, multiplication rule, Bayes' formula

Unit 5: Probability Distributions (08 hrs)

Random variables, discrete random variables and their probability distributions: binomial, Poisson; continuous random variable and its probability distribution: the normal distribution; the normal curve approximation to the binomial distribution.

## Reference Books:

1. E. Kreyszig, *Advanced Engineering Mathematics*, Eighth Edition, John Wiley and Sons, 2015.
2. R. K. Jain and S. R. K. Iyengar, *Advanced Engineering Mathematics*, Fifth Edition, Narosa Publishing House, 2016.
3. Steven C. Chapra and Raymond P. Canale, Numerical Methods for Engineers, 7th Edition, McGraw Hill
4. S.S. Sastry, Introductory Methods of Numerical Analysis, PHI learning Pvt. Ltd.
5. B.S. Grewal, Numerical Methods in Engineering & Science, Khanna Publication, Ed. 9th

6. V. K. Rohatgi and A.K. Md. Ehsanes Saleh, An Introduction to Probability and Statistics, 2nd Edition.
7. D. C. Montgomery and G.C. Runger, "Applied Statistics and Probability for Engineers", 5th edition, John Wiley & Sons, (2009).
8. P. S. Mann, Introductory Statistics, Wiley Publications, 7th edition (2013).

# Semester II

## PCC-TT304: Spun Yarn Technology - III

**(L3-T0-P2): 4 Credit**

**Course Objectives:**

*The student should learn:*

1. This course deals elaborately with the technology and operation of Ring Spinning machines.
2. Students will also cover other new spinning technologies and processes such as Rotor, Air-jet and Fiction spinning.
3. The students will be exposed to all quality aspects of yarns and their relationship in yarn manufacturing
4. Students will learn the design and manufacture of various yarns from apparel to technical and industrial applications

**Course Outcomes:**

CO1/ CO2 Students will learn and understand conventional ring spinning technology in details and fundamentals of new spinning technologies and processes such as Rotor, Air-jet and Fiction spinning along with other minor technologies.

CO3 Students will be able to analyze various process and machine parameters and their influence on respective output materials.

CO4 This course will make the students competent to evaluate the process and conduct experiment related to the process and its performances.

CO5 This course will enable students to design and manufacture different types of spun and engineered yarns from apparel to technical and industrial applications using various technologies

**Course Articulation Metrix:**

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

## Course Content:

Ring Spinning:

1. Ring spinning fundamentals, Principle of twisting and winding, Traveller lag and related calculation, Construction and working of ring spinning frame- gearing and drive, Various parts and their functions, Creel design, Structure and construction of spindle and types of spindle drives, Types of bobbin builds, Working of building mechanism.
2. Concept of yarn balloon, Importance and details of lappet guide, balloon separator, balloon control rings, Forces acting on yarn element in the balloon during spinning, Causes of yarn tension variation in ring spinning, Forces acting on the traveller, Twist flow in ring spinning.
3. Limitations of ring frame productivity, Design and shapes of ring/traveller combinations-relative merits and demerits, Specification of ring and travellers, Doffing and auto doffing mechanism.
4. Spinning geometry, Spring-loaded and pneumatic drafting systems in ring frame - design concepts, settings, roller pressure, aprons, cots, condensers, spacers, cleaners etc., Roller lapping- causes and remedies, Modern developments in ring spinning, Monitoring devices in ring spinning- ring data system

Modern Spinning:

5. Fundamentals of open-end/ break spinning, Construction and working of rotor spinning system, Mechanism of yarn twisting, Concepts of fibre flux and draft, production and twist calculation.
6. Raw material requirements and preparation, Opening/Combing roller details, Fibre deposition and gap formation on rotor collecting surface, Factors influencing rotor spinning and yarn quality, Structure and properties of rotor yarns and comparison with ring yarns.
7. Principle of Friction spinning, Mechanism of yarn twisting, Construction and working of OE-friction spinning, Dref-II, Dref-III machines, Structure and properties of friction yarns, Principle of Air-jet spinning. Concepts of edge fibres and geometry of edge fibre twisting, Structure and properties of air-jet yarns, Comparison with ring yarns.
8. Principles of Self-twist spinning, Twist-less spinning, Compact spinning-details comparison with ring spinning, Core yarn spinning, Bobtex spinning etc. Siro yarn, Principles and manufacturing methods of various fancy yarns- slub yarn, marl yarn, corkscrew yarn, snarl yarn, loop yarn, knop yarn.

## Practical Work:

1. Study the path of the material through ring spinning machine. Also study and sketch the spinning geometry of the system with all major dimensions, angles etc.
2. Calculate the draft and draft constant of a given ring frame drafting system. Also calculate the break draft and break draft constant.
3. Calculate the spindle speed and yarn delivery speed of a ring frame. Also calculate the twist and twist constant of the ring frame.
4. Find out the angle of yarn pull at empty and full bobbin stages. Also calculate the winding revolutions and linear speed of traveller at empty and full bobbin stages in the given ring frame.

5. Study the bobbin building mechanism of the ring frame. From this mechanism and geometry calculate the approximate theoretical chase length.
6. Study the various setting and gauges required in ring frame.
7. Study the path of material through rotor spinning machine. Sketch the various parts involved.
8. Study the path of material through friction/air-jet spinning machine. Sketch the various parts involved.

## Reference Books:


1 A Practical Guide to Ring Spinning, Short Staple Spinning Series, Vol.-4 by W. Klein, (The Textile Institute)

2 New Spinning Systems, Short Staple Spinning Series, Vol.-5 by W. Klein, (The Textile Institute)

3 Man-made Fibres and their Processing, Short Staple Spinning Series, Vol.-6 by W. Klein, (The Textile Institute)

4 The Technology of Short Staple Spinning Vol.-1 by W. Klein, (The Textile Institute)

5 Fundamentals of Spun Yarn Technology by Carl A. Lawrence, (CRC Presss)

6 The Principles and Theory of Ring Spinning, Vol.-V by A. E. De Barr and H. Catling, (The Textile Institute)

7 Textile Mathematics, Vol.-2 by J. E. Booth, (The Textile Institute)

8 Open-end Spinning by V. Rohlena, (Elsevier Science)


# PCC-TT305: Post Spinning and Texturing

**(L3-T0-P2): 4 Credit**

**Course Objectives:**

*The student should learn:*

1. To educate basics of synthetic filament drawing, it's technology & effect on structures & properties due to drawing.
2. To educate on heat setting & twisting machines & technology.
3. To educate basics of texturing of filaments, their varieties & DT yarn production technology & properties in details.
4. To educate on Air Jet texturing process & technology
5. To enlighten basics of characterization of fibres & different instruments used

## Course Outcomes:

*Upon successful completion of this course, the student will be able to:*

CO1 Students understanding of engineering knowledge in post spinning operation & specially in texturizing developed.

CO2 Students understanding of problem analysis skills in properties of drawn & textured filaments due to corresponding process parameters & fibre structural aspects developed.

CO3 Students understanding of conducting investigations of complex problems like reasons of anomaly in different property aspects developed.
CO4 Students understanding of Modern Tools & machines for post spinning operation & quality aspects measurement is developed.

**Course Articulation Metrix:**

| 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 | 1 | 1 | 1 | 2 | |
| CO2 | 3 | 3 | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | |
| CO3 | 3 | 3 | 2 | 3 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| CO4 | 3 | 1 | 1 | 2 | 2 | 1 | 1 | | | | | |

## Course Content:

1. Drawing: Structure and properties of As spun filament, LOY, MOY and FOY; Objects of filament drawing; Comparison of one step process (OSP) with two step process (TSP); Significance of $T_g$ on drawing; Neck drawing, homogeneous drawing; Temperatures and orientation induced crystallization; Factors affecting draw-ability and drawn yarn properties; Industry practices; Draw warping.
2. Twisting: Draw twisting and Two for One (TFO), Principles and mechanism of TFO machine.
3. Texturizing: Purpose, classification of textured yarns; Different methods of Texturizing; Twist heat set-untwist methods, Edge crimping method; Stuffer box crimping; Structural geometry and properties of these types of textured yarns.
4. Texturizing methods and yarn properties: False twisting and texturizing; Mechanics of friction texturizing; Sequential and simultaneous draw texturizing; Different factors affecting texturing process & properties of textured yarns; Post treatment of false twist textured yarns; Properties of draw textured yarn; Defects of textured yarn.
5. Air Jet texturing and other methods: Air texturing jets; Different types of nozzles; Factors affecting air jet textured yarn process and properties; Different properties of textured yarns; Texturing of non-thermoplastic yarns; Solvent texturing.
6. Textured Yarn Characterization: Methods of characterization of bulk and textured yarn.

## Practical Work:

1. Determine the natural draw ratio (NDR) and residual draw ratio (RDR) of a POY
2. Draw the POY with different draw ratio by keeping draw temperature constant
3. Draw the POY with different draw temperature by keeping draw ratio constant
4. Draw and heat set the given POY
5. Heat setting of drawn filaments with different variables
6. Determine the crimp contraction percentage of the textured yarn
7. Determine the bulk gain percentage of the textured yarn
8. Make a review of the draw texturing machine

## Reference Books:


1. Yarn Texturing Technology by J W S Hearle, L Hollick & D K Wilson, Textile Institute, A Volume in Wood Head Publishing Series in Textiles, CRC Press UK, 2001
2. False Twist Textured Yarns: Principles, Processes and Applications, by C Atkinson, Textile Institute, Wood Head Publishing Series in Textiles, 2012
3. Production of Synthetic fibres, by A A Vaidya, Prentice-Hall of India Private Limited, 1988.
4. Winter School on Manmade Fibers, Production, Processing, Structure Properties & Applications Vol 1 by V B Gupta (Edr), IIT Delhi, 1988
5. Textile yarns: Technology, Structure & Applications by B C Goswami, J G Martindale & F L Scardino, Wiley, 1977
6. A Guide to Crimping/Texturizing Technology by MVS Rao & AB Talele, MANTRA, Surat, 1979


# HMC391: Costing and Financial Management

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

**Course Objectives:**

*The student should learn:*

1. To understand basic terms and concepts of costing
2. To learn different costing methods adopted in a company
3. To know how to raise funds for a company
4. How to read and analyze Balance sheet and Profit – Loss Accounts of a company and prepare a financial project report for a new company

**Course Outcomes:**

*Upon successful completion of this course, the student will be able to:*

CO1 Remember terms and definitions related to cost accounting & finance.
CO2 Understand product cost sheet and company balance sheet & profit-loss accounts.
CO3 Solve overheads, depreciation, capital expenditure and costing related problems.
CO4 Analyze company balance sheet and prepare a project report for new start-ups.

**Course Articulation Metrix:**

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

## Course Content:

1. Nature of financial management: Basic Definition, Job of the Finance Manager, Financial Goal, Profit Vs Wealth.
2. Sources of funds: Shares, Debentures and Term Loans, Convertible Securities and Warrants,

Lease Financing, Venture Capital Financing, Management of working capital.

3. Statements of financial information: Financial Statements, Balance Sheet, Assets, Liabilities, Equity, Relationship between Assets, Liabilities & owner's Equity, Forms of the Balance Sheet, Profit & Loss Account, Ratio Analysis.
4. Cost classification and allocation: Nature of Cost, Cost Classification in a Manufacturing Firm, Cost Concepts for Planning & Control Cost Allocation, Distinction between Fixed and Variable Costs, Opportunity Costs and their use, Sunk Costs, Direct & Indirect Costs, Overheads, Controllable & Non-controllable Costs
5. Overheads: Definition, classification, primary & secondary distribution of overheads, Illustrations
6. Job costing and process costing: Concepts, Comparison, Job cost sheet and Process cost sheet
7. Marginal costing: Definition, concept of Fixed and Variable Costs, contribution, Break Even Chart, Break Even Point, Margin of safety, Profit -Volume Ratio, Effect of sales and costs on P/V Ratio
8. Standard costing: General Principals of Standard Costing, Advantages of Standard Costing, Types of Standard Cost, Standard Cost for Direct Material, Direct Labour and Overheads, Computation & Analysis of Variances of Same.
9. Costing: Its application to Textiles, Determination of cotton Cost/kg, Cost Calculations of Standard Fabrics.
10. Methods of Asset Depreciation, Capital expenditure & profitability, Return on investment, Payback period, Discounted cash flow
11. Preparation of New Industrial Project Reports

## Reference Books:


1. Cost Accounting by ATIRA, Ahmedabad
2. Cost Control & Costing in Spinning Mills by T.V. Ratnam, Publisher - SITRA
3. Modern Management Accounting by S.P. Deshpande
4. Cost Accounting by Arora
5. Principles & Practices of Cost Accounting by N. K. Prasad & A. K. Prasad
6. Production & Operations Management by S. N. Chary
7. Cost Accounting: A Managerial Emphasis by Charles T. Horngren, Datar, G. Foster, M. V. Rajan and C. Ittner


## SII-TT306: Winter/Summer Internship:

**(L0-T0-P2): 1 Credit**

**(2 weeks duration min.)**

**Course Objectives:**

1. Students will understand the working and mechanism of different machines and processes
2. Students will learn about latest industrial practices in the field of textiles
3. They will the theories already learnt with the practical works
4. They will learn the management and financial aspects of a factory.

**Course Outcomes:**

CO1/CO2- The practical knowledge acquired in the internship program is vast and crucial for understanding and validating the theoretical knowledge.

CO3- The knowledge and understanding of the industrial practices may be applied subsequently to improve and modify processes and working.

CO4- This will enable the students to conduct experiments on processes and machines.

CO5- This will help to design, evaluate and manufacture various textile products in the long run.

**Course Articulation Metrix:**

| 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 | 2 | 1 | 2 | 1 | 1 | 1 |
| CO2 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 1 | 1 | 1 |
| CO3 | 2 | 2 | 3 | 3 | 1 | 2 | 1 | | 2 | 1 | 1 | 1 |
| CO4 | 2 | 2 | 3 | 3 | 1 | | | | 1 | | | |
| CO5 | 2 | 2 | 3 | 3 | 1 | | | | 1 | | | |

## Course Content:

The students will undergo internship program/training in spinning/ weaving/ manmade fibre spinning/ dyeing, printing, finishing/ technical textiles depending upon the industry in one or more than one area.

Every student needs to undergo minimum two weeks of industrial training in the third year in summer/ winter vacation. Everybody needs to present the work done during the internship program in front of departmental examiners. A bound volume of the report (containing the work done in internship) is to be submitted in the department.

# Elective Courses:

## PEC-TT307: Fibres for Composites

**(L4-T0-P0): 4 Credit**

**Course Objectives:**

The student should learn:

1. Basic components and classification of composites
2. Manufacture of reinforcing fibers like ceramic, boron and properties of some high
3. performance fibers
4. Various matrix materials like epoxy, polyester
5. Mechanics of composite material and calculations based on it
6. Production techniques of composites like PMC
7. Testing of composites
8. Applications in various sectors such as construction, space, sports, biomedical etc.

### Course Outcomes:

*Upon successful completion of this course, the student will be able to:*

CO1 Determine suitable material for making a composite
CO2 Determine suitable process to manufacture a composite
CO3 Compare properties of various composites for probable application
CO4 Calculate composition of components suitable for an application
CO5 Select high performance fiber for special applications
CO6 Select post manufacturing process

### Course Articulation Metrix:

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

## Course Content:

1. Composites: Definition, Objectives, Classification & Advantages.
2. Fibers: Glass, Carbon, Ceramics, Boron, Polyamides, Kevlar, Ceramic fibres - Alumina, Silicon derivatives.
3. Matrix Materials: Polymers used, Properties of polymers, Thermoset and thermoplastic resins, Nonpolymeric materials
4. Fabrication: Hand lay, Bag molding, Pultrusion, Blow molding, Compression moulding, Filament winding, Preformed molding, etc.
5. Mechanics: Critical Fiber Length, Critical Fiber volume, Calculations for stress, strain and modulus.
6. Applications: For structural engineering, electrical, civil, aerospace, defense, automobile, sports, medicine and others
7. Surface treatments, Flammability and fire resistance of composites, Laminated composites

## Reference Books:

1. Design and Manufacture of Textile Composites, by C A Long, Woodhead Publishing Series in Textiles.
2. Fiber-reinforced composites: materials, manufacturing, and design. P K Mallick, CRC press UK, 2007
3. Mechanics of composite materials, by A K Kaw, CRC press,2005
4. Composite Materials, by K Srinivasan, Narosa Publishing House Pvt Ltd, Delhi, 2018
5. Analysis and Performance of Fiber Composites, by B D Agarwal, L J Broutman & K Chandrashekhara, Wiley, 2006

6. Composite Materials: Design and Applications, by D Gay, S V Hoa & S W Tsai, CRC Press, 2002
7. Composite Material Science & Engineering, by K K Chawla, Springer Science & Business Media, 2012
8. 3D Textile Reinforcements in composite Materials, by A Miravete (Edr), Woodhead Publishing Series in Textiles, 1999
9. Mechanical Engineering – Introduction to Composites - NPTEL, IIT Kanpur, Retrieved from https://nptel.ac.in/courses/112/104/112104229/

## PEC-TT308: Theory of Textile Structures

**(L4-T0-P0): 4 Credit**

**Course Objectives:**

The student should learn:

1. Student will learn about theoretical models related to yarn and fabric with their analysis.
2. Analysis of problems related fabric and correlate practical data with theory.
3. They will be able to understand and analyze yarn structure and properties relations.

**Course Outcomes:**

*Upon successful completion of this course, the student will be able to:*

CO1 Learners will get an exposure on structural aspects of yarn and fabric.
CO2 Students will able to understand yarn and fabric properties and structure relationship
CO3 Students will able to analyze various yarn and fabric structures
CO4 Students will able to evaluate different yarn and fabric structures critically
CO5 Students will be able to design and experiment of yarn and fabric manufacturing process

**Course Articulation Metrix:**

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

## Course Content:

Yarn Geometry:

1. Geometry of twisted yarns, Idealized helical yarn geometry, Yarn diameter and twist, Count and twist factor, Twist contraction: Theoretical calculations and related numerical.
2. Limits of Twist, Average fibre length in twisted yarns and derivations, Packing of fibres in yarns, Packing coefficient, Open and close packing & numerical.
3. Small and large extension behavior of continuous filament yarns-related numerical, Extension and breakage behavior of spun yarns
4. Migration of fibres in yarns- Ideal and real, Characterization of migration behavior, Tracer

measurements, Morton and his associates work and view on migration

Fabric Geometry:

5. Float and weave value, warp & weft crimp, density of cloth, cover factor, elements of fabric geometry, cloth setting theories, plain and matt weaves.
6. Peirce's equations-Flexible thread model, plain woven fabrics assumptions, jamming condition, crimp-inter change equation, Race track model, Jamming conditions, Rigid thread model and crimp balance equation.
7. Plain Jersey knitted fabric geometry: Cover factor, loop-length, wrap angle.

## Reference Books:

1. Textile Yarn Structure & Application by Martindal & Goswami, Publisher - Wiley, 1977
2. Structural Mechanics of Yarns, Fibre and Fabrics by Grosberg, Hearle and Backer, Publisher - Wiley-Interscience, 1969
3. Cloth Geometry – F T Pierce

# PEC-TT309: Garment Technology

**(L3-T0-P2): 4 Credit**

**Course Objectives:**

The student should learn:

1. Apply basic elements and principles of garment manufacturing.
2. Handle and control garment manufacturing process
3. Solve running problems of garment unit
4. Design and produce a buyer specification garment

**Course Outcomes:**

*Upon successful completion of this course, the student will be able to:*

CO 1 Understand the importance garment industry and different fashioning deals.
CO 2 Understand basic operations of garment manufacturing process.
CO 3 Solve technical as well as managerial problems.
CO 4 Able to stitch different types of fashioning garments.

**Course Articulation Metrix:**

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

## Course Content:

1 Introduction – Sectors and structure of apparel industry, Overview of Indian garment

industry, Nature & scope of apparel manufacturing industry and its developments in recent years. Sequence of garment manufacturing process. Latest developments in garment technology.

2 Preparation for sewing – Grading, Types and making of lay plan, Requirements of spreading, types and methods of spreading, spreading equipment and tools, cutting equipment and tools and their modernization, size charts, Various terms used- Fashion cycle, fad, classic styles etc.

3 Sewing – Types, construction & parts of sewing machines, Sewing machine needles, Feed mechanism – principles, feed teeth, types of feed, Stitching mechanisms – needles, loops, looper spreader, shuttle, hooks, different tension devices, bobbin and bobbin case, tongues and chaining plates, throat plates, stitching auxiliaries. Sewing defects.

4 Stitching – Difference between stitch, Stitching and seams and their classifications. Stitch class like 300,400, 500 600, 200 &100, Details of seam types and their uses. Fabric sewability, principles of selecting proper stitch and seam types, Effect of stitch type on elasticity and strength, Effect of stitch type on seam slippage. Switchless garments.

5 Garment manufacturing techniques such as fashioning, neck finishes, Darts, Plates, Tucks and Gathering. Sleeve insertion, hemlines, waist lines, contours of garments. Cost structure in garment manufacturing.

6 Buttons – Buttons, Characteristics of buttons, button size, and button applications, Snaps

7 Fusing and pressing machinery – Process, methods and equipment

8 Garment dyeing and finishing, Value added garments.

9 Pressing & finishing: object, classifications, means, components, machinery and equipment, garment finishing and inspection, Quality Standards of some giant retailers, TUV, SGS and ASTM testing standards.

10 Production technology: Manual systems, make through systems, straight line systems, modular production systems, unit production systems, quick response systems

11 Ware housing: Handling equipment, storage equipment, packing equipment.

12 Application of CAD/CAM in garment manufacturing

## Practical Work:

1 Study of various parts of sewing machines their functions and objectives.

2 Some attachment to sewing machines.

3 Study of different types of stitching machines available in the industry.

4 Study of different stitches and seams.

5 Draw a sketch drafting of a denim trouser and stitch a garment of own size.

6 Draw a sketch drafting of a T- shirt and stitch a garment of own size.

7 Study the organization and flow chart of a clothing manufacturing company.

8 Visit to a clothing manufacturing company and study the pattern construction, lay plan, and spreading, cutting, stitching & pressing technique.

9 Study the fabric and sewing faults, safety measurements and work measurements practices.

## Reference Books:


1 The Technology of clothing manufacturing by Harold Carr, Barbara Latham, Publisher – Blackwell scientific publications
2 Handbook for designing by Ritu Jindal, S. Malhan, Publisher - Mittal Publications
3 Managing Productivity in the apparel Industry by Rajesh Bheda, Michael T. Fralix, Publisher
CBS publications & distributors
4 Ila Kantilal "The apparel industry in India"
5 CAD/CAM in clothing & Textiles by Grey and Stephens Publications – Gower Publishing, Hampshire, 1998.


# PEC-TT310: Data Science with Python

**(L3-T0-P2): 4 Credit**

**Course Objective:**

The objective of this course is to provide comprehensive knowledge of python programming paradigms required for Data Science.

**Course Outcomes:**

CO1 Demonstrate the usage of built-in objects in Python
CO2 Analyze the significance of python program development environment by working on real world examples
CO3 Implement numerical programming, data handling and visualization through NumPy, Pandas and MatplotLib modules

**Course Articulation Metrix:**

| Program Outcome (PO)→ Course Outcome (CO)↓ | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | 2 | 1 | | | 2 | 1 | | 2 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 2 | | | 3 | 2 | | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 1 | | | 3 | 1 | | 2 |

## Course Content:

**Unit-1**

INTRODUCTION TO PYTHON: Structure of Python Program-Underlying mechanism of Module Execution-Branching and Looping-Problem Solving Using Branches and Loops-Functions - Lists and Mutability- Problem Solving Using Lists and Functions

**Unit-2**

SEQUENCE DATATYPES AND OBJECT-ORIENTED PROGRAMMING: Sequences, Mapping and Sets- Dictionaries- -Classes: Classes and Instances-Inheritance-Exceptional Handling-Introduction to Regular Expressions using "re" module.

**Unit-3**

USING NUMPY: Basics of NumPy-Computation on NumPy-Aggregations-Computation on Arrays-Comparisons, Masks and Boolean Arrays-Fancy Indexing-Sorting Arrays-Structured Data: NumPy's Structured Array.

**Unit-4**

DATA MANIPULATION WITH PANDAS- PART 1: Introduction to Pandas Objects-Data indexing and Selection-Operating on Data in Pandas-Handling Missing Data-Hierarchical Indexing - Combining Data Sets

**Unit-5**

DATA MANIPULATION WITH PANDAS- PART 2: Aggregation and Grouping-Pivot Tables-Vectorized String Operations -Working with Time Series-High Performance Pandas- and query ()

**Unit-6**

VISUALIZATION AND MATPLOTLIB: Basic functions of matplotlib-Simple Line Plot, Scatter Plot-Density and Contour Plots-Histograms, Binnings and Density-Customizing Plot Legends, Colour Bars-Three-Dimensional Plotting in Matplotlib.

## Reference Books:

1. Jake VanderPlas, Python Data Science Handbook - Essential Tools for Working with Data, O'Reily Media Inc., 2016
2. Zhang. Y, An Introduction to Python and Computer Programming, Springer Publications, 2016
3. Joel Grus, Data Science from Scratch First Principles with Python, O'Reilly Media, 2016
4. T. R. Padmanabhan, Programming with Python, Springer Publications, 2016

## Practical Work:

1. Demonstrate usage of branching and looping statements
2. Demonstrate Recursive functions
3. Demonstrate Lists
4. Demonstrate Tuples and Sets
5. Demonstrate Dictionaries
6. Demonstrate inheritance and exceptional handling
7. Demonstrate use of "re"
8. Demonstrate Aggregation
9. Demonstrate Indexing and Sorting
10. Demonstrate handling of missing data
11. Demonstrate hierarchical indexing
12. Demonstrate usage of Pivot table
13. Demonstrate use of and query ()
14. Demonstrate Scatter Plot
15. Demonstrate 3D plotting