## Textile Engineering

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Module-I  
(18 hours)

Partial differential equation of first order, Linear partial differential equation, Non-linear partial differential equation, Homogenous and non-homogeneous partial differential equation with constant co-efficient, Cauchy type, Monge’s method, Second order partial differential equation

The vibrating string, the wave equation and its solution, the heat equation and its solution, Two dimensional wave equation and its solution, Laplace equation in polar, cylindrical and spherical coordinates, potential.

Module-II  
(12 hours)

Complex Analysis:
Analytic function, Cauchy-Riemann equations, Laplace equation, Conformal mapping,

Complex integration: Line integral in the complex plane, Cauchy’s integral theorem, Cauchy’s integral formula, Derivatives of analytic functions

Module III  
(10 hours)

Power Series, Taylor’s series, Laurent’s series, Singularities and zeros, Residue integration method, evaluation of real integrals.

Text books:
   Reading Chapters: 11,12(except 12.10),13,14,15
   Reading chapter: 18

Reference books:
Module I


2. Corrosion: Theories of corrosion, Types of corrosion, Factors affecting corrosion, Corrosion Control: (Proper design and fabrication procedure, Cathodic protection, Passivation).

Module II

1. Fuels: Classification of fuels, Calorific value, (Determination by Dulong’s formula), G.C.V & N.C.V
Liquid fuel: Classification of petroleum, Refining of petroleum, Cracking, Knocking and anti knocking, cetane and octane numbers. Unleaded petrol, synthetic petrol, power alcohol
Gaseous Fuel: Producer gas, Water gas, LPG, CNG, Kerosene gas
Combustion Calculation.

2. Battery Technology
Introduction, Batteries and cells, Basic components of battery, its Classification characteristics, Chemical batteries (dry, Lead acid & gel batteries) Alkaline batteries (zinc-air, aluminium-air, Nickel metal hydride battery) Reserve batteries (magnesium-copper, Gordon-magnesium battery) Nickel cadmium battery

Module III

1. Polymer: Polymer: Types, polymerization process and mechanisms
Conducting polymers (poly aniline, poly acetylene), polymer composite (carbon fiber)
Preparation. Properties and uses of following polymer (polyethylene, PMMA, PTFE, Bakelite, polyurethanes, polycarbonate)

2. Nano materials
Nano material; Carbon nano tube, (synthesis, properties and application.) Application of nano material in medicine, fuel cell, catalysis (only general idea)

Text Books:
1. Engineering chemistry by Putti R. Vijayasararhy, PHI Ltd
2. Engineering chemistry by P.C. Jain and M. Jain

Reference Books:
1. Engineering chemistry by N. Krishnamurthy, P. Vallinaygam, Dmadhavan, PHI Ltd
2. Engineering chemistry by Mary Jane Shultz, Cengage learning publication
Module I  (08 hrs)
Introduction to object oriented programming, user defined types, structures, unions, polymorphism, encapsulation. Getting started with C++ syntax, data-type, variables, strings, functions, default values in functions, recursion, namespaces, operators, flow control, arrays and pointers.

Module II  (16 hrs)
Abstraction mechanism: Classes, private, public, constructors, destructors, member data, member functions, inline function, friend functions, static members, and references.
Inheritance: Class hierarchy, derived classes, single inheritance, multiple, multilevel, hybrid inheritance, role of virtual base class, constructor and destructor execution, base initialization using derived class constructors.
Polymorphism: Binding, Static binding, Dynamic binding, Static polymorphism: Function Overloading, Ambiguity in function overloading, Dynamic polymorphism: Base class pointer, object slicing, late binding, method overriding with virtual functions, pure virtual functions, abstract classes.
Operator Overloading: This pointer, applications of this pointer, Operator function, member and non member operator function, operator overloading, I/O operators.
Exception handling: Try, throw, and catch, exceptions and derived classes, function exception declaration.

Module III  (08 hrs)
Dynamic memory management, new and delete operators, object copying, copy constructor, assignment operator, virtual destructor.
Template: template classes, template functions.
Namespaces: user defined namespaces, namespaces provided by library.

Text Books:
1. Object Oriented Programming with C++ - E. Balagurusamy, McGraw-Hill Education (India)
2. ANSI and Turbo C++ - Ashoke N. Kamthane, Pearson Education

Reference Books:
1. Big C++ - Wiley India
2. C++: The Complete Reference - Schildt, McGraw-Hill Education (India)
5. Mastering C++ - Venugopal, McGraw-Hill Education (India)
HSSM3204 Engineering Economics & Costing

Module-I: (12 hours)

Module-II: (12 hours)

Module-III: (12 hours)
Cost concepts, Elements of costs, Preparation of cost sheet, Segregation of costs into fixed and variable costs. Break-even analysis-Linear approach. (Simple numerical problems to be solved)

Banking: Meaning and functions of commercial banks; functions of Reserve Bank of India. Overview of Indian Financial system.

Text Books:

Reference Books :
4. Gupta, “ Managerial Economics”, TMH
5. Lal and Srivastav, “ Cost Accounting”, TMH
HSSM 3205 Organizational Behaviour

Module I:
The study of Organizational Behaviour: Definition and Meaning, Why Study OB
Learning – Nature of Learning, How Learning occurs, Learning and OB.
Foundations of Individual Behaviour: Personality – Meaning and Definition, Determinants of Personality, Personality Traits, Personality and OB.

Module II:

Module-III:

Text Books:

Reference Books:
1. Stephen P. Robbins, Organisational Behaviour, Prentice Hall of India
Module-I (10 Hrs)
Introduction:
a) Classification of textile fibres according to their nature and origin,
b) essential and desirable properties of textile fibres,
c) staple fibre and continuous filaments,

Natural fibres:
a) cotton: concept of varieties; ginning, baling,
b) jute, flax: varieties; retting process (extraction of fibre from bast),

Module-II (10 Hrs)
Man-made fibres:
a) Principles of melt spinning, dry spinning and wet spinning,
b) Manufacturing process of regenerated fibres - viscose & diverse forms of viscose, cuprammonium and acetate rayon

c) Manufacturing of synthetic fibres: principles of polycondensation with reference to polyesters, polyamides, principles of poly addition with reference to acrylics

d) concept of quenching operation and finish application,

Module-III (10 Hrs)
Properties of Fibres
Physical properties: Fibre length: Technical significance of fibre length, introduction to length distributions, Measurement of fibre length of cotton fibre - Baer sorter diagram, 2.5% and 50% span length, Uniformity ratio, Fibre fineness: Fibre linear density, Technical significance of fibre fineness; methods of measuring fineness of cotton fibres, jute, flax, wool, silk and man-made fibres, Maturity of cotton fibre and its influence on fineness. Determination of maturity of cotton fibre by different methods. Maturity Co-efficient, concept of micro denier fibre

Moisture Content and Regain: Moisture content and regain, relative and absolute humidity, effect of moisture on fibres, Fibre density, Crimp: Significance, measurement. Tensile Strength: Tensile strength of single fibre, bundle strength of cotton,

Chemical Properties of Fibres: Chemical properties of different cellullosic, protein and synthetic fibres such as cotton, jute, flax, pineapple, wool, silk, polyester, polyamide, polyacrylonitriles etc.

Text Books:
1. Manmade Fibres - R.W. Moncrieff,
2. Textile Fibre - V.A. Shenai
3. Dyeing and Chemical Technology of Textile Fibres by E.R. Trotman,

Reference Books:
4. Man-made Fibres Science and Technology, Vol. 1,2,3 - H.F. Mark, S.M. Atlas and E. Cernia,
5. Polyester Fibres Chemistry and Technology - H. Ludwig,
6. Textbook of Polymer Science by F.W. Billmeyer,
7. Production of Man-made Fibres – A.Vaidya
PCTX4202  Yarn Manufacture – I

Module – I  
(20 hrs)
1. Short Staple fibre Spinning (brief idea): Introduction, raw materials, opening and cleaning - the need for opening and cleaning, mixing/blending, drafting, Principle of yarn formation systems.

2. Blow Room:
Basic operations in the blow room - opening, cleaning, feeding, dust removal, Blow room line - sequence of machines- need for various types of machines, study of various openers and cleaners used in a modern Blow room line - their classification - principle of operation- position etc., study of components such as feed apparatus - feed with two clamping cylinders, feed with a roller and pedals; grid - grid as an opening device, elements of grid, waste collection under the grid, grid adjustment; different type of mixer/blender. General factors influencing opening and cleaning; Idea of accessories and associated equipment (dust removing and disposing devices; material transport devices, material flow control devices, metal extractors, fire eliminator, chute feed system). Production calculations; Performance assessment of blow room line -: cleaning efficiency, degree of opening, waste, nep generation, lap weight variation and rejection, lap build, norms for blow room operations - Miantanace schedule.

Module – II  
(10 hours)
3. Carding:

Module – III  
(15 hours)
4. Draw Frame:
Objects of Draw frame, Operation principle, Principle of roller drafting, Drafting wave, Drafting Force, behaviour of the fibres in the drafting zone, friction fields, distribution of draft, additional effects of draft; perfect and real drafting; nature of drafting irregularities; Equalizing: unevenness of fibre strands, basic possibilities of equalizing, doubling, levelling; Study of various drafting system, Drafting Rollers arrangement, Doubling, blending and hook removal at draw frame, coiling- delivery, condensing, sliver coiling, can changing. Gearing and production calculation, Design and principle of Auto leveler- open loop and close loop. Maintenance schedule. Recent development in Draw frame.

5. Combing:
Introduction, Objects of combing process, types of comber, sequence of operation in a comber (combing cycle); Methods of lap preparation for combing; process - outline, operating principles of sliver lap machine, ribbon lap machine and sliver doubling machine; comparative assessment of web doubling and sliver doubling processes; combing: parameters influencing combing operation- raw material, material preparation, factors associated with machine setting, ambient conditions, influence of feed stock on combing, parallelisation of fibres in the sheet, sheet thickness (wt.), evenness of the lap sheet, disposition of hooks, number of draw frame passages, degree of combing, noil theory, noil elimination with forward feed and backward feed, influence of machine components and settings on combing, feed distance moved per cycle, type of feed, detachment setting, points on the combs, depth of penetration of the top comb, piecing;

Text Books:
1. A Practical Guide to Opening and Cleaning - W. Klien
2. A Practical guide to Carding – W. Klien

Reference Books:
4. Spun Yarn Technology - Oxtoby
5. Spun Yarn Technology, Vol. I & II - V. ubramani
7. The Principle of Roller Drafting & The Irregularity of Drafted Materials by G. A. R. Foster,
HSSM7203  Communication & Interpersonal skills for Corporate Readiness Lab.

Lab 30 hours

This course will focus on communication in professional (work-related) situations of the kind that BPUT graduates may expect to encounter on entering the professional domain. Some typical forms of work-related communication, oral or written, are listed below. Practice activities for all four skills can be designed around these or similar situations.

1. Gaining entry into an organization
   i. Preparing job-applications and CVs
   ii. Facing an interview
   iii. Participating in group discussion (as part of the recruitment process)

2. In-house communication
   a. Superior/ Senior ➔ subordinate / junior (individual ➔ individual / group)
      i. Welcoming new entrants to the organization, introducing the workplace culture etc.
      ii. Briefing subordinates / juniors: explaining duties and responsibilities etc.
      iii. Motivating subordinates / juniors (‘pep talk’)
      iv. Instructing/ directing subordinates/ juniors
      v. Expressing/ recording appreciation, praising/ rewarding a subordinate or junior
      v. Reprimanding/ correcting/ disciplining a subordinate/junior (for a lapse); asking for an explanation etc.

   b. Subordinate / Junior ➔ Superior / Senior
      i. Responding to the above
      ii. Reporting problems / difficulties / deficiencies
      iii. Offering suggestions
BEC7212 C++ & Object Oriented Programming Lab

1. Programs on concept of classes and objects.(1 class)
2. Programs using inheritance.(1 class)
3. Programs using static polymorphism.(1 class)
4. Programs on dynamic polymorphism.(1 class)
5. Programs on operator overloading.(1 class)
6. Programs on dynamic memory management using new, delete operators.(1 class)
7. Programs on copy constructor and usage of assignment operator.(1 class)
8. Programs on exception handling .(1 class)
9. Programs on generic programming using template function & template class.(1 class)
10. Programs on file handling.(1 class)

PCTX7201 Fibre Science & Technology – I Lab.

1. To calculate the moisture regain and moisture content of a given Cotton sample by hot air oven method.
2. To trace the Fibre length-cumulative frequency percentage by means of sorter diagram.
3. To measure the Maturity co-efficient of Cotton fibre by caustire method.
4. To measure the fineness of a given sample by Air flow method.
5. To determine the bundle strength of Cotton fibre using Stelometer.
6. To calculate Trash Content % of a given Cotton sample by the TRASH ANALYSER.
7. To measure the diameter of Wool fibre.
8. To determine the denier of silk fibre.
9. To find the crimp % of fibre.
10. To measure the tensile strength of single fibre.

PCTX7202 Yarn Manufacture – I Lab.

1. To study the flow of materials through various organs of a Blow room line.
2. To study and sketch the working mechanism of various openers, cleaners, blenders and lap formation unit in a Blow-Room line.
3. To study and sketch the working mechanism of various operations of a card with respect to flow of material.
4. To study different settings of the card.
5. To study the gearing plan and calculation of draft constant, draft and production constant of a Card.
6. To study and sketch the working mechanism of draw frame with respect to flow of material.
7. To study and sketch the working mechanism of drafting zone of draw frame.
8. To study the ratch setting of draw frame drafting system.
9. Calculation of draft constant and draft of a drawframe.
10. General study of different parts of comber and their operations.
4th Semester

BSCM1210 Mathematics – IV

Module-I (20 hours)

Numerical methods:
Approximation and round of errors, Truncation error and Taylor’s series
Roots of equation: The bisection method, the false-position method, fixed point iteration, the
Newton-Raphson method, Muller’s method
Linear algebraic equation: LU decomposition, the matrix inverse, Gauss-Seidel method
Interpolation: Newton divided difference interpolation, Lagrange Interpolation, Newton’s forward
and backward interpolation.
Numerical integration: The trapezoidal rule, The Simpson’s rules, Gauss quadrature
Ordinary differential equation: Euler’s method, Improvement of Euler’s method, Runge-Kutta
methods

Module-II (10 Hours)

Probability:
Probability, Random variables, Probability distributions, Mean and variance of distribution,
Binomial, Poisson and Hypergeometric distributions, Normal distribution, Distribution of several
random variables.

Module-III (10 Hours)

Mathematical Statistics:
Random sampling, Estimation of Parameters, Confidence Intervals, Testing of hypothesis,
Acceptance sampling, Chi square test for goodness of fit, Regression Analysis, Fitting Straight
Lines, Correlation analysis.

Text books:

   Hill Education
   Reading Chapters: 2, 3(3.1, 3.2), 4(4.2, 4.3), 5(5.1, 5.2, 5.3), 6(6.4), 9(9.1, 9.2), 10(10.2),
   13(13.1,13.2,13.5), 16(16.1, 16.2), 17(17.3), 20(20.1, 20.2, 20.3)

   Reading Chapters: 22, 23(except 23.5 and 23.8)

Reference books:

Module I: (10 hours)
Database System Architecture - Data Abstraction, Data Independence, Data Definitions and Data Manipulation Languages. Data models - Entity Relationship(ER), Mapping ER Model to Relational Model, Network .Relational and Object Oriented Data Models, Integrity Constraints and Data Manipulation Operations.

Module II: (12 hours)
Relation Query Languages, Relational Algebra and Relational Calculus, SQL.
Relational Database Design: Domain and Data dependency, Armstrong's Axioms, Normal Forms, Dependency Preservation, Lossless design.
Query Processing Strategy.

Module III: (10 hours)
Database Recovery System: Types of Data Base failure & Types of Database Recovery, Recovery techniques

Text Books:
1. Database System Concepts by Sudarshan, Korth (McGraw-Hill Education )
2. Fundamentals of Database System By Elmasari & Navathe- Pearson Education

References Books:
(1) An introduction to Database System – Bipin Desai, Galgotia Publications
(2) Database System: concept, Design & Application by S.K.Singh (Pearson Education)
(3) Database management system by leon &leon (Vikas publishing House).
(4) Fundamentals of Database Management System – Gillenson, Wiley India
PCTX4203 Fibre Science and Technology – II

Module-I (10 hours)

1. **Mechanical properties of Textile fibres**: Basic definition- true stress, specific stress, tenacity and breaking length, recapitulation of elastic and plastic deformation, Hook’s law and Poisson’s ratio; stress-strain curves; comparative stress-strain diagrams of different fibres.

2. **Elastic recovery, strain recovery, work recovery**: Shear, bending, torsion and compression;

3. **Other properties**
   a) Optical Properties, b) Thermal properties, c) Fibre friction and d) Dielectric properties.

Module-II (10 hours)

4. **Structure of Fibres**:
   a. **Morphological structure**: Longitudinal and cross-sectional view of natural and man-made fibres.
   b. **Chemical structure**: chemical structure of synthetic fibres, chemical structure of natural fibres-vegetable or cellulosic, animal or polypeptide fibres, recapitulation of bonding in polymer fibres – primary bonding, secondary bonding, methods of investigating structure-idea of infrared spectroscopy, x-ray, microscopy, NMR etc;
   c. **Microstructure and macrostructure of fibres**: Recapitulation of crystalline and non-crystalline materials –structure of crystals, polymer crystals, X-ray diffraction and crystallinity, thermal analysis of polymers by DTA, TGA and DSC.

Module-III (10 hours)

5. **Texturing**: Introduction, purpose, bulked and textured yarns, methods of texturing thermoplastic and non-thermoplastic yarns- basic principles, feed material characteristics-study of twist-set-detwist, false twist, edge crimp, stuffer box crimp; knit de-knit techniques of texturing and the techniques of modified stretch yarn; properties and uses of textured.

6. **High performance fibres.**: Introduction to Polyurethene, Kevlar, Nomex, Glass fibre, Carbon fibre, PVA fibre, PVC fibre etc.

**Text Books**
2. Manmade Fibres - R.W. Moncrieff,
3. Textile Fibre, V.A. Shenai

**Referene Books**
1. Fiber Science by Steven B. Warner,
2. Mechanical Properties of Solid Polymers by I. M. Ward,
PCTX4204  

Yarn Manufacture –II

Module-I  (10 hours)

1. SPEED FRAME:

- Principles and objects of Speed Frame.
- Study of flow of material and different parts
- Study of various parts of drafting system, roller weighting and setting, distribution of
- Principle of twisting, parts and function of flyer, development of a flyer.
- Principle of Winding, Flyer leading and bobbin leading systems
- Principles of differential mechanism in a Simplex.
- Function and description of building mechanism, cone drum arrangements.
- Features of a modern Simplex Frame, recent developments.
- Defects and remedies in Simplex process.
- Lubrication and maintenance schedule for Speed Frame.
- Calculations pertaining to speed, production, draft and twist, coils/inch, etc.

Module-II  (20 hours)

2. RING FRAME:

- Objects and principles of Ring Spinning Machines.
- Constructional features and identification of different parts.
- Study of creel, Principles of drafting systems on Ring Frames, High drafting and Super High Drafting System, Weighting System on Ring Frame. Twisting and winding operation.
- Study of Rings, Travellers, Spindles for their designs and efficient working.
- Study of building mechanism. Factors affecting yarn tension and its control in spinning. Methods of driving ring frame, variable and dual motor drive.
- Study of special attachment such as Automatic doffing and pneumatic waste extraction.
- Study of common defects in ring spun yarn and their methods of analysing yarn defects due to roller vibrations, roller slip and roller eccentricity.
- Modifications to be effected while spinning polyester, viscose and blends on Ring Frame.
- Calculation regarding speed, production and efficiency in Ring Frame, Study of twist factor for single yarn and twist, strength and count relationship.
- General idea about Lubrication and maintenance of High Speed Ring Frame.

Module – III  (15 hours)

3. DOUBLING:

- Principles and objects of doubling, wet and dry doubling, different methods of threading, detailed study of creels, building motions, rings, travellers and spindles on doublers. Concept of balanced twist in doubled yarn, direction of twist in doubled yarn and its relation to single yarn. TFO- Principle, technique, Fancy doublers, different systems of fancy yarn production.

4. REELING:

- Brief study of machines used for reeling, straight and cross reeling, advantages and disadvantages, doffing systems, Calculation.

5. NEW SPINNING SYSTEM:

- a) Open end spinning systems: principle of rotors spinning system, constructional features and different parts rotor spinning m/c. Economics and quality of rotor spun yarn.
- b) Principle of Friction Spinning, Features of DREF – I, DREF-II and DREF-III spinning system.
- c) Airjet Spinning: Principle,
- d) Comparison of the properties among Rotor, DREF, Airjet and Ring spun yarn.
Text Books:
1. A Practical Guide to Ring Spinning, W.Klien
2. A Practical guide to Combing and Drawing. W.Klien

Reference Books:
2. Manual of Cotton Spinning (Vol-V), The Textile Institute, Manchester
3. Open End Spinning, O. Neil
4. New Spinning System, W.Klein
5. Spun Yarn Technology, Oxtoby
6. TFO- Technology & Techniques, HVS Murty

PCTX4205 Fabric Manufacture – I

Module – I (15 hours)
1. Introduction: a) The fabric, b) methods of fabric formation, c) phases in the formation of fabric by weaving, d) a technical introduction to weaving mechanism.
3. Winding and Warping:
   Single –end Warp Winding: a) Winding machines-basic function - study of different parts of warp winding m/c- classification of winding machines, spindle and drum driven machines- driving the package e.g., constant surface speed, constant angular speed, varying angular speed. - Types of yarn clearers and their merits and demerits, yarn tensioner, anti patterning device etc.b) Different types of packages and package build-parallel, near parallel wind & cross wound packages, standard package formats (cop, cone, cheese, pineapple etc.) c) winding techniques-random, precision and combined, d) winding parameters: winding rate, wind and traverse ratio, gain, winding angle, e) winding faults; pattern formation, principles of pattern breaking.
   Single –end Weft winding: a) Introduction b) need, c) shape and build of the pirn, c) basic requirements, d) elements of the pirn winding machines, e) concept of basic terms-pirn density, cohesion, consistency of pirn diameter, bunch building, chase, winding and binding coils, yarn tails and back wind, spindle speed, direction of rotation, f) degree of automation, g) description of features of a pirn winding machine with respect to a latest commercially available machine.

Module-II (20 hours)
Warping: a) Introduction, b) principal methods of warping, c) warping process, d) warping creels- continuous chain creel, truck creel, magazine creel, automatic creel, unrolling creel e) yarn tension in warping, f) stop motions and measuring motions, g) leasing and beaming, h) beam warping or direct warping- process, machines, i) section warping- process, machines, section building and relating drum storage capacity to beam flange diameter.
4. Sizing: a) Introduction, b) sizing process, c) size ingredients, d) factors which affect the properties of sized yarns, f) preparation of the size paste- formulation and equipments, g) techniques of sizing, h) types of sizing, i) concept of factors governing the pick up of size, j) principal machine elements- creel, size box, drying arrangements, head stock, tension control mechanisms, measuring and marking mechanisms etc., k) modern trends in sizing.

Reaching in and Drawing in: a) Introduction, b) need, c) process, d) modernization, e) related calculations.

Module –III (10 hours)
5. Basic mechanism of Loom (weaving) - a) Classification of looms, history of loom development b) Study of different parts of a Handloom and Powerloom c) Study of basic operations i.e Shedding – types of shedding - study of tappet shedding, Picking and checking mechanism, Beating up etc, Eccentricity of the sley, Timing and seeting.
Text Books and Reference Books:
1. Winding – Silver Jubilee Monograph by BTRA,
2. Sizing – Materials, Methods, Machinery Ajgoankar, Talukdar & Wadekar,
3. Weaving Conversion of Yarn to Fabric Lord & Mohammed,
4. Textile Maths Volume III J.E.Booth,
5. Cotton Weaving Gordeev, Volkov, Blinov & Svyantenko,
6. Weaving Mechanism – Pat-I & II N.N.Banerjee
7. Handbook of Weaving Preparation D.S. Verma,
8.
9. Plain Weaving Motion K.T Aswani

PCTX7203 Fibre Science and Technology – II Lab.

1. To study the stress-strain behavior of different fibres.
2. To study the longitudinal and cross-sectional views of different fibres.
3. To learn the identification of different cellulosic, protein and synthetic fibres by burning test, touching, observing the cross-section.
4. To learn the identification of different cellulosic, protein and synthetic fibres by chemical testing.
5. To determine % of blend composition of different variety of blended yarn (minimum 5 Varieties)

PCTX7204 Yarn Manufacture –II Lab.

1. Study of different parts and flow of material in a Simplex Machine.
2. Study of building mechanism in Simplex.
4. Study of drafting rollers setting in Speed frame.
5. Study of different parts and flow of material in a Ring Frame.
7. To learn the roller setting, spindle gauging and lappet centering of a Ring Frame.
8. Study of Building mechanism in a Ring Frame.
9. Study of different parts of Rotor Spinning Frame.
10. Study of different parts of a Ring Doubler.
11. Study of different parts of Reeling, Bundling, Baling M/c.
12. To Produce a yarn from a given roving/sliver in Ring Frame/ Rotor Frame.
PCTX7205  **Fabric Manufacture - I Lab**

1. Study of the passage of yarn through winding machine and its various parts.
2. To convert some ring bobbins to cone/cheese by adjusting the tension and slub catcher.
4. Study of passage of yarn through a sectional warping m/c and its different parts.
5. Study of path of warp sheet in a multi cylinder-sizing machine.
6. To prepare a size paste for a given sort.
7. To study the working of a automatic knotter on a winding machine
8. To study the passage of yarn and different parts of a plain loom.
9. To study the operational mechanism and different motion in a Power loom
10. To have practice of synchronizing body movements for shedding, picking and beat-up on the handloom by producing a meter of fabric with least fabric faults.

BECS7208  **Database Managements System Lab**

1. Use of SQL syntax: insertion, deletion, join, updation using SQL. (1 class)
2. Programs on join statements and SQL queries including where clause. (1 class)
3. Programs on procedures and functions. (1 class)
4. Programs on database triggers. (1 class)
5. Programs on packages. (1 class)
6. Programs on data recovery using check point technique. (1 class)
7. Concurrency control problem using lock operations. (1 class)
8. Programs on ODBC using either VB or VC++. (1 class)
9. Programs on JDBC. (1 class)
10. Programs on embedded SQL using C / C++ as host language. (1 class)
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| Practical / sessional                     | 2          |        | Practical / sessional                     | 2          |        |
| PCTX7301 Fabric Manufacture-II Lab.       | 0-0-3      | 2      | PCTX7305 Textile Chemical Processing-II Lab| 0-0-3      | 2      |
| PCTX7302 Textile Chemical Processing-I    | 0-0-3      | 2      | PCTX7306 Fabric Manufacture-III Lab        | 0-0-3      | 2      |
| PCTX7303 Testing of Textile Materials Lab | 0-0-3      | 2      | PCTX7307 Textile Design Lab-II            | 0-0-3      | 2      |
| PCTX7304 Textile Design Lab-I             | 0-0-3      | 2      | Total                                     | 6          |        |
| Total                                     | 8          |        |                                           | 24         |        |

Grand Total: 27

BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ORISSA
TEXTILE ENGINEERING
Module I:  Functions of Management
Concept of Management, Management as an Art or Science, The Process of Management, Managerial Skills, Good Managers are Born, not Made, Management is concerned with Ideas, Things and People, How a Manager Induces Workers to Put in Their Best, Levels and Types of Management, Evolution of Management Thought: Managerial Environment, The process of Management-Planning, Organizing, Directing, Staffing, Controlling.

Module II:  Marketing Function of Management.


Reference Books:
2. Business Organization & Management, Tulsia, Pandey, Pearson
3. Marketing Management, Kotler, Keller, Koshi, Jha, Pearson
4. Financial Management, I.M. Pandey, Vikas
5. Human Resource Management, Aswasthapa, TMH.
Unit-I (10 Hours)
Idea of Engineering optimization problems, Classification of optimization algorithms, Modeling of problems and principle of modeling.
Linear programming: Formulation of LPP, Graphical solution, Simplex method, Big-M method, Revised simplex method, Duality theory and its application, Dual simplex method, Sensitivity analysis in linear programming

Unit-II (10 Hours)
Transportation problems: Finding an initial basic feasible solution by Northwest Corner rule, Least Cost rule, Vogel’s approximation method, Degeneracy, Optimality test, MODI method, Stepping stone method
Assignment problems: Hungarian method for solution of Assignment problems
Integer Programming: Branch and Bound algorithm for solution of integer Programming Problems
Queuing models: General characteristics, Markovian queuing model, M/M/1 model, Limited queue capacity, Multiple server, Finite sources, Queue discipline.

Unit-III (10 Hours)
Non-linear programming: Introduction to non-linear programming.
Unconstrained optimization: Fibonacci and Golden Section Search method.
Constrained optimization with equality constraint: Lagrange multiplier, Projected gradient method
Constrained optimization with inequality constraint: Kuhn-Tucker condition, Quadratic programming
Introduction to Genetic Algorithm.

Recommended text books

Recommended Reference books:
Module – I (20 hours)

Functions and working principles of dobby and jacquards, electronic jacquards, Working of multiple box motions and Card saving device attachment

Module-II (10 hours)
Features of an automatic loom, Types of weft feeler mechanism (mechanical, electrical and photo electric type), Automatic cop changing mechanism, Automatic shuttle changing mechanism, Functions of shuttle eye and selvedge weft cutters, automatic weft replenishment-feelers, specialty of automatic shuttle

Module-III (15 hours)
Origin of shuttleless looms, Salient features and motions of shuttle less looms (Gripper, Rapier, Water Jet & Air Jet looms), Mechanisms of weft insertion by projectile, rapier, air jet and water jet. Techno-economics of shuttleless weft insertion systems. Weft accumulators and selvedges used in shuttle less looms.

Production Calculations related to various shuttle and shuttleless loom.

REFERENCE BOOKS:
1. Principle of Weaving , R. Marks and A. T. C. Robbinson
3. Weaving Mechanism, N.N. Banerjee
4. Weaving Calculation, Sengupta
6. Cotton Weaving, V. Goordev
7. Weaving Tablets, TAI
8. Weaving: Conversion from yarn to Fabric, P. R. Lord & Mohamad
Module-I (10 hours)

Dry preparatory process: Mending, Stamping, Shearing and cropping. Singeing- Different methods of singeing (Plate, Roller and Gas Singeing), drawbacks and advantages.


Module-II (15 hours)


Mercerization: Objectives, Process parameters and operation, mechanism related to various physical and chemical changes in cotton during mercerization. Causticization, Barium activity number - its determination and interpretation. Brief idea of hot and cold ammonia mercerization.

Module-III (20 hours)

Theory of dyeing: Classification of Dyes, Dye-fibre interaction,

Dyeing technology of textiles of natural fibres (Cotton, Silk and Wool) with direct, reactive, vat, azoic, sulphur, acid and basic dyes.

Machineries used in wet processing: Jigger, Kier and J-Box system; Hydro-extractor, Drying processes of textile materials (Hot air stenter, cylinder dryer and infrared / RF dyer). Working principles of Winch, Jet, Beam, Hank and Package Dyeing machine.

Books for References:

2. Chemical Technology of Scouring and Bleaching: E. R. Trotman, Griffin.
3. Technology of Bleaching and Mercerisation: V.A. Shenai, Sevak Publication,
5. Dyeing & Chemical Technology of Textile Fibres : E. R. Trotman,
Module-I (15 Hrs)
1. Classification of fabrics; concept of fabric structure; representation of weave; use of point paper, repeat of weave; drafts and peg plan; relationship between weave, draft and peg plan;

**Basic Weaves:** Method of construction, features and uses of plain weave and its derivatives, twill weave and its derivatives, Satin and sateen weaves and their derivatives.

Module-II (15 hours)
Method of preparation, features and uses of Diamond weaves, Honey comb weaves-ordinary and brighton, Huck-a-back and Mockleno weaves, crepe weave.
**Cord weaves:** Method of construction, features, cross-sectional view, and uses – Bedford cord, welt and cork screw
**Stripe and Check Weaves:** Features, Methods of preparation and uses.
**Extra warp and extra weft designs:** Extra weft figuring-concepts of simple techniques; idea of continuous figuring in one extra warp and extra weft.

Module-III (15 hours)
**Terry Weaves:** Definition, classification, process of formation of pile, graphical representation of terry weaves.
**Backed fabrics:** Definition, features, classification and uses of backed fabrics. Graphical representation of warp backed, weft backed cloth, reversible backed fabric and wadded backed fabric.
**Double Cloth:** Definition, features, classification and uses. Method of preparation of self stitched and centre stitched double cloths, their salient feature and uses. Wadded double cloth.
Brief idea on cross-woven designs and floral designs.

Books Recommended
Module- I (15 Hrs)
Introduction to textile testing: Relative and absolute humidity and standard testing atmosphere, conditioning
Yarn dimension: Yarn linear density-direct and indirect system; Conversion from one system to another, Measurement of yarn count, linear density of plied and cable structure, Yarn diameter and packing density. Yarn twist – its type and its relation with yarn strength, measurement of yarn twist.

Module-II (15 Hrs)
Fabric Dimension- Measurements of different dimensions properties like length, width, thread density, yarn number, yarn crimp, weave, cover factor, weight, and thickness.
Physical properties of fabrics- shrinkage, air permeability, water permeability, crease recovery, stiffness, drape and handle. Determination of abrasion resistance and pilling

Module- III (15 Hrs)
Mechanical properties of Textiles: Characterization of mechanical behaviour of textiles; stress strain curve; mechanics of CRT, CRE & CRL type testers and their comparisons,
Measurement of Yarn strength – lea strength, single yarn strength
Measurement of Fabric strength: Tensile strength, Tearing strength and Bursting strength of cloth.

Books for References:
1. Principle of Textile Testing: J.E. Booth
Free Electives

PETX5301 COMPUTER AIDED GARMENT DESIGN (3-0-0)

Module – I  (10 hours)
Elements of designs and their development using CAD software. Principles of motif generation on computers / motif for border, motif for all over design. Principles & elements of colour. Colour selection & application through CAD.

Module – II  (10 hours)
Operational principles of various tools of CAD software for woven knitted & Printed design. Weave simulation, Draping & 3D image on CAD. Principles of Development of basic weave design & their derivatives. Concept of garment design developing & cutting in fashion studio using CAD software.

Module – III  (10 hours)
Principles of CAD for pattern making, Pattern grading and pattern layout. Use of Anthropometric data for CAD based garment manufacturing. Detailed study on various Computer Aided Cutting & sewing machineries.

REFERENCE BOOK:
1. CAD/CAM by Groover & zimmer
**Module – I**

**Module – II**
(b)Air Pollution : Air pollution and pollutants, criteria pollutants, Acid deposition, Global climate change –greenhouse gases, non-criteria pollutants, air pollution meteorology, Atmospheric dispersion. Industrial Air Emission Control. Flue gas desulphurization, NOx removal, Fugitive emissions.

**Module – III**

**Text Book :**
2. Environmental Engineering by Prof B.K. Mohapatra, Dhanpat Rai & Co Publication

**Reference Books**
1. Environmental Engineering by Arcadio P. Sincero & Gergoria A. Sincero PHI Publication
3. Environmental Science, Curringham & Saigo, TMH,
4. Man and Environment by Dash & Mishra
5. An Introduction to Environmental Engineering and Science by Gilbert M. Masters & Wendell P. Ela - PHI Publication.
Module - I  
**12 Hours**
Overview: Data warehousing, The compelling need for data warehousing, the Building blocks of data warehouse, data warehouses and data marts, overview of the components, metadata in the data warehouse, trends In data warehousing, emergence of standards, OLAP, web enabled data warehouse, Introduction to the data warehouse project, understanding data warehousing Architecture, Data warehousing implementation, from data warehousing to data mining.

Module - II  
**14 Hours**
Introduction to Data mining, Data mining Functionalities, Data preprocessing (data summarization, data cleaning, data integration and transformation, data reduction, data discretization), Mining frequent patterns, associations, correlations (market basket analysis, the apriori algorithm, mining various kinds of association rules, from association mining to correlation analysis) Classification: classification by decision tree induction, Rule based classification, classification by neural networks, classification by genetic algorithm

Module - III  
**10 Hours**
Cluster Analysis: types of data in cluster analysis, A categorization of major clustering methods(partitioning methods, hierarchical methods),clustering high dimensional data, outlier analysis Advanced techniques: web mining, spatial mining, temporal mining, Data mining applications in (financial data Analysis, retail industry, telecommunication industry, Biological data analysis, intrusion detection, in other scientific applications)

Text Books:
1. Data warehousing Fundamentals: Paulraj Ponniah, Willey India.

Reference books:
1. Data Mining: Arun Pujari, University Press
2. Data Mining –a Tutorial based primer by R.J.Roiger, M.W.Geatz, Pearson Education.
3. Data Mining & Data Warehousing Using OLAP: Berson, TMH.
4. Data Warehousing: Reema Thareja, Oxford University Press
PCTX7301  FABRIC MANUFACTURE – II LAB (0-0-3)

1. To study the working of five wheel take up mechanism and calculation of dividend.
2. To study the working of seven wheel take up mechanism and calculation of dividend.
3. To study the negative let off motion.
4. To study the loose reed and fast reed warp protector mechanism.
5. Study of side weft fork motion.
7. Study of 4 x 1 drop box mechanism and preparation of pattern card.
8. Study of automatic cop changing mechanism with mechanical weft feeler.
9. To study and sketch the working of ordinary climax dobby.
10. To study and sketch the working of ordinary paper dobby.
11. To study pegging the lattice for the desired peg plan.
12. To study and sketch working of a double lift jacquard along with its types of needles, cylinders and their mounting.
13. To study the different mechanism of Air-jet loom.
14. To study the different mechanism of Rapier loom.
15. To find out the loom speed and production calculation of different types of loom available in laboratory.

PCTX7302  TEXTILE CHEMICAL PROCESSING –I Lab (0-0-3)

Desizing and Scouring of Cotton yarn / Fabric.
Bleaching of Cotton yarn / Fabric with Bleaching powder , NaClO2/NaOCl
5. Degumming of Silk
6. Scouring and Bleaching of Wool.
10. Measurement of fastness properties to washing, light , rubbing.

PCTX7303  TESTING OF TEXTILE MATERIAL LAB (0-0-3)

Yarn Testing
1. To determine the hank of a Drawing sliver and Roving by using physical balance
2. To determine the count of a yarn by using physical/electronic balance.
3. To measure the TPI of given yarn sample using Twist Tester.
4. To determine the Count and CSP by using Knowle’s balance and lea strength tester
5. To determine the single yarn strength.
6. To measure U% /CV% of a yarn
Fabric Testing

1. To characterize a woven fabric with respect to its dimensional properties:
   - Thread density, yarn number, yarn crimp, weave, cover factor, weight (GSM),
   - areal density, skewness, thickness
2. To determine the tensile strength of a woven fabric by strip test method. Draw
   load-elongation curve of a woven fabric.
3. To determine the tear strength of a fabric using Elmendorf tear tester or
   ballistic tester.
4. To determine the bursting strength of a fabric using hydraulic bursting tester.
5. To determine the abrasion resistance of a fabric.
6. To determine the bending length and flexural rigidity of a woven fabric using
   the Shirley tester.
7. To determine the crease recovery of fabric and observe the effect of loading
   time and recovery time on crease recovery.
8. To determine the drape coefficient of woven and knitted fabric using the drape
   meter.

PCTX7304 TEXTILE DESIGN LAB-I (0-0-3)

1. Analysis of the following Cloths in respect to fabric parameters and design with
   drafting and lifting plan, denting order, colour plan and use:
   - Plain and its derivatives
   - Twill and its derivatives
   - Diamonds and Drapers
   - Honey comb
   - Huck-a-back
   - Mockleno
   - Welts and Piques
   - Stripe and Cheques
     - Satin / Sateen
   - Terry pile
   - Colour and Weave effect.
   - Double Cloth
   - Extra warp and weft

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Module-I (15 Hours)
Dyeing of polyester fabric using disperse dye by HT&HP, Carrier and Thermosol processes; Dyeing of cationic dyeable polyester fabrics; dyeing of P/C and P/W blended fabrics with suitable dyes; Dyeing of Nylon with acid dyes; dyeing of acrylic with basic dyes.

Module-II (15 Hours)
Printing: Object of Printing, Difference between dyeing and printing, ingredients of printing paste. Discuss different styles of printing: Direct, Discharge and Resist. Methods of printing- Block printing, Screen printing, Roller printing, Rotary Screen printing, Transfer printing. Printing of cotton (with reactive, vat and azoic dyes and pigment), Silk (with acid dyes), Polyester (with disperse dye) and Acrylic (with basic dyes).

Module-III (15 Hours)
Finishing: Classification and importance of finishing. Mechanical finish: Calendaring and working of different calendaring machines; Sanforizing.
Chemical finish: Anti crease finish, water proof and water repellent finish; flame retardant and fire proof finish; Moth proof finish; Soil release finish; Organdi finish; Bio-polishing, Stonewashing of denim, Anti-bacterial finish, UV finish.

Books for References:

1. Dyeing & Chemical Technology of Textile Fibres : E. R. Trotman,
2. Technology of Dyeing : V.A. Shenai, Sevak Publication.
3. Chemistry of the Textiles Industry: C. M. Carr
4. Textile Printing: L.W.C. Miles
5. Technology of Textile Printing: R. S. Prayog
7. Technology of Textile Finishing: V. A. Shenai
Module I (15 Hours)
Introduction to Braiding, Needle (Tape) loom weaving, multiphase weaving and circular weaving

KNITTING: Introduction to Knitting: Difference between woven and knitted products and process. Classification of knitting machines and mechanisms, terms and definitions used in knitting. Elements of knitting: needles, sinker and cam. Yarn requirement for knitting, norms of cotton yarn for knitting, fibres used in knitting for both weft and warp knitting. Weft Knitting: Classification and representation of weft knit structures, structures and characteristics of plain, rib, interlock and purl structures.

MODULE II (10 Hours)
WARP KNITTING: basic principle, types of warp knitting machines, different motions, basic warp knitted structures, fabrics and their uses.

Fabric defects, Fabric parameters and constants, Fabric relaxation treatments, Calculation related to knitting.

MODULE-III (20 HOURS)

Book Recommended:
3. Aswani K T, “Fancy Weaving mechanism”, Mahajan Publisher Private Ltd., Ahmedabad, India (1990)
Module-I (15 hours)

Introduction: Definition and scope for technical textiles, present status and future of technical textile. Brief idea about technical fibres - Carbon fibres-Aramid and related fibres, Glass threads, composite material.

Filtration textiles: Definition of filtration parameters, theory of dust collection and solid liquid separation, filtration requirements, concept of pore size and particle size, role of fiber, fabric construction and finishing treatments.

Geotextiles: Brief idea about geo-synthetics and their uses, essential properties of geotextiles, geotextile testing and evaluation, application examples of geotextiles.

Module-II (15 hours)

Medical textiles: Classification of medical textiles. Medical Textiles: Surgical Textiles and Sutures. Cardio Vascular Textiles (Knitted cardiac biological valves). Dialytic Textiles, Hollow fibres as dialysis membrane, Hospital Textiles- operating and post operating clothing, disposable drapes. Textiles for sanitary applications.

Protective Clothing: Brief idea about different type of protective clothing, functional requirement of textiles in defence including ballistic protection materials and parachute cloth, temperature and flame retardant clothing, chemical protective clothing, water proof breathable fabrics.

Module-III (15 hours)

Sports and recreation textiles: Functional requirement of different types of product and their construction.

Automotive textiles: Brief idea about the important properties and requirements in automotive textiles, textiles components in tyre, tyre structure and design.

Other uses of technical textile: Textiles in agriculture, electronics, power transmission belting, hoses, canvas covers and tarpaulins.

Books Recommended

Module-I (15 hours)

Overview Of Special Textiles: Definition, Significance of special textiles, Differences between conventional and special textiles, classification of special textiles, scope for special textiles.

Cross Woven structure: Principles of leno structures; bottom and top douping, methods of producing leno and idea of simple constructions; half and full cross leno; net leno; structural difference between gauge and leno. Cellular and Russian leno

Principles of Developing design for Tapestry and Quilts

Braided and Pile Fabrics: 2-D Braiding – Circular braiding; Flat braiding, 3-D braiding. Formation of Pile structures – Loop pile, cut pile.

Module-II (15 hours)


Module-III (15 hours)

Textiles in Defence: Manufacturing process of military textiles – ballistic protection, chemical & biological protection, environmental protection, nuclear protective fabrics, thermal insulation and High altitude fabric. Specific testing methods for Technical textiles

Medical Textiles: Manufacturing process of Medical Textiles. Testing methods for Medical Textiles – Knot-pull tensile strength


Industrial fabrics: Canvases, Belts, Parachute Fabrics and umbrella cloth. High stretch fabric (Lycra Fabric)

Books for references:

Module-I (15 hours)

Introduction: Definition of quality and its importance, different approaches to quality, Description of Deming’s fourteen points and Ishikawa’s seven tools of quality. Utility of statistical method for quality control with special reference to textile industry

Statistical Analysis for Continuous Function: Population and sampling distribution of mean, statistical estimation theory, points estimates, concept of single tail and double tail test, confidence limit, statistical decision theory, tests of hypotheses and significances, type I and type II errors. Test for single variance, F-test, test for the difference between two variances, confidence limits for variance and ratio of two variances, choice of sample size.

Statistical Analysis for Discrete Function: Application of binomial and Poisson’s distribution, normal approximation, test for a single proportion and difference between two proportions, application of $\chi^2$ distribution.

Module-II (15 hours)

Statistical Process Control:

Control Charts: Advantages using quality control charts, random and assignable causes, action and warning limits, $\bar{X}$, $R$, $\bar{p}$, $n\bar{p}$ and $c$ chart, Process Capability Ratio ($C_P$ and $C_{PK}$), concept of 6 sigma process control.

Acceptance Sampling: Basic idea about acceptance sampling, OC curve, producer’s risk and customer’s risk.

ANOVA and Regression: Some basic concept of Analysis of Variance, method of least squares, linear regression methodology, correlation and standard error.

Module-III (15 hours)

Total Quality Management (TQM),


Quality circles: Back ground to quality circle, essential preconditions for successful quality circles, organizing and training for quality control (with special reference to Textile Industry).

Books Recommended
Module-I
**Garment Manufacturing**: Introduction, Indian apparel industry. Different garment production systems.

**Selection of Fabrics**: Garment from Woven and knitted fabrics, Various fabrics available in market, their characteristics and applications to suit to different purposes

**Pattern making**: Introduction to pattern making and garment, Construction. Different terminologies. Drafting, Basic bodies blocks, Muslin pattern. Commercial pattern, Methods of making basic pattern, grading of pattern, size, size charts.

**Spreading and lay planning**: Introduction to symmetrical and asymmetrical fabrics, criteria of spreading, methods of spreading, spreading m/cs. Principles of lay plan, types of lay plan.

Module-II
**Garment Cutting**: Introduction to cutting room processes, cutting methods and their merit demerits. Bundling system.

**Garment Sewing**: Introduction to sewing m/c and its parts, sewing room processes and working details. Different types of sewing m/c and its suitability, Different sewing m/c driving system. Attachment of sewing m/c. Sewing needle and its sizes.

**Sewing stitches and seams types**: Stitch formation, types of stitches, seam classification, seam geometry seam strength and slippage, seam puckering. Thread calculation and its consumption

**Trimming and Garment accessories**: Definition, types, trimming methodologies and accessories application.

Module-III
**Garment finishing**: Fasteners, thread tucking, care and size labeling system, checking, pressing, folding and packing, packing standards for domestic and export markets.

**Quality Control in Garment manufacturing**: Control in pattern making, grading, fabric laying, marking, sewing and finishing, control of garment defects.

**Computer Application in Garment Manufacturing**: Application in pattern making, grading, lay planning, sewing and finishing, computer aided embroidery designs. Concepts of computer integrated manufacturing (CIM) to the garment industry.

Books Recommended
Module – I

   Direct Kinematic model: Mechanical Structure and notations, Description of links and joints, Kinematic modeling of the manipulator, Denavit-Hartenberg Notation, Kinematic relationship between adjacent links, Manipulator Transformation matrix.

Module – II
3. Inverse Kinematics: Manipulator workspace, Solvable of inverse kinematic model, Manipulator Jacobian, Jacobian inverse, Jacobian singularity, Static analysis.


Module – III

7. Trajectory Planning: Definition and planning tasks, Joint space planning, Cartesian space planning.

8. Applications of Robotics: Capabilities of robots, Material handling, Machine loading and unloading, Robot assembly, Inspection, Welding, Obstacle avoidance.

Text Books:
2. Introduction to Robotics: Mechanics and control, John J Craig, PHI

Reference Books:
3. Robotics, Appuu Kuttan K.K., I.K. international
4. Robot Dynamics and Control, M.W. Spong and M. Vidyasagar, Wiley India.
5. Industrial Robotics Technology, programming and application, M.P. Groover, TMH
FEFT6302 INTELLIGENT AND FUNCTIONAL CLOTHING
(3-0-0)

MODULE –I (10 hours)


MODULE –II (10 hours)

Protective clothing from x-rays, gamma chamber, Bullet proof and ballistic protective clothing. Detailed study of Space suit.

MODULE –III (10 hours)

Smart Garment: Chameleonic Garments, Communicative Garment, Shape memory Garment, Responsive Garment.
Wearable electronics: Musical Jacket, Garment fitted with electronics appliances like torch, mobile, calculator, motherboard etc.

Reference Books:

1. Industrial Textile by Sabit Adnoor.

PCTX7305 TEXTILE CHEMICAL PROCESSING - II LAB.

1. Dyeing of Polyester yarn/fabric with Disperse Dye
2. Dyeing of Nylon yarn/fabric with Acid Dye.
3. Dyeing of Acrylic yarn/fabric with Basic Dye
4. Dyeing of blended fabric with various dyes
5. Block/Screen printing of cotton and silk fabric with suitable dyes.
10. Determination of the dye exertion, shade % by spectrophotometer.
To study the path of yarn through plain knitting machine.
To study the different knitting elements including the cam system.
To study the driving mechanism of plain knitting m/c.
To study the cloth take-down mechanism of plain knitting m/c.
To study the rib knitting m/c including arrangement of dial and cylinder needles, cam system and driving mechanism.
To study the Interlock knitting m/c including arrangement of dial and cylinder needles, cam system and driving mechanism.
To study cam system of V - bed rib knitting m/c.
To study driving mechanism of V - bed rib knitting m/c.
Preparation of Fabric sample (rib, circular, half cardigan and full cardigan) in V-bed rib knitting machine.
To study the effect on loop length with the change in cam setting in flat knitting machine.
To study the effect of variation in yarn input tension on the loop length in V-bed rib flat knitting machine.
To study plain, rib and Interlock knitted fabrics (course per inch, wales per inch, loop length etc.)

1. Free hand sketching, arrangement of motifs on different bases.
2. Practice in colour mixing - Light theory, pigment theory charts.
3. Preparation of painted designs for stripe, check, spotted and diaper fabrics.
4. Development of point paper design for dobby weaving.
   ( Extra warp/Extra weft/ double cloth/backed cloth)
5. Development of point paper design for jacquard weaving.
6. Working with Corel draw & Making of a sari design on Corel draw.
7. Working with CAD software and designing different colour pattern, motif for dobby weaving.
8. Working with CAD software and designing different colour pattern, motif for Jacquard weaving

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<tr>
<th>Course Code</th>
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Total: 21
Module-I (14 Hours)
1. **Yarn Geometry**: Basic geometry of twisted yarns, the idealized helical yarn structure and its deviation. Yarn diameter and count, Twist contraction and retraction, specific volume, packing of the fibres in yarn, packing fraction of yarn.

2. **Fibre Migration**: Ideal migration, Parameters affecting migration, characterization of migration behaviour, mechanism of migration in single and plied structure.

Module-II (14 Hours)
3. **Structural Mechanics**: Analysis of tensile behaviour of continuous filament. Small extension theory without and with considering lateral contraction, prediction of breakage, nature of rupture for continuous filament yarn, extension and breakage of spun yarn: traditional view and approach by Hearle and E1-Sheikh.


Module-III (12 Hours)

6. **Fabric Properties**: An elementary idea about tensile, bending, shear and drape behaviour of fabric. An elementary idea about fabric objective measurement

**Books Recommended**
Module-I (14 Hours)
1. Drives and Power Transmission:
Belt Drives (mathematical representation of open and cross drives), Concept of Flat and V pulley, timing belt drive. Chain & sprocket drum, Gear Drives- study of gears, type of gears in spinning preparatory machines, Ring frame, looms etc., worm and worm wheels in looms and ring frames, Bevel gears in carding, speed frames etc., epicyclic and differential gearing in comber and speed frames, rack & pinion, movement of bobbin drive in speed frame, idea of double hook joint, planetary mechanism in coiling. Screw traversing mechanism.

2. Intermittent Rotary motion:
Ratchet and pawl mechanism, Let off and Take up motion in weaving machines, Geneva wheel, special oscillatory mechanism, detaching roller drive in combing

3. Cams:
Introduction, types of cams, types of follower, follower displacement programming, motions of the follower, cams with specified contours- tappets, winding cams, ring frame builder cams, picking cam, knitting cam, etc.

4. Clutches & Brake:

Module-II (14 Hours)
5. Linkage Mechanisms: Link , kinematic pair, degrees of freedom, kinematic chain, linkage mechanism and structure, Classification of mechanisms, Velocity & acceleration diagrams of four and six bar linkage mechanisms, Relative velocity and instantaneous method, Applications of different mechanism for the sley driving.

6. Control mechanisms: Introduction- elements of control mechanism- open loop and closed loop systems, the detecting elements - detection of broken yarns and slivers, pick finding devices on loom, control of yarn and cloth tension, stretch control in sizing, control of temperature and liquor ratio in textile processing.

7. Friction and lubrication: introduction, the nature of friction, lubrication by means of chemical films, lubrication by thick films of fluid, the use rolling instead of sliding contact, journal and roller bearing - classification of bearings used in textile machines, special lubrication techniques in textile machines, friction in textile materials, friction clutches and brakes in textile machines, friction drives, cone drum drives in speed frame, indirect loom beam drive, friction tensioner in winding etc.

Module-III (12 Hours)
8. Balancing of Machine parts: Basic concepts with reference to balancing of card cylinder, bobbin rail of speed frame, flyer balancing, ring rail & spindle in ring frame, rotor, crank shaft balancing etc.

9. Vibration: Basic concepts, vibration in looms, ring frame, speed frame etc.

10. Static and Dynamic force analysis:
Introduction, basic concepts, static equilibrium; concept of dynamic analysis, D’Alembert’s principle, dynamic analysis of crank sley mechanism, turning moment of ring frame main shaft, crank shaft of loom etc., fly wheels on looms etc., moment of inertia, centripetal and centrifugal forces, Mathematical concept of balloon formation in ring frame and winding, Forces acting on yarn in ring frame, roller movement and loading in drafting, motion of winding traverse, motion of beams and drums, Mathematical analysis of beat-up mechanism. Dynamics of shedding, dynamics of Torsion bar picking mechanism.

Books Recommended
3. Textile Mechanics – W.M. Taggart
5. Textile Mathematics, Vol-I, II & III - J.E. Booth, Textile Institute, Butterworth
Module-I (12 Hours)
1. Design of various opener and cleaning and their position in a modern Blow room line, Analysis of piano feed regulating motion. Theories of carding and transfer mechanism of fibres – design aspects and factors for cylinder load and transfer efficiency, Improvement in technology of carding for increased production and improved quality of sliver, high speed carding: designs of carding machines for improved performances. Theories of drafting- Design features of high drafting system and roller weighting in draw frame, speed frame and ring frame. Recent developments in design of drawing, lap preparation, combing processes, speed frames, basic principle of design of autolevellers. Differential motion used in speed frames, Designing of cone drums for speed frame.

Module-II (14 Hours)
2. Design changes in drafting zone of ring frame for compact spinning system, Theory of ballooning in ring spinning, Forces acting and yarn tension in ring spinning, Development in design of spindle, ring and traveller, Design of cam and building mechanism in modern ring frame, drives on modern ring frames. Design of opening roller, naval and rotor in rotor spinning system Design features of TFO twister and its advantages over ring twister.


Module-III (14 Hours)

4. Kinematics of sley and heald motion, Shed depth and interference factor, Shedding cam design, Mechanism of picking, Shuttle retardation and its importance, Causes of pick variation, Cloth fell equation, Bumping condition.

Books recommended
Module-I (12 Hours)
1. System of process control in spinning: Role and scope, establishing norms or standards, collection and interpretation of data and corrective actions.
2. Mixing quality and Cost: Control of mixing quality through fibre characteristics, control of mixing cost and quality, LP approach for cotton mixing. Applications of AFIS and HVI
4. Measurement and analysis of productivity, means to improve it by control of the end breaks in spinning. Controlling end breakage rate- causes and remedies, Controlling of soft waste and hard waste generation. Yarn realization – Importance, estimation of yarn realization, norms for yarn realization

Module-II (14 Hours)
5. Control of yarn quality: Control of count at various stages during yarn manufacture, Improving Sliver Evenness in Draw Frame, Improving Roving Evenness. Computation of within bobbin and between bobbins lea count variations, strength, unevenness and imperfections of yarn. Causes and remedies of yarn faults and package defects, assessment of yarn appearance, standard process and quality parameters for different counts, on line and off line monitoring systems
6. Process Control in Winding: Control of quality of knot, characteristics of good splice-appearance and strength rating, yarn faults classification by Classimat, yarn clearer setting adjustment and removal of yarn faults, package defects, performance in winding, control of productivity, calculation of expected efficiency of an Autoconer. Control of Tension level, Relative humidity and temperature,
7. Process Control in warping: Control of end breaks, tension levels, quality and the productivity in warping.

Module-III (14 Hours)
9. Process Control in Sizing: Choice of size receipe and preparation, control of size pick-up, control of yarn stretch in different zones and measurement of stretch in sizing, Control of moisture in sized yarns, quality of sized beam, Improvement of weavability of sized yarns, expected efficiency in sizing, Direct control of size losses.
10. Process Control in Drawing-in and Tying: Care in use and selection of healds and reeds; Drop Pins, Care in Drawing-in and Warp tying.
11. Control of Productivity in Loom Shed: Control of Loom Speed, efficiency and stoppages, quality of yarn. Calculations on loom efficiency, expected loom efficiency of Automatic Looms,
12. Control of Hard Waste and Consumption of Accessories: Control of waste in winding, warping, sizing and drawing-in, pirn winding and loom shed. Selection and care of accessories

Books Recommended
2. Monograph series in spinning, BTRA Publication
3. Quality Control in spinning, Ratanam T V SITRA Publication
4. End breaks in Ring Spinning, ATIRA Publication.
Module-I (14 Hours)
1. Introduction: Definition of process control and Quality control. Need for quality control in textile chemical processing – Flowcharts indicating process control and quality control tests to be carried out in Desizing, Scouring, Bleaching, Souring, Mercerizing, Dyeing, Printing and Finishing.
3. Analysis of Bleaching and Mercerizing: Absorbency tests by Drop test method and Wicks method, determination of ash content, determination of whiteness and whiteness retention, determination of caustic soda concentration and silica in peroxide bleach bath, determination of Barium Activity Number, determination of fabric shrinkage, lustre number and deconvolution count.

Module-II (14 Hours)

Module-III (12 Hours)
7. Computer Colour Matching: Concept of Computer Colour Matching (CCM), working principle of CCM, advantages and limitations of CCM, applications of CCM.
8. Quality Control and Productivity: Quality control and productivity in Bleaching, dyeing, printing and finishing, control of damages in chemical processing.

Books Recommended:
Module – I (16 Hours)

1. Long Staple Spinning:
   Principle, working and process parameters of spinning system for long staple fibres and their blends—such as woollen, worsted, spun silk, flax and jute spinning system.

Module – II (14 Hours)

2. Study of the spinning of man-made staple fibres. Spinning of dyed fibres, Spinning of micro fibres

3. Tow to sliver formation and bulked Acrylic yarn production.


Module-III (10 Hours)

5. Principle and mechanism of yarn formation by Siro Spinning system -.
6. Principle and mechanism of formation of core-spun yarn on various spinning system
7. Principle and mechanism of yarn formation by some unconventional spinning system:
   - Self-twisted yarn- concept of Repco spinning
   - Twist less yarn- concept of Twilo and Bobtex process,
   - Wrap-spun yarn- concept of wrap spinning
   - Concept of electrostatic spinning.

Books Recommended:
1. Spun Yarn Technology – ERIC OXTOBY
2. Textile Yarn- Goswami., Martindle, Scardino
3. New Spinning Technology, W. Klien
Module-I (12 Hours)
1. Development in Weaving Preparatory Processes:
2. Unconventional Weaving: Modern Developments in Projectile, Rapier, Air jet, and Water jet machines, measurement and control of tension variation on Unconventional weaving m/c.

Module-II (13 Hours)
3. Production of Terry/Pile Fabrics: Essential features and production techniques of terry/pile fabrics in weaving, knitting and nonwoven machines.
4. Developments in Knitting: Development in weft and warp knitting, New structures, mechanics of knitting, production of shaped garments/panels in knitting
5. Developments in Nonwoven: Developments in web formation, bonding of web and structures in nonwoven fabrics

Module-III (15 Hours)
6. 3D Fabrics: Concept of manufacturing 3D fabrics using different techniques of fabric formation and their uses.
8. Complex Textiles:
Gauge and leno structure with their production techniques.
Type of Carpets, production of hand knotted carpets and machine made carpets (Brussels, Wilton, Tufted and Face to Face Carpets), Unconventional methods of making carpets – thermal bonding, stitch bonding, flocking and knitting
Narrow fabrics: Weaving machines for narrow fabrics. Ribbon, tapes & webbings manufacturing techniques

Books Recommended:
Module-I (10 Hours)

1. **Cellulosic fibres**: New cellulosic fibre derivatives and their production systems, new environmental friendly and cost saving developments.

2. **Synthetic fibres**: Development of properties/structure like antistatic, hydrophilic, hollow, multi-lobal cross-section, micro voids, microgrooves, low pilling, flame retardant, carrier free dye able, cationic dye able, silk like appearance in synthetic fibres (polyester, nylon, acrylic, poly-propylene etc).

Module-II (15 Hours)

3. **High performance fibres**:
   Production process outline and properties of elastomeric fibres (lycra)
   Production process outline and properties of high performance fibres like Kevler & Nomex (aramid), spectrum and dynema (HDPE), aromatic polyesters etc.
   Production process outline, properties and applications of carbon fibres
   Production process outline, properties and applications of Glass, ceramic, metallic, silicon carbide and other fibres

Module-III (15 Hours)

4. Introduction to health fibres like Polylactic acid (PLA), Hydrogel fibre etc.

5. Production process outline, characteristics and applications of micro-denier fibres and Nano fibres.

6. Introduction to specialty fibres for using in technical textiles like Geo-tech, sport- tech, mobil- tech. etc,

**Books Recommended:**

1. New Fibres by Hongu and Phillips,
2. Polymers for Engineering Applications by R. B. Seymour,
ARTIFICIAL INTELLIGENCE

Module 1    12Hrs

Module 2    10Hrs

Module 3    8Hrs

Text Book:

References:
  1) Introduction to Artificial Intelligence & Expert Systems, Dan W Patterson, PHI., 2010
  2) S Kaushik, Artificial Intelligence, Cengage Learning, 1st ed. 2011
Module-1  
Introduction to apparel marketing, objectives of marketing. Scope & potential of apparel product in domestic & International market, exploration of fashion industry, concept of fashion forecasting.
Present scenario of apparel industry in India – challenges & prospects of these industries.
Instruments of trade policy

Module – II  
Introduction to retailing. Types of retailers, Types of retail ownership, elements of retail mix, types of retail locations, Benefits of retailing, Role of a retail merchandiser and buyer. Merchandise planning, Retail pricing and repricing, Retail pricing policies/ strategies (Market Skimming, Market Penetration, Price bundling, Leader pricing, Everyday low pricing, Odd pricing, etc.) Retail Store Design & Visual merchandising. Promotion of fashion.

Module-III  
International marketing environment, identifying foreign apparel markets, International marketing mix- PLC model, pricing decision, channels of distribution.
Export procedure & documentation, export assistance- various scheme, sources of information, role of export promotion counseling, INCO terms, terms of payment, export finance.
Working of export houses, categories – star trading export house & buying houses. Concept of Out sourcing

Reference Books:
1. International marketing management – Vasshney & Bhattachary
3. International marketing – Cateora
4. Retail Management Text & Cases 2nd Edition (Tata McGraw-Hill)- Swapna Pradhan,
Module- I: Principles and concepts

Module- II: Bioreactor Analysis
Analysis of ideal bioreactors: Fed-Batch reactors, Enzyme catalyzed reactions in CSTRs, CSTR reactors with Recycle and Wall growth, Ideal Plug- Flow Tubular reactor. Analysis of Non-ideal Reactor Analysis: Concept of ideal and non-ideal reactor; residence time distribution; models of non-ideal reactors – plug flow reactor for microbial processes; Mass transfer in biochemical processes; Multiphase bioreactors – packed bed with immobilized enzymes or microbial cells; three – phase fluidized bed trickling bed reactor; Design and analysis of the above reactor systems; Gas liquid reactors, Reactor stability.

Module- III: Bioreactor Design
Design considerations: oxygen transfer, heat transfer, rheology, mixing. Scale up and scale down concepts. Bioprocess control and computer coupled bioreactors; Growth and product formation by recombinant cells. Mechanical fittings in a bioreactor: vessel, agitation system materials, welds, finish, valves, piping and valves for biotechnology, special requirements of utilities and cleaning of production plants. Instrumentation and control of bioprocesses: Physical and chemical sensors, online sensors for cell properties, off-line analytical methods; Biosensors. Bioreactor design calculation.

Text Books
1. Levenspiel, O., Chemical Reaction Engineering, Wiley Eastern Ltd.
Module-I  
1. Application of process control approach in apparel manufacturing through estimation of labor productivity, m/c productivity, quality and cost control  
2. Quality control parameters from raw fabric to finished garment for monitoring Process. -Raw material stage, In process, pattern to finishing, Final: Assessment of fit while final inspection to be tested against size chart for specific garments.

Module-II  
3. Quality parameters to be checked for finished garment to eliminate rejection- garment checking in 3 zones on basis of specification sheet.  
4. Quality parameters in trims- buttons, linings, interlinings, zippers and others  
5. Inspection, defects analysis and estimation of value loss both for fabric and Finished garment, classification of on 4-point system, 6-point system, 10-point System, major and minor defects, garments rejection. AQL, AOQL estimation.

Module-III  
6. Evaluation of sewing process to assist process control in apparel manufacturing  
   -Evaluation of sewability.  
   -Evaluation of thread tension.  
   -Evaluation of damage on thread, fabric needle for control of sewing speed, needle heating, thread tension.  
Modern Fabric evaluation technique to support product development : KES instrument, FAST instrument and other subjective and objective evaluation methods for assessing product performances. HVI instrument.  
7. Knowledge on standard norms for various process and quality parameters. Statistical Quality Control (SQC)- acceptance sampling. Introduction to TQM, ISO, six sigma

REFERENCE BOOKS:

1. Basic process and clothing construction: SHERIE DOONGALI  
2. Managing productivity in apparel industry: Rajesh Bheda  
3. Apparel manufacturing hand book: Jacob Solinger  
4. Journals on Apparel Industry/Manufacturing  
5. Apparel production: sewn product analysis: Glock and Kunz- Prentice Hall  
7. An introduction to quality control for apparel industry- P Mehta
COMPUTER GRAPHICS

Module – I (10 hours)
Overview of Graphics System: Video Display Units, Raster-Scan and Random Scan Systems, Graphics Input and Output Devices.
Two Dimensional Geometric Transformation: Basic Transformation (Translation, rotation, Scaling) Matrix Representation, Composite Transformations, Reflection, Shear, Transformation between coordinate systems.
Two Dimensional Viewing: Window-to- View port Coordinate Transformation.

Module – II (12 hours)
Line Clipping (Cohen-Sutherland Algorithm) and Polygon Clipping (Sutherland-Hodgeman Algorithm).
Aliasing and Antialiasing, Half toning, Thresholding and Dithering, Scan conversion of Character.
Polygon Filling: Seed Fill Algorithm, Scan line Algorithm.
Two Dimensional Object Representation: Spline Representation, Bezier Curves and B-Spline Curves.
Fractal Geometry: Fractal Classification and Fractal Dimension.
Three Dimensional Geometric and Modeling Transformations: Translation Rotation, Scaling, Reflections, shear, Composite Transformation.
Projections: Parallel Projection and Perspective Projection.

Module – III (8 hours)
Illumination Models: Basic Models, Displaying Light Intensities.
Surface Rendering Methods: Polygon Rendering Methods: Gouraud Shading and Phong Shading.
Computer Animation: Types of Animation, Key frame Vs. Procedural Animation, methods of controlling Animation, Morphing.

Textbook

Reference Books
2. Procedural Elements of Computer Graphics- David Rogers (TMH)
Students will present seminar on one month Industrial Internship, they use to undergo in summer vacation after 6\textsuperscript{th} Semester Examination. Seminar topics will cover the following information to be learned during the industrial training.

1. Orientation of the mill, name and address, area and site details of the mill, product range of the mill, rules and regulations of the mill
2. Organizational setup, category wise number of workers, number of supervisory staff and general staff, yearly turnover.
3. Manufacturing process followed by the mill, significance of the plant layout with respect to the manufacturing process, technical details of the manufacturing department, maintenance management.
4. Technical project work taken if any

In this semester, students are required to define the problem, to review scientific literatures, identify possible solutions, select the best solution, develop an action plan, submit a written report and present the initial progress of the work in a seminar for assessment as per university norms.
Objective: This course introduces the students to the environmental consequences of Industries, development actions etc. and the methods of minimizing their impact through technology and legal systems.

Module – I

Module – II
Water Treatment: Water treatment processes, Pre-treatment of water, Conventional process, Advanced water treatment process.
Air Pollution : Air pollution and pollutants, criteria pollutants, Acid deposition, Global climate change –green house gases, non-criteria pollutants, emission standard form industrial sources, air pollution meteorology, Atmospheric dispersion.
Industrial Air Emission Control:
Characterization of air stream, Equipment selection, Equipment design, Special Methods: Flue gas desulphurization, NOx removal, Fugitive emissions.

Module – III
Solid Waste Management Source classification and composition of MSW: properties and separation, storage and transportation, MSW Management, Waste minimization of MSW, Reuse and recycling,
Environment impact Assessment, Origin and procedure of EIA, Project Screening for EIA, Scope studies, Preparation and review of EIS.

Text Book
2. Environmental Engineering & Safety by Prof B.K. Mohapatra, Seven Seas Publication, Cuttack

Reference Books
1. Environmental Engineering by Arcadio P. Sincero & Gergoria A.Sincero PHI Publication
3. Environmental Science, Curringham & Saigo, TMH,
4. Man and Environment by Dash & Mishra
5. An Introduction to Environmental Engineering and Science by Gilbert M. Masters & Wendell P. Ela - PHI Publication.
Module-I (15 Hours)

1. **Location and Layout Planning**: Plant location and site selection, Factors affecting location, Plant layout, Different types of layouts, Principles of machinery lay-outs and different flow plans of material for spinning, weaving and process house. Calculation for balancing of different machines in a Textile mill.

2. **Plant Services**: Ventilation and lighting plan. Humidification systems used in Textile Mills, Developments in humidification systems, Utilization of steam and power, Power consumption - Energy consumption in textile machines, Measures to reduce power consumption.

3. **Material handling**: Importance of material handling, Methods and equipment employed-classification of material handling equipments, control of wastes.

4. **Store Routine** – Function of stores, procedure for material procurement, effective stores management, ABC analysis, basic inventory control; stock evaluation.

Module-II (15 Hours)

5. **Human Resource Management**: Organizational structure, patterns, communication. Selection, recruitment and training, Different categories of labour required in various section of spinning, weaving and processing departments, work load, work assignment, Calculation for work assignment, Idea of productivity calculations of spinning/weaving mill and factors affecting productivity.

Labour laws, labour welfare activities, methods of wage remuneration, wage determination process, job evaluation, payments by results, motivation, financial & non-financial incentives, disciplinary action – warning, showcase notice, suspension and dismissals, retrenchment & VRS

6. **Maintenance Management**: Maintenance systems - types of maintenance practices and concepts, planned & unplanned maintenance, corrective & design maintenance, routine and preventive maintenance, Work Study in maintenance and, planning of maintenance work, making schedules, recording of maintenance activities. Accidents and safety engineering, Fire prevention and protection

Module-III (10 Hours)

7. **Cost Accounting and Control**: Introduction, costing - its importance & use, Elements of cost -Cost classification - Total cost analysis, Costing the products, Control and accounting of materials, labour and overhead.

8. **Financial Management**: Preparation of Balance sheet - Capital and running cost - profit and loss account, Break even analysis. Financial ratios - their analysis and interpretation

**Books Recommended**

Module-I (10 Hours)

2. **Basic Knowledge of Business Organisation**: Form of Business Organization – Types - Sole traders, partnership, Joint Hindu family, company, co-operatives. Meaning and definition of SSI, ancillary industry, importance of SSI, government policies for SSI, Basic criteria for final selection of a business opportunity, Amount of investment, Nature of technology. Input requirement for setting up SSI, Institutional support to SSI at State & National level. Organization and management of SSI

Module-II (15 Hours)
3. **Project Formulation** (special reference to textile): Identification of Business opportunities- Project ideas & Identification through Trade Fair, Exhibition, Selection of products - basis for selection, sources of information about products, Product design and development, market survey, identifying market tastes and requirement of prospective buyers.

4. **Mobilisation of Resources**: Materials, human resources, machines and methods, selection of equipment and other infrastructure; plant location-factors for selection of site, vicinity of production and marketing; location and layout of plant to suit local requirements. Finance – Self financing- loan from financing Institutions& Banks. Incentives & subsidies

Module-III (15 Hours)
5. **Financial Management**: Importance of financial management in context to small scale industry. Budgeting, investment for capital equipment, working capital, costing and other related economic aspects

6. **Preparation of Project Report**: Preparation of project report in a accordance with guidelines laid down by government and controlling institutions regarding environment aspects, feasibility reports, production feasibility, quality feasibility, market feasibility and economic feasibility.


**Books Recommended:**

1. Entrepreneurial Development, P. Saravanavel
2. Business Organisation- Bhusan Y.K
3. Principle of Economics – M.C.Seth
5. Developing New Entrepreneurs; Entrepreneurs Development Institute of India, Ahmedabad.
8. Starting and Managing the Small Business; Arthur M. Kuriloff, John M.Hemphill, Jr., and Dougless Cloud; McGraw Hill, 1993
Module-I (10 Hours)
1. Apparel Industry: Introduction to Apparel industry - Different garment manufacturing sectors and their production flow chart.
2. Selection of Fabrics: Various fabrics for apparel use, their characteristics and applications to suit to different purposes, criteria for selection of fabrics. Determination of quality requirements of the fabrics including comfort, handle and tailorability
3. Product Design: Factors to be considered, different techniques.
4. Garment Size and Fit: Scientific basis of garment sizing and size charts, assessment of garment fit and different fitting scales

Module-II (18 Hours)
4. Pattern Making: Introduction to pattern making, Drafting, Basic bodies blocks, Methods of making basic pattern, grading of pattern, pattern marker.
6. Cutting: Introduction to cutting room processes, cutting tools and methods and their merit & demerits. Bundling system
7. Garment Sewing: Introduction to sewing m/c and sewing room processes. Different types of sewing m/c and their suitability, Sewing needle and its sizes. Stitch formation, types of stitches, seam classification, seam geometry seam strength and slippage, seam puckering. Thread calculation and its consumption
8. Trimming and accessories: Definition, types, trimming methodologies and accessories application.

Module-III(12 Hours)
11. Computer Application in Garment Manufacturing: Application in pattern making, grading, lay planning, sewing and finishing, computer aided embroidery designs. Concepts of computer integrated manufacturing (CIM) to the garment industry

Books Recommended
Module-I (12 Hours)

1. **Introduction**: Consideration for finishing, various terms used in finishing, classification of finishing, types of finishing.

2. **Finishing Chemicals**: Stiffening agents, cross-linking agents, resins, softening agents, silicones, polymers, bleaching agents, optical brightening agents.

3. **Finishing Machines**: Padding mangle, calender, sanforizer, Stenter, Raising, Milling, Decatizer, Emerizer

Module-II (16 Hours)

4. **Various Functional Finishes**: Water repellent/proof, fire repellent, mildew/moth proof, soil release finish, anti static, miscellaneous finishes.

5. **Special Finishes**: Anti crease, Anti shrinkage, anti-microbial, UV resisting finish, softening, stiffening, raising, embossing, felting, non-felting new finishes, Biopolishing.

6. **Finishing of Garments**: Introduction to garment dyeing and printing - Flock printing, foam printing, transfer printing, wet transfer, film release, sublimation transfer printing - Preparations of logo and motifs for fixing on garments. Durable press finish - resin, wash and wear, acid wash, stone wash, bio-stoning, crinkled effect, softening, chemical and enzyme, denim and blast finishing and controlling factors. Brushing of garments.

Module-III (12 Hours)

7. **Spotting and Laundering of Garments**: Identification of stains, characteristics and history, selection of spotting chemicals, factors for spotting, dry cleaning, washing machine equipments and processing conditions, pressing.

8. **Applications of enzymes in Textile Processing and finishing**: Types of enzymes and their uses in retting process of linen fibres, textile processing- biosizing, bioscouring, biobleaching, wool processing, biostoning, biopolishing, textile after care

Books Recommended:

6. Biotechnology edited by H J Retim and G Reed
DIGITAL IMAGE PROCESSING

Module: 1  (12 hours)
Introduction: Digital Image fundamentals: Image sampling and quantization, relationship between pixels, Intensity transformations and spatial filtering, some basic intensity transformation functions, Histogram processing, spatial filters for smoothing and sharpening (Chapt: 2 & 3 of Text book 1)

Module: 2  (12 hours)
Filtering in the Frequency Domain: preliminary concepts, 2D DFT and its properties, basic filtering in the frequency domain, image smoothing and sharpening (Chapt: 4 of Text book 1)
Image Restoration and Reconstruction: Image restoration/degradation model, noise models, restoration in the presence of noise only, estimating the degradation function (Chapt: 5 of Text Book 1)

Module: 3  (12 hours)
Color Image Processing: color models, Color transformation (Chapt: 6 of Text book 1)
Wavelets and Multi-resolution Processing: multiresolution expansions, wavelet transforms in one and two dimension (Chapt: 7 of Text book 1)
Image Compression: Fundamentals, Some basic compression methods (Chapt: 8 of Text book 1)
Morphological Image Processing: Erosion and Dilation, opening and closing (Chapt: 9 of Text book 1)

Text Books:

Reference Books:
Module-I (14 hours)
1. Introduction to production, Operations, Concept of production, Productivity components of production, Different production systems (customized, divisional, batch, Progressive bundle, line, Modular production system, unit production system & mass customization)
2. Definition, Objectives and functions of Production planning, control, loading and Scheduling, organization of various departments in apparel industry. Development of MIS for production.
3. Introduction to plant layout- criteria for evaluation, determining minimum space requirement, calculation grid, plant size location, basic production layout

Module-II (15 hours)
4. Work measurement: Uses of work measurement, data, and basic procedure of work measurement.
5. Motion & Time study: Definition & scope of motion & time study, Data for sewing work study & GSD, improvement of production efficiency, principle of work cycle timing, concept of measuring operator efficiency, Quantitative Production analysis, Line balancing. Calculation of SMV and SAM
6. Introduction to supply chain management

Module-III (11 hours)
7. Production planning order preparation, material resource planning and Material management
   Co-ordination of activities in a garment manufacturing unit: Layering & marker planning, Cutting room planning, planning of sewing room, in clothing production.
8. Quick response in apparel manufacturing- concept of lean manufacturing, kanban, JIT, ERP

Reference Books:
1. Introduction to clothing production management : A.J. Chutter
2. Production management in apparel industry : Rajesh Bheda
4. Motion and time study- Barnes Ralph- John Wiley & Sons
Module-I (10 Hours)
Introduction to Microbial Kingdom- Bacteria, Viruses, Fungi and Yeast; Classical and Modern approaches of microbial taxonomy; Methods of Microbiology- Culture media, Sterilization, Establishment of pure culture, Staining of bacteria (Gram’s, Acid Fast, Capsule), Micrometry and Microscopy(Bright Field, Fluorescence, Phase Contrast and Electron).

Module-II (15 Hours)
Microbial Processes and fermentation technology: Introduction to fermentation technology, Microbial growth and product formation kinetics in batch, continuous and feed batch fermentation, Large scale production: submerged, solid and semi-solid fermentation; Microbiological processes for production of antibiotics, enzymes.

Module-III (15 Hours)
Enzyme technology – nature of enzymes, application of enzymes, limitations of microbial cells used as catalysts in fermentation, multi-enzyme reactors, genetic engineering & protein engineering of enzymes, technology of enzyme production, use of immobilized cells and enzymes (Ca-alginate beads, polyacrylamide), industrial applications of immobilized enzymes.

Books Recommended:
2. Microbiology, R.S. Mehrotra, Tata McGraw Hill
3. Microbiology by Pelczar
4. Brock Biology of micro-organisms
5. Microbiology by Presscott.
6. Microbial Genetics- Freifelder
7. Microbiology by Atlas
9. Industrial Microbiology, Prescott and Dunn,

In this semester, students are required to present a dissertation reporting all the aspects of the research work and defend the reports. The final assessment is to be done through a viva-voce test in presence of external examiner and the quality of report writing as per university norms.

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