

**ANNA UNIVERSITY CHENNAI :: CHENNAI 600 025**

**UNIVERSITY DEPARTMENTS**

**CURRICULUM – R 2009**

**B.TECH. (PART TIME) TEXTILE TECHNOLOGY**

**SEMESTER I**

<b>SL. NO</b>	<b>CODE NO</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1	PTMA 9111	<u>Applied Mathematics</u>	3	0	0	3
2	PTPH 9111	<u>Applied Physics</u>	3	0	0	3
3	PTCY 9111	<u>Applied Chemistry</u>	3	0	0	3
4	PTGE 9111	<u>Engineering Graphics</u>	3	1	0	4
5	PTGE 9112	<u>Fundamentals of Computing</u>	3	0	0	3
<b>TOTAL</b>			<b>15</b>	<b>1</b>	<b>0</b>	<b>16</b>

**SEMESTER II**

<b>SL. NO</b>	<b>CODE NO</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1	PTMA9212	<u>Transforms and Partial Differential Equations</u>	3	0	0	3
2	PTPH9164	<u>Physics of materials</u>	3	0	0	3
3	PTCY9112	<u>Applied Chemistry - II</u>	3	0	0	3
4	PTGE9151	<u>Engineering Mechanics</u>	3	0	0	3
5	PTEE9161	<u>Basics of Electrical and Electronics Engineering</u>	3	0	0	3
<b>TOTAL</b>			<b>15</b>	<b>0</b>	<b>0</b>	<b>15</b>

**SEMESTER III**

<b>SL. NO</b>	<b>CODE NO</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1	PTTT9151	<u>Textile Fibre Production</u>	3	0	0	3
2	PTTT9201	<u>Physical Structure and Properties of Fibres</u>	3	0	0	3
3	PTTT9251	<u>Spun Yarn Technology I</u>	3	0	0	3
4	PTTT9252	<u>Technology of Fabric Manufacture I</u>	3	0	0	3
5	PTTT9253	<u>Fabric Structure</u>	3	0	0	3
<b>TOTAL</b>			<b>15</b>	<b>0</b>	<b>0</b>	<b>15</b>

### SEMESTER IV

SL. NO	CODE NO	COURSE TITLE	L	T	P	C
1	PTTT9301	<u>High Performance Fibres</u>	3	0	0	3
2	PTTT9302	<u>Spun Yarn Technology II</u>	3	0	0	3
3	PTTT9303	<u>Technology of Fabric Manufacture II</u>	3	0	0	3
4	PTTT9304	<u>Chemical Processing of Textiles and Apparels I</u>	3	0	0	3
5	PTTT9305	<u>Knitting Technology</u>	3	0	0	3
<b>TOTAL</b>			<b>15</b>	<b>0</b>	<b>0</b>	<b>15</b>

### SEMESTER V

SL. NO	CODE NO	COURSE TITLE	L	T	P	C
1	PTTT9351	<u>Chemical Processing of Textiles and Apparels II</u>	3	0	0	3
2	PTTT9352	<u>Quality Assessment of Textile Products</u>	3	0	0	3
3	PTTT9353	<u>Technical Textiles</u>	3	0	0	3
4	PTTT9354	<u>Bonded Fabrics</u>	3	0	0	3
5	PTTT9355	<u>Financial Management for Textile and Apparel Industries</u>	3	0	0	3
<b>PRACTICAL</b>						
6	PTTT9359	<u>Textile Manufacture Laboratory</u>	0	0	3	2
<b>TOTAL</b>			<b>15</b>	<b>0</b>	<b>3</b>	<b>17</b>

### SEMESTER VI

SL. NO	CODE NO	COURSE TITLE	L	T	P	C
1	PTGE9261	<u>Environmental Science and Engineering</u>	3	0	0	3
2	PTTT9402	<u>Garment Technology</u>	3	0	0	3
3	PTTT9403	<u>Mechanics of Textile Machinery</u>	3	0	0	3
4		Elective I	3	0	0	3
5		Elective II	3	0	0	3
<b>PRACTICAL</b>						
6	PTTT9406	<u>Quality Assurance Laboratory</u>	0	0	3	2
<b>TOTAL</b>			<b>15</b>	<b>0</b>	<b>3</b>	<b>17</b>

### SEMESTER VII

SL. NO	CODE NO	COURSE TITLE	L	T	P	C
1	PTTT9401	<u>Total Quality Management for Textile and Apparel Industries</u>	3	0	0	3
2	PTTT9404	<u>Clothing Science</u>	3	0	0	3
3		Elective III	3	0	0	3
4		Elective IV	3	0	0	3
5	PTTT9451	Project Work	0	0	12	6
<b>TOTAL</b>			<b>12</b>	<b>0</b>	<b>12</b>	<b>18</b>

**LIST OF ELECTIVES FOR B.TECH. (PART TIME) TEXTILE TECHNOLOGY**

<b>CODE NO</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
PTGE9023	<u>Fundamentals of Nano Science</u>	3	0	0	3
PTTT9021	<u>Fibre and Textile Composites</u>	3	0	0	3
PTTT9022	<u>Textured Yarn Technology</u>	3	0	0	3
PTTT9023	<u>Silk Yarn Technology</u>	3	0	0	3
PTTT9024	<u>New Spinning Technologies</u>	3	0	0	3
PTTT9025	<u>Theory of Yarn Spinning</u>	3	0	0	3
PTTT9026	<u>Long Staple Fibre Spinning Technology</u>	3	0	0	3
PTTT9027	<u>Process Control in Man-made Fibre Yarn Production</u>	3	0	0	3
PTTT9028	<u>Mechanics of Textile Structures</u>	3	0	0	3
PTTT9029	<u>Warp Knitting Technology</u>	3	0	0	3
PTTT9030	<u>Advances in Spun bonded Melt Blown Technology</u>	3	0	0	3
PTTT9031	<u>Colour Science, Measurement and its Applications</u>	3	0	0	3
PTTT9032	<u>Fabric and Garment Finishing</u>	3	0	0	3
PTTT9033	<u>Synthetic Fibre Colouration</u>	3	0	0	3
PTTT9034	<u>Process Control in Textile Chemical Processing</u>	3	0	0	3
PTTT9035	<u>CAD and CAM for Textiles and Apparels</u>	3	0	0	3
PTTT9036	<u>Quality Assurance in Garment Industry</u>	3	0	0	3
PTTT9037	<u>Protective Garments</u>	3	0	0	3
PTTT9038	<u>Industrial Engineering for Textile and Apparel Industries</u>	3	0	0	3
PTTT9039	<u>Energy Management in Textile Industry</u>	3	0	0	3
PTTT9040	<u>Textile Mill Planning and Management</u>	3	0	0	3
PTTT9041	<u>Operations Research</u>	3	0	0	3
PTTT9042	<u>Production and Operations Management</u>	3	0	0	3
PTTT9043	<u>Personnel Management in Apparel Industry</u>	3	0	0	3
PTTT9044	<u>Textile Product Engineering</u>	3	0	0	3
PTTT9045	<u>Computer Programming for Textile Technologists</u>	3	0	0	3
PTGE9021	<u>Professional Ethics in Engineering</u>	3	0	0	3
PTTT9046	<u>Industrial Management for Textile and Apparel Industries</u>	3	0	0	3





**REFERENCES:**

1. R. K. Gaur and S.C. Gupta, 'Engineering Physics' Dhanpat Rai Publications, New Delhi (2003)
2. M.N. Avadhanulu and PG Kshirsagar, 'A Text book of Engineering Physics', S.Chand and company, Ltd., New Delhi, 2005.
3. Serway and Jewett, 'Physics for Scientists and Engineers with Modern Physics', 6<sup>th</sup> Edition, Thomson Brooks/Cole, Indian reprint (2007)

**PTCY 9111** **APPLIED CHEMISTRY** **L T P C**  
**(Common to all branches of B.E / B.Tech (PT) Programmes)** **3 0 0 3**

**UNIT I WATER TREATMENT AND POLLUTION CONTROL 9**

Treatment of water –impurities and disadvantages of hard water-Domestic and Industrial treatment - zeolite and ion exchange processes-Portable water-Boiler feed water – conditioning of boiler feed water. Scale and sludge formation –prevention –caustic embrittlement-boiler corrosion–priming and foaming Sewage treatment–Primary, secondary and tertiary treatment–significance of DO, BOD and COD-desalination – reverse osmosis. Control of water, air and land pollution.

**UNIT II FUELS 9**

Classification of fuels-Proximate and ultimate analysis of coal- coke manufacture-Otto Hoffman by product method-cracking-thermal and catalytic (fixed bed and fluidized bed)-petroleum-refining-fractions-composition and uses synthetic petrol-fischer drops methods- Bergius process- knocking-octane number and cetane number-Preparation, composition and uses of producer gas , water gas and natural gas. Flue gas analysis-Orsat apparatus- gross and net calorific values- calculation of minimum requirement of air(simple calculations)- Explosive range –spontaneous ignition temperature

**UNIT III THERMODYNAMICS AND SURFACE CHEMISTRY 9**

Second law of thermodynamics-entropy and its significance- criteria for spontaneity- free energy-Gibbs, Helmholtz and Gibbs-Helmholtz equation-applications and problems – Adsorption –types of adsorption- adsorption of gases on solids- adsorption isotherm-Freundlich and Langmuir isotherms-adsorption of solutes from solutions- applications

**UNIT IV STRY - CORROSION AND CATALYSIS 9**

Reversible and irreversible cells-electrode potentials-types of electrodes-cell reactions-Nernst equations- electrochemical and galvanic series-fuel cells and solar cells-corrosion-chemical and electrochemical-factors affecting corrosion-sacrificial anode-impressed current cathodic protection-surface treatment and protective coating-Catalysis –classification-characteristics of catalysis – auto catalysis- enzyme catalysis

**UNIT V POLYMERS-COMPOSITES AND NANOCHEMISTRY 9**

Polymers-definition-classification-thermoplastics and thermosetting plastics differences Preparation, properties and uses of polystyrene, bakelite, PET, polyurethane, Teflon, ureaformaldehyde, polycarbonates-Elastomers-Preparation, properties of Buna-S, nitrile, neoprene and butyl rubber, silicon rubber. Composites-FRP. Nanochemistry-introduction to nanochemistry- preparation and properties of nonmaterial-nano rods, nano wires-nanotubes-carbon nanotubes and their applications.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Dhara S S A text book of Engineering Chemistry, S.Chand & Co Ltd, New Delhi,2002
2. Jain. P.C and Monica Jain, Engineering Chemistry,Dhanpet Rai & Sons, New Delhi 2001

**REFERENCES:**

1. Puri B R.,Sharma L R and Madhan S. Pathania, Principles of Physical Chemistry, Shoban Lal Nagin Chand & Co. Jalandar-2000.
2. G.B. Sergeev, Nanochemistry.Elsevier Science, New York,2006
3. V.R.Gowarikar, N.V.Viswanathan and Jayadev Sreedhar, Polymer Science, Wiley Eastern Limited, Madras (2006).

**PTGE 9111****ENGINEERING GRAPHICS****L T P C**

(Common to All branches of B.E / B.Tech Programmes)

**3 1 0 4****OBJECTIVES:**

- To develop in students the graphic skills that would enable them to communicate the concepts, ideas and design of engineering products
- To provide an exposure to the national/international standards related to technical drawings

**INTRODUCTION****2**

Importance of graphics in engineering applications – use of drafting instruments – BIS specifications and conventions – size, layout and folding of drawing sheets – lettering and dimensioning

**UNIT I FREE HAND SKETCHING OF ENGG OBJECTS AND CONSTRUCTION OF PLANE CURVES****3+9**

Pictorial representation of engineering objects – representation of three dimensional objects in two dimensional media – need for multiple views – developing visualization skills through free hand sketching of three dimensional objects.

Polygons & curves used in engineering practice– methods of construction– construction of ellipse, parabola and hyperbola by eccentricity method – Cycloidal and involute curves- construction - drawing of tangents to the above curves.

**UNIT II ORTHOGRAPHIC PROJECTION: PROJECTION OF POINTS, LINES AND PLANE SURFACES****6+9**

General principles of orthographic projection – first angle projection – layout of views – projections of points , straight lines located in the first quadrant – determination of true lengths of lines and their inclinations to the planes of projection – traces – projection of polygonal surfaces and circular lamina inclined to both the planes of projection

**UNIT III ORTHOGRAPHIC PROJECTION: PROJECTION OF SOLIDS AND SECTIONS OF SOLIDS****6+9**

Projection of simple solids like prism, pyramid, cylinder and cone when the axis is inclined to one plane of projection –change of position & auxiliary projection methods- sectioning of above solids in simple vertical positions by cutting plane inclined to one reference plane and perpendicular to the other and above solids in inclined position with cutting planes parallel to one reference plane – true shapes of sections

#### **UNIT IV DEVELOPMENT OF SURFACES AND INTERSECTION OF SOLIDS**

**6+9**

Need for development of surfaces – development of lateral surfaces of simple and truncated solids – prisms, pyramids, cylinders and cones – development of lateral surfaces of the above solids with square and circular cutouts perpendicular to their axes. Intersection of solids and curves of intersection –prism with cylinder, cylinder & cylinder, cone & cylinder with normal intersection of axes and with no offset.

#### **UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS**

**4+9**

Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones – principles of perspective projections – projection of prisms, pyramids and cylinders by visual ray and vanishing point methods.

#### **COMPUTER AIDED DRAFTING (DEMONSTRATION ONLY)**

**3**

Introduction to computer aided drafting software packages and demonstration of their use.

**L: 45, T: 15, TOTAL= 60 PERIODS**

#### **TEXT BOOKS:**

1. Bhatt,N.D, “Engineering Drawing”, Charotar Publishing House, 46<sup>th</sup> Edition-2003
2. Natarajan,K.V, “ A Textbook of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2006 .

#### **REFERENCES:**

1. Shah,M.B and Rana,B.C.,”Engineering Drawing”, Pearson Education,2005,
2. Gopalakrishnan.K.R,. “Engineering Drawing I & II”, Subhas Publications 1998.
3. Dhananjay,A.J., “Engineering Drawing with Introduction to AutoCAD”, Tata McGraw-Hill Publishing Company Ltd., 2008.
4. Venugopal,K. and Prabhu Raja, V., “Engineering Graphics”, New Age International(P) Ltd.,2008.

#### **Codes from Bureau of Indian Standards**

1. IS 10711-2001: Technical Products Documentation – Size and Layout of Drawing Sheets
2. IS 9609 (Parts 0 & 1 )-2001: Technical Products Documentation – Lettering
3. IS 10714(Part 20)-2001 & SP 46 -2003: Lines for Technical Drawings
4. IS 11669-1986 & SP 46-2003: Dimensioning of Technical Drawings  
IS 15021(Parts 1 to 4)-2001: Technical Drawings-Projection Methods

Special points applicable to University Examinations on Engineering Graphics:

1. There will be five questions one from each unit covering all units of the syllabus
2. All questions will carry equal marks of 20 each making a total of 100
3. Answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solutions within A3 size
4. The examination will be conducted in appropriate sessions on the same day



**AIM:**

- To introduce the basics of computing and the fundamentals of C programming.

**OBJECTIVES:**

- To introduce the fundamentals of computing systems.
- To introduce the concepts of internet and WWW.
- To teach programming in C.

**UNIT I****9**

Computer systems – Exploring computers – Inside the system – Processing data – CPUs – Types of storage devices - Operating systems basics – Networking basics.

**UNIT II****9**

The internet and the WWW – Internet services – connecting to the internet - Working with applications software – productivity software – graphics and multimedia – Data base Management systems – Creating computer program.

**UNIT III****9**

C programming fundamentals – compilation process – variables – Data types – Expressions – looping – decisions.

**UNIT IV****9**

Arrays - Working with functions – structures – character strings – pre-processor.

**UNIT V****9**

Pointers – Dynamic memory allocation – linked list - Applications

**TOTAL: 45 PERIODS****TEXT BOOKS:**

1. Peter Norton, "Introduction to Computers", Sixth Edition, Tata McGraw Hill, 2007.
2. Stephen G. Kochan, "Programming in C", Third Edition, Pearson Education, 2007.

**REFERENCES:**

1. Kernighan, B.W and Ritchie, D.M, "The C Programming language", Second Edition, Pearson Education, 2006
2. Ashok N. Kamthane, "Computer programming", Pearson Education, 2007.
3. Kenneth A. Reek, "Pointers on C", Pearson Education, 2007.
4. Dromey, R.G, "How to solve it by Computer", Pearson Education, 2007.

**PTMA 9212 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS L T P C**  
**(Common to all branches of BE / B.Tech Programmes) 3 0 0 3**

**AIM:**

To facilitate the understanding of the principles and to cultivate the art of formulating physical problems in the language of mathematics.

**OBJECTIVES:**

- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems
- To acquaint the student with Fourier transform techniques used in wide variety of situations in which the functions used are not periodic
- To introduce the effective mathematical tools for the solutions of partial differential equations that model physical processes
- To develop Z- transform techniques which will perform the same task for discrete time systems as Laplace Transform, a valuable aid in analysis of continuous time systems

**UNIT I FOURIER SERIES 9**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half-range Sine and Cosine series – Complex form of Fourier series – Parseval's identity – Harmonic Analysis.

**UNIT II FOURIER TRANSFORM 9**

Fourier integral theorem – Fourier transform pair-Sine and Cosine transforms – Properties – Transform of elementary functions – Convolution theorem – Parseval's identity.

**UNIT III PARTIAL DIFFERENTIAL EQUATIONS 9**

Formation – Solutions of first order equations – Standard types and Equations reducible to standard types – Singular solutions – Lagrange's Linear equation – Integral surface passing through a given curve – Solution of linear equations of higher order with constant coefficients.

**UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9**

Method of separation of Variables – Solutions of one dimensional wave equation and one-dimensional heat equation – Steady state solution of two-dimensional heat equation – Fourier series solutions in Cartesian coordinates.

**UNIT V Z – TRANSFORM AND DIFFERENCE EQUATIONS 9**

Z-transform – Elementary properties – Inverse Z-transform – Convolution theorem – Initial and Final value theorems – Formation of difference equation – Solution of difference equation using Z-transform.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Grewal, B.S. "Higher Engineering Mathematics", Khanna Publications (2007)

**REFERENCES:**

1. Glyn James, "Advanced Modern Engineering Mathematics, Pearson Education (2007)
2. Ramana, B.V. "Higher Engineering Mathematics" Tata McGraw Hill (2007).
3. Bali, N.P. and Manish Goyal, "A Text Book of Engineering 7<sup>th</sup> Edition (2007) Lakshmi Publications (P) Limited, New Delhi.

**OBJECTIVE:**

- To introduce the essential principles of physics for chemical and related engineering applications.

**UNIT I MATERIALS PREPARATION AND PROCESSING 9**

Gibbs phase Rule – Phase Diagram – One component and multi component systems – eutectic – peritectic – eutectoid – peritectoid – invariant reactions – Lever Rule – Nucleation – homogeneous and heterogeneous nucleation – Free energy of formation of a critical nucleus – Nucleation rate – Experimental techniques of crystal growth – Czochralski Bridgman, Flux, Solution, Vapour, Sol-gel - hydrothermal – Epitaxy.

**UNIT II CONDUCTING MATERIALS 9**

Classical free electron theory of metals - Schrödinger wave equation - Time independent and time dependent equations. Physical significance of wave function, particle in a box ( in one dimension ) – electrons in a metal - Fermi distribution function – Density of energy states – effect of temperature on Fermi energy, Superconducting Phenomena, Properties of superconductors – Meissner effect and Isotope effect. Type I and Type II superconductors, High T<sub>c</sub> superconductors – Magnetic levitation and SQUIDS.

**UNIT III SEMICONDUCTING MATERIALS 9**

Origin of band gap in solids (qualitative) - Concept of effective mass of electron and hole – carrier concentration in an intrinsic semiconductor (derivation) – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – carrier concentration in n-type and p-type semiconductors (derivation) – variation of Fermi level with temperature and impurity concentration – Compound semiconductors – Hall effect – Determination of Hall coefficient – Solar cells.

**UNIT IV MAGNETIC AND DIELECTRIC MATERIALS 9**

Introduction to magnetic materials - Domain theory of ferromagnetism, Hysteresis, Soft and Hard magnetic materials – Anti-ferromagnetic materials – Ferrites, Giant Magneto Resistance materials, Electronic, Ionic, Orientational and space charge polarization – Internal field and deduction of Clausius Mosotti equation – dielectric loss – different types of dielectric breakdown – classification of insulating materials and their applications.

**UNIT V NEW MATERIALS AND APPLICATIONS 9**

Introduction to Ceramics and its applications - Ceramic Fibres - Fibre reinforced Plastics – Fibre reinforced Metal – Metallic glasses – Shape memory alloys – Copper base alloys – Nickel – Titanium alloys - Sensors and Actuators – Range - Accuracy Determination – Photo detectors, Bio-sensors, Scintillation detectors (Position sensitive) – Renogram – Computed Tomography Scan (CT Scan) - Magnetic Resonance Imaging (MRI) - Performance and Reliability testing.

**TOTAL: 45 PERIODS****TEXT BOOKS:**

1. Kumar.J, Moorthy Babu. S and Vasudevan. S., Engineering Physics, Vijay Nicole Imprints, 2006.
2. Palanisamy. P.K., Materials Science, Scitech., 2003.

## REFERENCES:

1. Gaur. R.K. and Gupta. S.L., Engineering Physics, Dhanpat Rai Publication., 2003.
2. Raghavan. V. Materials Science and Engineering, Prentice Hall of India, 2002.
3. Arumugam, M, Biomedical Instrumentation, 2<sup>nd</sup> Edition, Anuradha Agencies, 2003.

<b>PTCY9112</b>	<b>APPLIED CHEMISTRY</b>	<b>L T P C</b>
	<b>(Common to Chemical, Textile, Leather, Ceramic, Petroleum Refining &amp; Petrochemicals and Apparel Technology)</b>	<b>3 0 0 3</b>

## OBJECTIVE:

To learn and know the importance of varying nature of materials used for different industrial and engineering applications.

### **UNIT I WATER TECHNOLOGY 9**

Introduction – water quality parameters – impurities in water – hardness of water – disadvantage of hard water – estimation of hardness by EDTA method – alkalinity – determination of alkalinity – units of hardness – boiled feed water – boiler corrosion – scale and sludge formation in boilers – caustic embrittlement – priming and foaming – softening methods – removal of dissolved CO<sub>2</sub>, O<sub>2</sub> and acids – external treatment – ion exchange – desalination – electro dialysis – reverse osmosis.

### **UNIT II FUELS 9**

Introduction – classification of fuels – higher of gross calorific value – lower or net calorific value – explosive range – calorific intensity – spontaneous ignition temperature – requirements of a good fuel – solid fuels – classification of coal – analysis of coal (both proximate and ultimate analysis) – carbonization of coal (HTC and LTC) – metallurgical coke – liquid fuels – petroleum – refining of petroleum – cracking (thermal and catalytic) – manufacture of synthetic petrol – polymer gasoline – hydrogenation of coal – alkylation – reforming (thermal and catalytic) – knocking – octane number and cetane number – Bio fuels.

### **UNIT III CHEMISTRY OF BUILDING MATERIALS 10**

Cement – chemical composition – grading of cement – setting and hardening – concrete – special cements – high alumina cement, white Portland cement, water proof cement – ceramics – clays – silica – methods for fabrication of ceramic ware – glasses – classification – applications – special glasses – paints – varnishes and enamels – powder coatings.

### **UNIT IV POLYMER CHEMISTRY AND MATERIALS 12**

Monomers – functionality – polymer – degree of polymerization – classification based on source and applications – addition, condensation, co-polymerization and co-ordination polymerization – mechanism of addition polymerization and methods of polymerization - effect of polymer structure on properties thermal, mechanical and dielectric properties - plastic materials – commodity plastics (LDPE, HDPE, LLDPE, PP, PVC, PMMA, PS) engineering plastics (polyacetal, nylon 6, polycarbonate, Teflon, polysulphone) and reinforced plastics.

**UNIT V OILS, WAXES, SOAPS AND DETERGENTS 5**

Types of oils – edible oils – non-edible oils and essential oils – properties of oils – free acid value – saponification value and iodine value of an oil – waxes – classification – soaps and detergents – types, applications – emulsifiers.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Jhashi Chawla, A Text Book of Engineering Chemistry, Dhanpat Rai & Co. (Pvt) Ltd., New Delhi (2007).
2. P.C. Jain and Monica Jain, Engineering Chemistry, Dhanpat Rai Publishing Co. Ltd, New Delhi (2007).
3. K.S. Tiwari, N.K. Vishnoi and S.N. Malhotra “A Text Book of Organic Chemistry”, Third Edition, Vikas Publishing House Pvt. Ltd., New Delhi (2006).

**REFERENCES:**

1. J.A. Brydson, Plastic Materials, Butterworth-Heinemann, 7<sup>th</sup> Edition, New Delhi (2005).
2. J.M.G. Cowie, Polymers – Chemistry and Plastics of Modern Materials, Blackie, London (1991).
3. J.C. Kuriacose and J. Rajaram, Chemistry in Engineering and Technology, Vol.2, Tata McGraw Hill publishing, New Delhi (2001).

**PTGE9151**

**ENGINEERING MECHANICS**

**L T P C  
3 0 0 3**

**AIM:**

To introduce the basic principles which help to understand motion and/or forces involved in engineering applications

**OBJECTIVE:**

At the end of this course the student should be able to understand the vectorial and scalar representation of forces and moments, static equilibrium of particles and rigid bodies both in two dimensions and also in three dimensions. Further, he should understand the principle of work and energy. He should be able to comprehend the effect of friction on equilibrium. The student should be able to understand the laws of motion, the kinematics of motion and the interrelationship. The student should also be able to write the dynamic equilibrium equation. All these should be achieved both conceptually and through solved examples.

**UNIT I BASICS & STATICS 9**

Introduction - UNITS and Dimensions - Laws of Mechanics – Lame’s theorem, Parallelogram and triangular Law of forces – Vectors – Vectorial representation of forces and moments – Vector operations on forces, dot product and cross product - Coplanar Forces – Resolution and Composition of forces – Equilibrium of a forces – Forces in space - Equilibrium in space - Equivalent systems of forces – Principle of transmissibility – Single equivalent force

**UNIT II EQUILIBRIUM OF RIGID BODIES 9**

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem - Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions – Examples

**UNIT III PROPERTIES OF SURFACES AND SOLIDS 9**

Determination of Areas and Volumes – First moment of area and the Centroid of standard sections – T section, I section, Angle section, Hollow section – second and product moments of plane area – Rectangle, triangle, circle - T section, I section, Angle section, Hollow section – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia – Principal moments of inertia of plane areas – Principal axes of inertia - Mass moment of inertia – Derivation of mass moment of inertia for rectangular solids, prism, rods, sphere from first principle – Relation to area moments of inertia.

**UNIT IV DYNAMICS OF PARTICLES 9**

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion – Newton's law – Work Energy Equation of particles – Impulse and Momentum

**UNIT V CONTACT FRICTION & ELEMENTS OF RIGID BODY DYNAMICS 9**

Frictional force – Laws of Coloumb friction – simple contact friction – Rolling friction – Belt friction Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion – Impact of elastic bodies

**TOTAL: 45 PERIODS**

**TEXT BOOK:**

1. Beer, F.P and Johnson Jr. E.R, "Vector Mechanics for Engineers", Vol. 1 Statics and Vol. 2 Dynamics, McGraw-Hill International Edition, 2007.

**REFERENCES:**

1. Irving H. Shames, Engineering Mechanics - Statics and Dynamics, IV Edition – PHI / Pearson Education Asia Pvt. Ltd., 2003
2. Hibbeler, R.C., Engineering Mechanics, Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2000.
3. Ashok Gupta, Interactive Engineering Mechanics – Statics – A Virtual Tutor (CDROM), Pearson Education Asia Pvt., Ltd., 2002
4. J.L. Meriam & L.G. Karige, Engineering Mechanics Vol. I & Vol. II, V edition, John Wiley & Sons, 2006.
5. P. Boresi & J. Schmidt, Engineering Mechanics Statics & Dynamics, Micro Print Pvt. Ltec., Chennai, 2004.



**UNIT I GENERAL INTRODUCTION 9**

Definition - fibre, filament, staple fibre; broad classification of fibres; global production trends; requirements for fibre forming polymers; properties of major textile fibres - density, moisture regain,  $T_g$  and  $T_m$ ; applications of different fibres; identification of fibres; identification of fibres; introduction to spinning - melt, wet, dry, dry jet wet, liquid crystal, gel spinning of polymers.

**UNIT II NATURAL FIBRES 9**

Cotton-cultivation, varieties, practices, grading and baling, colour cotton; silk – pre and post cocoon operations; varieties of silk and their properties; wool shearing and grading; varieties of wool and their properties; bast fibres – jute cultivation, fibre extraction and properties; pineapple and banana fibres.

**UNIT III SPINNING MACHINERY AND COMPONENTS 9**

General features of melt spinning line with and without gadgets; extruder - single and multi screw extruder; basic operations and zones of extruder; mechanism of melting; melt flow; design features of extruder; three dimensional dynamic mixer; continuous vertical polymer filter; melt manifold; static mixer; spin pack; quenching system and quenching chamber; factors influencing quenching; types of air quench media; take up and high speed winder; solution spinning - dope, candle filter, gadgets, coagulation bath, dryer and winder.

**UNIT IV PRODUCTION OF FILAMENT YARNS 13**

PET - polymer production, DMT and TPA route, production process batch, semi continuous, continuous, transfer line injection online compounding, catalysts used and its role, DEG – effect in polymer and fibre properties, control of DEG formation; nylon 6 - raw material, caprolactum specifications, types of catalyst, process - batch, continuous, integrated continuous process; nylon 66 - raw materials and their specification, production process - batch, continuous, polymerization using dry nylon 66 salt and direct polymerization; PP- MFI, fibre production methods, the traditional long air quench melt spinning, water quench melt spinning, tape yarns from slit film, spinning parameters and role in fibre formation; rayon fibres - chemistry of viscose, manufacture of viscose rayon, spinning, spinning bath composition, modified high wet modulus yarns; polynosic - super high wet modulus rayon; lyocell manufacturing; acrylic – acrylic and mod acrylic fibres, need for co monomers, dope preparation, influence of coagulation variables on fibre structure, dry spinning, spinning cell, fibre cross section formation, spin stretch during dry spinning, finish application and winding; production of filament sewing thread.

**UNIT V POST SPINNING OPERATIONS 5**

Spin finishes - need and composition of spin finish, spin finish application technique, spin finish for staple fibre production and filament types; drawing, need for drawing, drawing unit, high speed spinning, spin draw process, draw warping; heat setting need for heat setting, stability and measurement of degree of set; crimping and texturisation - introduction and need, principles, types; merits and demerits of tow to tow converters and tow to staple converters.

**TOTAL: 45 PERIODS**





## REFERENCES:

1. Morton W. E. and Hearle J. W. S., 'Physical Properties of Textile Fibres', The Textile Institute, Manchester, U.K., 1993. ISBN:1870812417.
2. Meredith R. and Hearle J. W. S., "Physical Methods of Investigation of Textiles", Wiley Publication, New York, 1989.
3. Meredith R., "Mechanical Properties of Textile Fibres", North Holland, Amsterdam, 1986.
4. Hearle J. W. S. Lomas B. and Cooke W. D., "Atlas of Fibre Fracture and Damage to Textiles", The Textile Institute, 2<sup>nd</sup> Edition, 1998, ISBN: 1855733196.
5. Raheel M. (ed.), "Modern Textile Characterization Methods", Marcel Dekker, 1995 ISBN:0824794737.
6. Mukhopadhyay S. K., "The Structure and Properties of Typical Melt Spun Fibres", Textile Progress, Vol 18, No 4, Textile Institute, 1989. ISBN: 1870812115.
7. Mukhopadhyay S. K., "Advances in Fibre Science" The Textile Institute., 1992, ISBN: 1870812379.
8. Hearle J.W.S., "Polymers and Their Properties, Vol.1. Fundamentals of structures and mechanics", Ellis Horwood, England, 1982.
9. Greaves P.H. and Aville B.P., "Microscopy of Textile Fibres", Bios Scientific, U.K., 1995.
10. Saville "Physical Testing of Textiles", M. K. Book Distributors, 1998.

**PTTT9251**

**SPUN YARN TECHNOLOGY I**

**L T P C  
3 0 0 3**

### **UNIT I INTRODUCTION 9**

Sequence of spinning machinery for producing carded, combed and blended yarns in short staple and long staple spinning system; yarn numbering systems- direct, indirect and conversions; influence of characteristics of raw material – fibre fineness, length, strength, elongation, stiffness, fibre friction, cleanness on spinning; spinnability.

### **UNIT II GINNING AND BLOWROOM MACHINERY 9**

Description and working of different types of gins; selection of right type of gins; ginning performance on yarn quality; objects, principle and description of opening, cleaning and blending machines used in blowroom; chute feed; cleaning efficiency; neps and fibre rupture; waste control; process control; production calculations.

### **UNIT III CARD 9**

Objects and principle of carding; detailed study of flat card; card clothing and its maintenance; drives and production calculation; neps, waste and quality control.

### **UNIT IV COMBER 9**

Objectives of comber preparatory; detailed study of sliver lap, ribbon lap and super lap formers; objects and principles of combing; sequence of combing operation; combing efficiency and production calculation; hooks and neps removal, noil control, quality control.



automatic drawing- in, leasing, knotting and pinning machines; selection and care of reeds, healds and drop pins, control of cross ends and extra ends and calculations.

**UNIT III INTRODUCTION TO WEAVING AND SHEDDING MOTIONS 13**

Principle of weaving with hand and power looms, passage of material, various motions—primary, secondary and auxiliary motions, various shafts and plain power loom driving, timing of motions; shed geometry and shedding requirement, principles of tappet, dobbie and jacquard shedding mechanisms, positive and negative shedding mechanisms, reversing mechanisms and force diagram, limitations of various shedding mechanisms, types of shed; developments from principle dobbie mechanism to electronic dobbie; developments from principle jacquard mechanism to electronic jacquard .

**UNIT IV SHUTTLE PICKING AND BEAT UP 5**

Shuttle picking mechanisms, shuttle flight and timing, acceleration and retardation of the shuttle, power required for picking; kinematics of sley, sley eccentricity; beat up mechanism in modern looms; timing of the primary motions in plain looms.

**UNIT V SECONDARY AND AUXILIARY MOTIONS IN PLAIN LOOMS 5**

Take up and let - off motions used in power looms; cloth formation, weaving condition - factors and control; warp protector and warp and weft stop motion; plain loom accessories.

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. Talukdar M.K., Sriramulu P.K. and Ajgaonkar D.B., "Weaving: Machines, Mechanisms, Management", Mahajan Publishers, Ahmedabad, 1998, ISBN: 81-85401-16-0
2. Ajgaonkar D.B., Talukdar M.K. and Wadekar., "Sizing \* Materials \* Methods \* Machines", 2<sup>nd</sup> Edition, Mahajan Publishers, Ahmedabad. 1999.
3. "Weaving: The knowledge in technology", Papers presented at the Textile Institute Weaving Conference 1998, textile Institute, ISBN: 18770372182.
4. Booth J.E., "Textile Mathematics Volume 3", The Textile Institute, Manchester, 1977, ISBN: 090073924X
5. "Yarn Preparation: A Hand Book", Textile Institute, Manchester, 1992, ISBN: 1853390429.
6. Marks R. and Robinson T.C., "Principles of weaving", The Textile Institute, Manchester, 1989, ISBN: 0 900739 258.
7. Lord P.R. and Mohamed M.H., "Weaving: Conversion of yarn to fabric", Merrow, 1992, ISBN: 090409538X
8. Ormerod A. and Sondhelm W.S., "Weaving: Technology and operations", Textile Institute, 1995, ISBN: 187081276X

**PTTT9253**

**FABRIC STRUCTURE**

**L T P C**

**3 0 0 3**

**UNIT I**

**9**

Elementary weaves – plain and its derivatives; twill and its derivatives; satin, sateen and their derivatives.

**UNIT II**

**9**

Ordinary and Brighten Honey Comb; Huck-a-Back and its modifications; Mock Leno; crepe weaves; colour theory – light and pigment theory; modification of colour; application of colours; colour and weave effects.

**UNIT III**

**9**

Bedford cords - plain and twill faced, wadded; welts and piques, wadded piques; backed fabrics - warp and weft, reversible and non-reversible fabrics; extra warp and extra weft figuring - single colour and double colour.

**UNIT IV**

**9**

Pile fabrics; warp pile - wire pile, terry pile, loose backed; weft pile – plain back and twill back velveteen, lashed pile, corduroy, weft plush.

**UNIT V**

**9**

Double cloth, types of stiches; Damasks; Gauze and Leno principles.

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. Grosicki Z. J., "Watson's Textile Design and Colour", Vol.1, Butterworths, London, 1989.
2. 1989.
3. Grosicki Z. J., "Watson's Advanced Textile Design and Colour", Vol.II, Butterworths, London, 1989
4. London, 1989
5. Wilson J., "Handbook of Textile Design", Textile Institute, Manchester, 2001,
6. ISBN:1 85573 5733
7. Horne C.E., "Geometric Symmetry in Patterns and Tilings", Textile Institute, Manchester, 2000, ISBN:1 85573 4923.
8. Manchester, 2000, ISBN:1 85573 4923.
9. Seyam A. M., "Structural Design of Woven Fabrics, Theory and Practice", Textile Institute, Manchester, 2002, ISBN: 1 87037 2395.
10. Georner D, "Woven Structure and Design, part 1:Single Cloth Construction",
11. WIRA, U.K., 1986.
12. Georner D, "Woven Structure and Design, Part 2: Compound Structures", WIRA, U.K., 1989.



**UNIT IV NEW SPINNING TECHNOLOGIES 13**

Principle of open end spinning; technologies of yarn production by using OE spinning system; principle of yarn production by rotor, friction and air-jet spinning methods, raw material used, structure, properties and applications; principle of yarn production by self-twist, wrap, integrated compound spinning systems.

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. Oxtoby E., "Spun Yarn Technology ", Butterworth Publications, London, 1987.
2. Klein W., "The Technology of Short-staple Spinning", The Textile Institute, Manchester, 1998.
3. Klein W., "A Practical Guide to Ring Spinning ", The Textile Institute, Manchester, 1999.
4. Klein W., "New Spinning Systems ", The Textile Institute, Manchester, 1993.
5. Lord P.R., " Yarn Production: Science, Technology and Economics ", The Textile Institute, Manchester, 1999.
6. Shaw J., "Short-staple Ring Spinning, Textile Progress", The Textile Institute, Manchester, 1982.
7. Iredale J., "Yarn Preparation: A Handbook ", Intermediate Technology, 1992.

**PTTT9303 TECHNOLOGY OF FABRIC MANUFACTURE II L T P C  
3 0 0 3**

**UNIT I PREPARATIONS FOR HIGH SPEED WEAVING 5**

Yarns quality requirements for high speed automatic shuttle looms and shuttle less loom; warp and weft preparation for high speed looms

**UNIT II AUTOMATIC SHUTTLE LOOMS 9**

Automatic weft replenishment in shuttle looms – pirn changing and shuttle changing looms; mechanisms involved in automatic pirn changing – feelers, cutters, design of shuttle, three try motions; multi shuttle looms- eccentric & lever box changing principle, system overview of multi box loom with cop changing mechanism; pile fabric weaving principle looms; tape weaving

**UNIT III SHUTTLELESS LOOMS 22**

Principles of weft insertions in shuttle less looms; selvages used in shuttle less looms; weft feeder – types, passage of material; mechanism of weft insertion by projectile, gripper cycle; rapier loom-classification, weft insertion mechanism, devices timings, pile fabric production.

Water jet weft insertion; Air jet Loom – dynamics of weft insertion, jet energy, loss and transfer to yarn related derivations, developments for high speed and width operation of loom; weft arrival control and automation; selvedge devices (ISD, RLD, ELD)technologies, advantages and disadvantages

Shedding devices for shuttleless looms; drive technologies consideration in looms; techno economics of shuttle less loom weft insertion systems; Multi-Phase weaving systems; quick style change; loom monitoring and control





**REFERENCES:**

1. Trotman E. R., "Dyeing and chemical technology of textile fibres", B.I Publishing Pvt. Ltd, New Delhi, 1994.
2. Menachem Lewin and Eli M. Pearce, "Handbook of fibre chemistry: Second Edition, Revised and Expanded, Marcel Dekker, Inc., 1998.
3. Menachem Lewin and Stephen B. Sello., "Handbook of fibre science and technology: volume I: Chemical Processing of Fibres and Fabrics-Fundamentals and Preparation Part A", Marcel Dekker, Inc., 1983.
4. Karmakar S. R., "Chemical Technology in the Pre-treatment Process of Textiles", Elsevier sciences B.V.,1999.
5. Shenai V. A., "Technology of Bleaching and Mercerizing", Sevak Publications, 2003.
6. Bhagwat R. S., "Handbook of Textile Processing", Colour Publication, Mumbai.,1999.
7. Cavaco-Paulo A. and Gubitz G. M., "Textile Processing with enzymes", Woodhead Publication Ltd., 2003.
8. Shenai V. A., "Technology of Textile Finishing", B.I. Publication, Mumbai, 1989.
9. Heywood D., "Textile Finishing",Woodhead Publishing Ltd., 2003, ISBN 0 901956 813

**PTTT9305****KNITTING TECHNOLOGY****L T P C  
3 0 0 3****UNIT I INTRODUCTION****5**

Comparison between different types of fabrics - wovens, knits and bonded fabrics; classification of knitting processes; yarn quality requirements for knitting and its preparation

**UNIT II FUNDAMENTALS OF WEFT KNITTING****9**

General definitions and principles of knitting; knitting needles; elements of knitted loop structure; fundamentals of formation of knit, tuck and float stitches; basic knitted structures and their production - plain, rib, interlock and purl; knitted fabric geometry

**UNIT III CIRCULAR KNITTING****13**

Construction and working of circular knitting machines used for the production of basic structures; production of derivatives of weft knitted structures; needle control in circular knitting machines; factors affecting the formation of loop; effect of loop length and shape on fabric properties; quality control in knitted fabric production; production calculation

**UNIT IV FLAT KNITTING****9**

Basic principles; elements of flat knitting machines; different types of flat knitting machines - manual, mechanical and computer controlled; production of various fabric structures

**UNIT V WARP KNITTING****9**

Basic principles; machine classification; preparation of yarns for warp knitting; production of elementary structures

**TOTAL: 45 PERIODS****REFERENCES:**

1. Ajgaonkar D.B., "Knitting technology", Universal Publishing Corporation, Mumbai, 1998, ISBN: 81-85027-34-X.
2. Chandrasekhar Iyer, Bernd Mammel and Wolfgang Schach., "Circular Knitting", Meisenbach GmbH, Bamberg, 1995, ISBN: 3-87525-066-4.



<b>UNIT I</b>	<b>9</b>
Introduction to quality control - definition of quality, importance of quality assessment; fabric inspection - independent product quality certification, acceptable quality level, MIL standards and final inspection; care labels - international care labeling system, Japan/Canada/British care labeling systems, eco labels; sampling plan and statistical application	
<b>UNIT II</b>	<b>13</b>
Cotton fibre testing - fibre length, strength, fineness, maturity and trash content; yarn testing - yarn numbering, crimp rigidity, strength, twist, evenness, hairiness and yarn appearance; course length determination, standards and test specifications used for testing	
<b>UNIT III</b>	<b>9</b>
Fabric testing - weight, strength, tensile strength, tearing strength, bursting, impact, abrasion resistance, pilling, crease recovery, stiffness, drapeability, air permeability, water permeability, flammability; objective evaluation of fabrics	
<b>UNIT IV</b>	<b>5</b>
Moisture and thermal properties; colour fastness testing – washing, light, rubbing, perspiration; shrinkage and dimensional stability	
<b>UNIT V</b>	<b>9</b>
Quality assessment of garments - cutting, sewing, pressing, finishing and package defects; analysis of specification sheet, rejection of goods by customers; inspection procedure; testing of garment accessories	

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. Booth J.E., "Principle of textile testing", Butterworth Publications, London, 1989.
2. Saville B.P., "Physical testing of textiles", Textile Institute, Manchester, 1998.
3. Kothari V. K., "Testing and Quality management", Progress in Textile Technology Vol.1, IAFL Publications, New Delhi, 1999.
4. Ruth clock and Grace Kunz., "Apparel manufacture – sewn product analysis", Upper Sadle River Publications, New York, 2000.
5. Pradip V. Mehta., "Managing quality in the apparel industry", NIFT Publication, India, 1998
6. Sara J. Kadolph., "Quality assurance for textiles and apparels", Fair child Publications, New York, 1998.
7. Slater K., "Physical testing and quality control", The Textile Institute, Vol.23, No.1/2/3 Manchester, 1993.

**UNIT I TECHNICAL TEXTILES IN TRANSPORT, FISHING AND INDUSTRY 9**

Design and characteristics required in textiles for transport applications like carpet, seat, air bag, belt, tyre, hose etc.; use of textile reinforced composites in transport sector; quality requirement of yarns used in fishing industry like nets, ropes; use of textiles in filters, conveyor belts, power transmission belts

**UNIT II TECHNICAL TEXTILES IN MEDICAL, HYGIENE AND SPORTS 9**

Design and characteristics required in textiles for medical and hygiene applications such as anti microbial fibres, operating room garments, disposable products, bandage and pressure garments, wound care materials, implantable devices; use of textiles in the sports field and by sports persons

**UNIT III TECHNICAL TEXTILES IN HOME, CLOTHING COMPONENT AND PROTECTION 14**

Design of textile materials used in furnishing, wadding, fibre fills, carpets, curtains, cleaning materials etc.; technology involved in the manufacture of sewing threads, interlinings etc.; garment design and choice of materials in protecting human from heat, flame, chemicals, cold, wind, static charge, bullets etc.

**UNIT IV TECHNICAL TEXTILES IN CONSTRUCTION, GEO TECHNICAL APPLICATIONS AND ENVIRONMENT PROTECTION 13**

Use of geo textiles in filtration, drainage, separation and reinforcement application in construction; type of fibre and fabric to be used in such applications; evaluation of geo textiles; use of textile materials in permanent and temporary civil construction - tents, awnings, sound and thermal insulation

**TOTAL: 45 PERIODS****REFERENCES:**

1. Anand S.C., "Medical Textiles", Textile Institute, Manchester, 2001, ISBN:185573494X.
2. Mukhopadhyay S.K. and Partridge J.F., "Automotive Textiles", Textile Progress, Vol.29, No1/2, 1999, ISBN:1870372212.
3. Horrocks A.R. and Anand S.C., "Handbook of Technical Textiles", The Textile Institute, Manchester, 2000, ISBN: 1855733854.
4. Adanur S., "Wellington sears handbook of Industrial textiles", Technomic publishing co inc., 1995, ISBN : 1-56676-340-1.
5. Pushpa Bajaj and Sengupta A.K., "Protective clothing", The Textile Institute, Manchester, 1992, ISBN 1-870812-44-1.
6. Scott.R.A., "Textiles for protection", Woodhead Publishing Limited, Cambridge, UK, 2005, ISBN 1-85573-921-6.
7. Saville.B.P, "Physical testing of textiles", Woodhead Publishing Limited, Cambridge, UK, 1999, ISBN 1-85573-367-6.
8. Long.A.C, "Design and manufacture of Textile Composites", Woodhead Publishing Ltd, Cambridge, UK, 2005, ISBN 1-85573-744-2.
9. Fung.W, "Coated and laminated textiles", Woodhead Publishing Ltd, Cambridge, UK, 2002, ISBN 1-85573-576-8.

10. Anand.S.C, Kennedy.J.F, Miraftab.M and Rajendran.S., "Medical textiles and biomaterials for health care", Woodhead Publishing Ltd, Cambridge, UK, 2006, ISBN 1-85573-683-7.
11. Fung.W and Hardcastle, "Textiles in automotive engineering", Woodhead Publishing Ltd, Cambridge, U. K, 2001, ISBN 1-85573-493-1.
12. John.N.W.M, "Geo Textile", Blackie and Sons Ltd, London, U.K., 1987, ISBN 0-412-01351-7.

**PTTT9354**

**BONDED FABRICS**

**L T P C  
3 0 0 3**

<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>5</b>
Definitions and classification of bonded fabrics; fibres and their characteristics for the production of bonded fabrics, uses; production methods and consumption of non-wovens		
<b>UNIT II</b>	<b>WEB FORMING</b>	<b>9</b>
Production of staple-fibre web by dry and wet methods; web laying methods and its influence on fabric properties; manufacture of web from filaments; uniformity and quality control of web		
<b>UNIT III</b>	<b>BONDING</b>	<b>13</b>
Bonded fabric production by needling, stitching, water jet consolidation, thermal and chemical methods; production of bonded fabrics by spun bonding and melt blown process; effect of processing parameters on fabric properties		
<b>UNIT IV</b>	<b>FINISHING</b>	<b>9</b>
Dry finishing – shrinkage, wrenching and creping, calendaring, perforating, slitting and splitting; wet finishing – washing, dyeing, printing; softening, flame proofing; coating; laminating; flocking		
<b>UNIT V</b>	<b>EVALUATION</b>	<b>9</b>
Various end uses of bonded fabrics; evaluation of non-woven fabrics; structure- property relationship in bonded fabrics		

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. Lunenschloss J., Albrecht W. and David Sharp., "Non-woven Bonded Fabrics", Ellis Horwood Ltd, New York, 1985, ISBN: 0-85312-636-4.
2. Gulrajani M.L., "Non wovens", Textile Institute, Manchester, 1992.
3. Mrstina V. and Feigl F., "Needle punching Textile Technology", Elsevier, New York, 1990.
4. Dharmadhikary R.K., Gilmore T.F., Davis H.A. and Batra S.K., "Thermal bonding of nonwoven fabrics", Textile Progress, Vol.26, No.2, Textile Institute Manchester, 1995, ISBN: 1870812786
5. Jirsak O. and Wadsworth L.C., "Non woven Textiles", Textile Institute, Manchester, 1999, ISBN: 0 89089 9788
6. Russell S., "Hand book of nonwovens", Textile Institute, Manchester, 2004, ISBN: 1 85573 603 9.

<b>UNIT I</b>	<b>5</b>
Costing - concepts; classification of costs; preparation of cost sheet; costing of yarn, fabric and garment	
<b>UNIT II</b>	<b>9</b>
Depreciation – method of computing depreciation; techniques of investment analysis - payback period method, accounting rate of return, DCF methods - IRR, NPV, PI	
<b>UNIT III</b>	<b>9</b>
Cost of capital; equity, debt, convertible debentures, preference share capital; capital structure; dividend policy; short, intermediate and long term financing	
<b>UNIT IV</b>	<b>5</b>
Working capital management - management of liquidity and current assets, estimation of working capital requirements for spinning mill, composite textile mill and garment unit; management of cash and marketable securities	
<b>UNIT V</b>	<b>17</b>
Tools of financial analysis and control- trading, profit and loss account, balance sheet; financial ratio analysis; funds flow analysis and financial forecasting; analysis of operating and financial leverage; illustrations for spinning mill, composite textile mill and garment industry	

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. Pandey I. M., "Financial management", Vikas Publishing House Pvt. Ltd., New Delhi, 8<sup>th</sup> Edition, 1999.
2. Bhavé P.V. and Srinivasan V., "Costing accounting to textile mills", ATIRA, Ahmadabad, 1976.
3. Thukaram Rao M.E., "Cost and management accounting" New Age International, Bangalore, 2004.
4. Thukaram Rao M.E., "Cost accounting and financial management" New Age International, Bangalore, 2004.
5. Prasanna Chandra, "Financial management, theory and practice, Tata McGraw-Hill Publishing Company Ltd, 5th Edition, New Delhi., 2001.
6. James C. Vanhorne, "Financial management and policy", Pearson Education Asia (Low priced edition) 12<sup>th</sup> edition, 2002.
7. Narang, G. B. S. and Kumar V., "Production and costing", Khanna Publishers, New Delhi, 1988.
8. Aswat Damodaran, "Corporate finance theory and practice", John Wiley & Sons, 2000.
9. Hrishikes Bhattacharya, "Working capital management, strategies and techniques", Prentice – Hall of India Pvt. Ltd., New Delhi, 2001.
10. Khan and Jain, "Basic financial management & practice", Tata McGraw Hill, New Delhi, 5<sup>th</sup> edition, 2001.

1. Study of blow room machinery
2. Card-Draft and production calculations and setting
3. Draft and production calculation in draw frame
4. Study of comber
5. Draft and twist calculations of speed frame and ring frame
6. Study of weaving preparatory machines
7. Study of primary motions
8. Study of secondary motions
9. Study of auxiliary motions
10. Study of circular and flat knitting machine
11. Securing and bleaching of cotton
12. Dyeing of cotton with different classes of dyes
13. Degumming and dyeing of silk
14. Dyeing of synthetic fibre
15. Printing of cotton fabrics
16. Colour measurement

**TOTAL: 45 PERIODS**

**AIM:**

To create awareness in every engineering graduate about the importance of environment, the effect of technology on the environment and ecological balance and make them sensitive to the environment problems in every professional endeavour that they participates.

**OBJECTIVE:**

At the end of this course the student is expected to understand what constitutes the environment, what are precious resources in the environment, how to conserve these resources, what is the role of a human being in maintaining a clean environment and useful environment for the future generations and how to maintain ecological balance and preserve bio-diversity. The role of government and non-government organization in environment managements.

**UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14**

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

Field study of common plants, insects, birds

Field study of simple ecosystems – pond, river, hill slopes, etc.

**UNIT II ENVIRONMENTAL POLLUTION 8**

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.

Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

**UNIT III NATURAL RESOURCES 10**

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging,



salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

#### **UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

#### **UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

**TOTAL: 45 PERIODS**

#### **TEXT BOOKS:**

1. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", 2<sup>nd</sup> edition, Pearson Education (2004).
2. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, (2006).

#### **REFERENCES:**

1. R.K. Trivedi, "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, "Environmental law", Prentice hall of India PVT LTD, New Delhi, 2007.
4. Rajagopalan, R, "Environmental Studies-From Crisis to Cure", Oxford University Press (2005).

**PTTT9402**

**GARMENT TECHNOLOGY**

**L T P C  
3 0 0 3**

**UNIT I GARMENT PRODUCTION 9**

Anthropometry, mass-production, mass-customization; pattern making, grading, marker planning, spreading & cutting

**UNIT II SEAMS AND STITCHES 13**

Different types of seams and stitches; sewing machine - mechanism and accessories; needle – functions, special needles, needle size, numbering, needlepoint; sewing thread-construction, material, thread size, packages.

**UNIT III COMPONENTS AND TRIMS 5**

Labels, linings, interlinings, wadding, lace, braid, elastic, hook and loop fastening, shoulder pads, eyelets and laces, zip fasteners, buttons

**UNIT IV TESTING AND PRODUCT EVALUATION 9**

Raw material, in process and final inspection; needle cutting; sewability of fabrics; strength properties of apparel; dimensional changes in apparel due to laundering, dry-cleaning, steaming and pressing; care labeling of apparel

**UNIT V PRESSING AND GARMENT PROCESSING 9**

Garment dyeing, printing and finishing; pressing categories and equipment

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. Carr H., and Latham B., "The Technology of Clothing Manufacture", Blackwell Science Ltd., Oxford, 1994, ISDN: 0632037482.
2. Winifred Aldrich., "Metric Pattern Cutting", Blackwell Science Ltd., Oxford, 1994.
3. Peggall H., "The Complete Dress Maker", Marshall Caverdish, London, 1985.
4. Gerry Cooklin., "Introduction to Clothing Manufacture", Blackwell Scientific Publications, London, 1991, ISDN: 0-632-02661-8.
5. Jai Prakash and Gaur R.K., "Sewing Thread", NITRA, 1994.
6. Ruth Glock, Grace I. Kunz, "Apparel Manufacturing", New Jersey, 1995, ISDN: 0-02-344142-9.
7. Pradip V.Mehta, "An Introduction to Quality Control for the Apparel Industry", 1992.

**PTTT9403**

**MECHANICS OF TEXTILE MACHINERY**

**L T P C  
3 0 0 3**

**UNIT I MACHINE DESIGN 14**

Equations of forces, motion and energy; design of cams; gear trains and draft calculations; principles of clutches and brakes - practical application in textile machines

**UNIT II ROTARY MOTION 13**

Equations of rotary motion; energy stored in rotating masses; power transmitted by rope and belt drives; friction calculations; balancing of rotating masses

**UNIT III SPINNING MACHINERY 9**  
Differentials and variable speed drives – principles, application in textile machines; design of cone drums – piano feed regulation, speed frame builder mechanism; balloon and traveler dynamics

**UNIT IV WEAVING MACHINERY 9**  
Design of winder drums; kinematics of shedding; picking – cams, torsion bars and other mechanisms; beat up; back rest

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. Booth J. E., "Textile Mathematics", Vol.2&3, The Textile Institute, Manchester, 1975, ISBN-10: 0900739193.
2. Slater K., "Textile Mechanics", Vol. 1&2, The Textile Institute, Manchester, 1977, ISBN: 0900739274.
3. Rengasamy R. S., "Mechanics of spinning machines", NCUTE, Ministry of Textiles, Govt of India, 2000.

**PTTT9406 QUALITY ASSURANCE LABORATORY**

**L T P C  
0 0 3 2**

**LIST OF EXPERIMENTS**

1. Determination of fibre fineness, length and maturity
2. Determination of single and bundle yarn strength and count
3. Determination of yarn twist
4. Determination of yarn crimp
5. Determination of evenness of sliver roving and yarn
6. Determination of seam strength
7. Determination of fabric tensile strength
8. Determination of air permeability
9. Determination of fabric bursting strength
10. Determination of fabric drape
11. Determination of fabric crease recovery and wrinkle recovery
12. Determination of fabric abrasion resistance and pilling
13. Determination of fabric colour fastness (light, rubbing, washing and perspiration)
14. Assessment of fabric faults
15. Assessment of garment faults

**TOTAL : 45 PERIODS**

**PTTT9401 TOTAL QUALITY MANAGEMENT FOR TEXTILE AND APPAREL INDUSTRIES**

**L T P C  
3 0 0 3**

**UNIT I INTRODUCTION 9**

Definition of quality, dimensions of quality, quality planning, quality costs – analysis techniques for quality costs; basic concepts of total quality management, historical review; principles of TQM; leadership – concepts, role of senior management; quality council, quality statements; strategic planning; Deming philosophy; barriers to TQM implementation

**UNIT II TQM PRINCIPLES 13**

Customer satisfaction – customer perception of quality, customer complaints, service quality, customer retention; employee involvement – motivation, empowerment, teams, recognition and reward; performance appraisal, benefits; continuous process improvement – Juran trilogy, PDCA cycle, 5S, Kaizen; supplier partnership – partnering, sourcing, supplier selection, supplier rating, relationship development; performance measures – basic concepts, strategy, performance measure

**UNIT III STATISTICAL PROCESS CONTROL (SPC) 9**

Seven tools of quality; statistical fundamentals – measures of central tendency and dispersion, population and sample, normal curve; control charts for variables and attributes; process capability, concept of six sigma; new seven management tools; SPC applied to textile industry

**UNIT IV TQM TOOLS 9**

Benchmarking – reasons to benchmark, benchmarking process; Quality Function Deployment (QFD) – House of quality, QFD process, benefits; Taguchi quality loss function; Total Productive Maintenance (TPM) – concept, improvement needs, FMEA – stages of FMEA; TQM tools application in textile industry

**UNIT V QUALITY SYSTEMS 5**

Need for ISO 9000 and other quality systems; ISO 9000:2000 quality system – elements, implementation of quality system, documentation, quality auditing; QS 9000, ISO 14000 – concept, requirements and benefits; quality systems implementation in spinning, weaving and garment industry

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. James R.Evans and William M.Lidsay., “The Management and Control of Quality”, (5<sup>th</sup> Edition), South-Western (Thomson Learning), 2002, ISBN 0-324-06680-5.
2. Dale H. Besterfield. et al., “Total Quality Management”, Pearson Education Asia, 1999, Indian reprint -2002
3. Feigenbaum A.V., “Total Quality Management”, McGraw-Hill, 1991.
4. Oakland J.S., “Total Quality Management”, Butterworth, Oxford. 1989.
5. Narayana V., and Sreenivasan N.S., “Quality Management – Concepts and Tasks”, New Age International, 1996.
6. Zeiri., “Total Quality Management for Engineers”, Woodhead Publishers, 1991.

**PTTT9404**

**CLOTHING SCIENCE**

**L T P C**  
**3 0 0 3**

**UNIT I FABRIC APPEARANCE 9**

Fibre structure, yarn structure and fabric construction; their effect on fabric appearance; study of properties such as pilling, fastness, and lustre

**UNIT II COMFORT 9**

Effect of fibre properties, yarn structure and fabric construction on the fabric properties – drapeability, air permeability, moisture absorption, bending rigidity, shear

**UNIT III DURABILITY 9**

Study of tensile, tearing strength, bursting strength with respect to fibre properties, yarn structure and fabric design

**UNIT IV FABRIC AS PROTECTION 4**

Study of protective properties of apparel for various applications; desirable properties of protective textiles; method of testing for thermal protective performance, impact, abrasion and wear resistance; evaluation of resistance to mildew, ageing, sunlight, chemical, static electricity and flame propagation; ASTM standards for protective garments

**UNIT V EASY CARE 5**

Crease resistance, anti-shrink, pilling resistance behaviour – role of fibre properties and chemical treatments

**UNIT VI FABRIC ENGINEERING 9**

Fabric engineering for a given end use - selection of fibre, type of yarn, fabric structure and finishing treatments

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. Morton W.E., and Hearle J.W.S., "Physical Properties of Textile Fibers", The Textile Institute, Manchester, 1993.
2. Hearle J.W.S., Grosberg P. and Baker S., "Structural mechanics of Fibres yarn and Fabrics", Vol .1, Wiley-Intersciences, New York, 1969.
3. Meridith R., "Mechanical Properties of Textiles Fibres", Interscience, New York, 1986.
4. Goswami B.C., Martindale J. and Scandino F.L., "Textiles Yarns; Technology, Structure and Applications", Wiley Interscience, New York, 1997.
5. Shenai V.A., "Textiles finishing", Sevak publications, Bombay, 1989.

**PTTT9451**

**PROJECT WORK**

**L T P C**  
**0 0 1 2 6**

Each student is required to submit a report on the project assigned to him by the Department. The report should be based on the information available in the literature or data generated in the laboratory/industry. The object of the project is to make use of the knowledge gained by the student at the various stages of the degree programme. This helps to judge the level of proficiency, originality and capacity for application of knowledge attained by the students by the end of the programme.

**UNIT I INTRODUCTION****10**

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

**UNIT II PREPARATION METHODS****10**

Bottom-up Synthesis-Top-down Approach: Precipitation, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

**UNIT III PATTERNING AND LITHOGRAPHY FOR NANOSCALE DEVICES****5**

Introduction to optical/UV electron beam and X-ray Lithography systems and processes, Wet etching, dry (Plasma /reactive ion) etching, Etch resists-dip pen lithography

**UNIT IV PREPARATION ENVIRONMENTS****10**

Clean rooms: specifications and design, air and water purity, requirements for particular processes, Vibration free environments: Services and facilities required. Working practices, sample cleaning, Chemical purification, chemical and biological contamination, Safety issues, flammable and toxic hazards, biohazards.

**UNIT V CHARACTERISATION TECHNIQUES****10**

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation

**TOTAL: 45 PERIODS****TEXT BOOKS:**

1. A.S. Edelstein and R.C. Cammearata, eds., "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, "Nanoscale characterisation of surfaces & Interfaces", 2<sup>nd</sup> Edition, Weinheim Cambridge, Wiley-VCH, 2000

**REFERENCES:**

1. G Timp (Editor), "Nanotechnology", AIP press/Springer, 1999
2. Akhlesh Lakhtakia (Editor), "The Hand Book of Nano Technology, Nanometer Structure", Theory, Modeling and Simulations", Prentice-Hall of India (P) Ltd, New Delhi, 2007.

**UNIT I INTRODUCTION AND THEORY 9**

Chemistry and development of resins, resin additives and their effects; reinforcements; properties of composite materials; comparison of structural materials

**UNIT II CONSTRUCTION OF COMPOSITE STRUCTURES 9**

Techniques for manufacturing composites – open and closed moulds and continuous processes; preparation of reinforcing structures - 3D woven and knits; curing - chemical and temperature effects; fiber volume fraction

**UNIT III PROPERTIES AND BEHAVIOR OF COMPOSITES 9**

Behavior of composites under stress, anisotropy of stress; elasticity-thermal and electrical conductivity; fatigue resistance; effect of manufacturing settings, chemicals and materials on the properties of composites

**UNIT IV QUALITY CONTROL 9**

Quality control in raw materials, material selections/preparation, mould preparation; operation control in manufacturing and curing; control of finished products

**UNIT V REINFORCING FIBERS 9**

Chemistry and manufacture of high performance filaments – kevlar, high performance polyethylene, glass, carbon; end uses with composite structures reinforced with reinforcing fibres

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. Pipes R. B., "Composite Materials", Vol. 1, 2 & 3, Elsevier Science Publishers, New York, 1990.
2. Ashbee K. H. G., "Fundamental principles of fiber reinforced composites", CRC Press, 1993, ISBN 0877629234.
3. Hearl J. W. S., "Physical properties of Textile Fibres", The Textile Institute, Manchester. 1997.

<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>9</b>
Need for bulking of synthetic yarns; texturability of fibres, classifications and principles of methods of texturing		
<b>UNIT II</b>	<b>HEAT SETTING</b>	<b>9</b>
Heat setting – need, types of setting, factors involved; effect on fibre morphology and yarn properties; evaluation of heat setting processes		
<b>UNIT III</b>	<b>FALSE TWIST TEXTURING</b>	<b>9</b>
Draw texturing - simultaneous and sequential draw texturing; twisting devices; heating and cooling systems; take-up systems; characteristics of feed yarns; process parameters-time, temperature, twist, tension; evaluation of false-twist textured yarns; end-uses.		
<b>UNIT IV</b>	<b>AIR JET TEXTURING</b>	<b>9</b>
Types of yarns produced; airflow pattern in different types of nozzles; loop formation-mechanism, factors involved; evaluation of air-jet textured yarn; comparison of air-jet textures yarn with spun and false twist textured yarns; end-uses		
<b>UNIT V</b>	<b>OTHER METHODS OF TEXTURING</b>	<b>9</b>
Stuffer box, edge crimping, knit-de-knit and gear crimping methods; bi-component filament texturing; differential shrinkage texturing; chemo - mechanical texturing; limitations and applications		

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. Hes L. and Ursiny P., "Yarn Texturing Technology ", Eurotex, U.K. 1994.
2. Ali Demir and Hassan M. Behery., "Synthetic filament yarn texturing technology", Prentice Hall, 1996, ISBN: 0134400259.
3. Gulrajani M. L. (Ed.), "Annual symposium of texturing", I.I.T Delhi, 1977.
4. Wilson D. K. and Kollu T., "Production of textured yarns by the false twist technique", Textile progress Vol. 21, No.3, Textile Institute, Manchester, U.K., 1991.
5. Wilson D. K. and Kollu T., "Production of textured yarns by methods other than false twist technique", TP Vol.16, No.3, Textile Institute, 1981.
6. Hearl J.W.S., Hollick L. and Wilson D.K., " Yarn texturing Technology", Woodhead Publication Ltd., 2001 ISBN: 185573575X



<b>UNIT I</b>	<b>REARING</b>	<b>5</b>
Domestic silk worm rearing – multivoltine, bivoltine and univoltine species; wild silk worms rearing – Tasar, Muga and Eri culture		
<b>UNIT II</b>	<b>SILK REELING</b>	<b>13</b>
Cocoon quality; stifling and conditioning of cocoons, boiling and brushing of cocoons; reeling; re-reeling; raw silk testing and classification; wild silk reeling; production of spun silk yarn		
<b>UNIT III</b>	<b>SILK WEAVING</b>	<b>9</b>
Technological parameters of weaving and productivity; weaving of silk fabrics using semi automatic, automatic, shuttleless and pile looms		
<b>UNIT IV</b>	<b>PREPARATION OF SILK</b>	<b>9</b>
Properties of sericin; degumming of silk - extraction with water, treatment with alkalis and digestion with enzymes; bleaching of silk – origin and nature of colours, bleaching with reducing and oxidising agents		
<b>UNIT V</b>	<b>DYEING, PRINTING AND FINISHING</b>	<b>9</b>
Dyeing with acid, basic and reactive dyes; different styles of printing with acid and reactive dyes, printing with pigments, khadi and metallic powders, sublimation transfer printing; finishing of silk – weighting, softening, flame proofing, crease proofing, mildew proofing		

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. "Manuals on Sericulture", Food and agriculture organisation of the United Nations, Rome, 1976.
2. "Silk dyeing and finishing handbook", compiled by Shanghai Municipality Silk Industry Corporation, China, 2000, ISBN :1578080886.
3. "Silk weaving", compiled by Zhejiang silk engineering institute, China, Suzhou silk engineering institute, China, Oxford & IBH Publishing company pvt. Ltd, New Delhi, 2002.
4. Gulrajani M.L., (ed.) "Silk – dyeing printing and finishing", Indian Institute of Technology, New Delhi, 1989.
5. Nanavathy M., "Silk production, processing and marketing", Wiley Eastern, 1991.
6. Scott P., "The book of silk", Thames and Hudson, 1993.
7. Sinha S., "The development of Indian silk: A wealth of opportunities", Intermediate technology, U.K, 1990.
8. Rheinberg L., "The romance of silk", Textile progress, The Textile institute, Manchester, 1991.
9. Sonwalker T.A., "Handbook of silk technology", Wiley Eastern, Chennai, 1992.
10. Shekar P. and Ardingham., "Sericulture and silk production – A hand book", Intermediate Technology, U.K., 1995, ISBN:1853393177.
11. Dandin S.B., Jayaswal J. and Giridhar K. (ed.), "Handbook of Sericulture Technologies", Central Silk Board, Bangalore, 2003.
12. Huang Guo Rui (ed.), "Silk reeling", Oxford & IBH Publishing company Pvt. Ltd., New Delhi, 1998.

<b>UNIT I</b>	<b>CONDENSED YARN SPINNING</b>	<b>5</b>
Principle of condensed yarn spinning; working of different methods of condensed yarn spinning; advantages of this method over conventional ring spinning method.		
<b>UNIT II</b>	<b>ROTOR SPINNING</b>	<b>13</b>
Description of the working of the rotor spinning; requirements of the raw materials; preparation of the sliver for rotor spinning; yarn formation and its structure; yarn withdrawal and winding; rotor design and its implications on production and yarn quality; production limits; comparison with ring spinning.		
<b>UNIT III</b>	<b>FRICTION SPINNING</b>	<b>9</b>
Detailed study of the DREF-2, DREF-3 and master spinner machines working on the principles of friction spinning; the use of raw materials; application of these machines for different end products; the economics; technological limitations.		
<b>UNIT IV</b>	<b>AIR - JET SPINNING</b>	<b>9</b>
Description of the yarn production in air jet spinning machine; feasibility of higher draft applied in this machine; structure and quality of the air-jet spun yarn; raw materials requirement.		
<b>UNIT V</b>	<b>OTHER SPINNING TECHNOLOGIES</b>	<b>9</b>
Production of yarn in PLY fil spinning, process applying similar principle; comparison with other spinning methods; working details of the production of double-rove yarns and wrap yarns; use of raw materials; economics of these methods of yarn production; yarn characteristics and their application.		

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. Oxtoby E., " Spun Yarn Technology ", Butterworths, London, 1987.
2. Klein W., " New Spinning Methods ", The Textile Institute, Manchester, 1993.
3. Dyson E., " Rotor Spinning, Technical and Economics Aspects ", Textile Trade Press, New Mills, Stock Port, 1975.
4. Salhotra K.R. and Ishtiaque S.M., " Rotor Spinning; its advantages ", Limitations and Prospects in India, ATIRA, Ahmedabad, 1995.
5. Lord P.R., " Yarn Production; Science, Technology and Economics ", The Textile Institute, Manchester, 1999.
6. Trommer G., " Rotor Spinning", Meliand Textilebenchte GmbH, Rohrbacher, 1995.
7. Lawrence C.A and Chen K.Z., " Rotor Spinning ", Textile Progress, The Textile Institute, Manchester, 1984.

**UNIT I FIBRE DISPERSION****9**

Ginning of cotton; the necessity of fibre-individualization; fibre opening in blow-room machinery; the mechanism of fibre-dispersion during carding operation; the minimum requirements during carding and the new approaches to improve fibre-dispersion in carding operation; neps formation and removal; theory of hook formation.

**UNIT II ATTENUATION AND FIBRE STRAIGHTENING****13**

Principle of roller drafting and its application in yarn production; drafting irregularities – their causes and remedies; the function of aprons in roller drafting; limitation of apron-drafting and the scope for improvement; mechanism of wire-point drafting and its application in yarn production; merits and demerits of wire-point drafting; comparison of wire-point drafting with roller drafting; definition of fibre-extent; influence of fibre-extent on yarn quality; improvement of fibre-extent by straightening actions in carding, drafting and combing.

**UNIT III TWISTING****9**

Effect of twisting of staple-fibre strand on its strength; meaning of twist multiplier and the basis of selection of required twist; fundamental requirement to create real twist in a strand; mechanism of different twisting principles – ring-twisting, open-end twisting, air-jet twisting, up-twisting, two-for-one twisting, hollow-spindle twisting.

**UNIT IV FIBRE BLENDING AND LEVELLING****9**

Importance of fibre-mix homogeneity on yarn quality; types of mixing during spinning preparatory process; assessment of blend efficiency; influence of intermediate product uniformity on yarn uniformity; methods of leveling adopted during spinning processes.

**UNIT V FIBRE CLEANING****5**

Methods adopted to clean the fibres from trash, short fibres and neps; role of blow-room, card and comber in fibre cleaning.

**TOTAL: 45 PERIODS****REFERENCES:**

1. Oxtoby E., "Spun Yarn Technology", Butterworths, London, 1987.
2. Klein W., "The Technology of Short-staple Spinning", The Textile Institute, Manchester, 1998. ISBN: 1870812980.
3. Klein W., "A Practical Guide to Opening and Carding", The Textile Institute, Manchester, 1999. ISBN: 1870812999.
4. Klein W., "A Practical Guide to Combing, Drawing and the Roving Frame", The Textile Institute, Manchester, 1999. ISBN: 1870372287.
5. Klein W., "A Practical Guide to Ring Spinning", The Textile Institute, Manchester, 1999. ISBN: 1870372298.
6. Lord P.R., "Yarn Production: Science, Technology and Economics", The Textile Institute, Manchester, 1999. ISBN: 1870372174.
7. Salhotra K.R. and Chattopadhyay R., "Book of papers on Blow-room, Card", Indian Institute of Technology, Delhi, 1998.
8. Shaw J., "Short-staple Ring Spinning", Textile Progress, The Textile Institute, Manchester, 1982.
9. Doraiswamy I., Chellamani P., and Pavendhan A., "Cotton Ginning", Textile Progress, Vol. 24, No.2, The Textile Institute, Manchester, 1993. ISBN: 1870812484.
10. Grosberg P. and Iyre C., "Yarn Production: Theoretical Aspects", Textile Institute, 1999, ISBN: 1870372034.

<b>UNIT I</b>	<b>FIBRE CLEANING AND BLENDING</b>	<b>5</b>
Impurities in the long-staple fibre like wool and their removal; methods adopted to process raw flax and jute; blending methods followed for long stable fibres		
<b>UNIT II</b>	<b>FIBRE INDIVIDUALISATION</b>	<b>9</b>
Fibre individualization in the carding machine; working principle and details of different type of carding machine-worsted carding, semi -worsted carding, woollen carding, flax carding and jute carding; card clothing and its maintenance; carding performance		
<b>UNIT III</b>	<b>COMBING</b>	<b>9</b>
Objective of combing; basic principles of combing; details of wool combing preparation and combing operation; worsted top finishing		
<b>UNIT IV</b>	<b>DRAWING</b>	<b>9</b>
Principle of long-staple drafting; effect of doubling; drafting irregularities; working details of worsted, semi worsted, jute and flax drawing; operating principle of roving machine		
<b>UNIT V</b>	<b>YARN SPINNING</b>	<b>13</b>
Mule spinning -drafting, twisting, backing-off, winding on; description of centrifugal spinning; flyer spinning; ring spinning - twisting, rings and travellers; condenser yarn spinning; cap spinning; open end spinning –general features of rotor and friction spinning as applicable to long-stable fibres; double-rove spinning; self twist spinning system		
<b>TOTAL: 45 PERIODS</b>		

**REFERENCES:**

1. Oxtoby E., "Spun Yarn Technology", Butterworths, London, 1987.
2. Happey F., "Contemporary Textile Engineering", Academic Press, London, 1983.
3. Lord P.R., "Yarn Production: Science, Technology and Economics", The Textile Institute, Manchester, 1999.
4. Ross D.A., Carnaby G.A and Lappage J., "Woollen Yarn Manufacture", Textile Progress, The Textile Institute, Manchester, 1986.
5. Richards R.T.D. and Sykes A.B., "Woollen Yarn Manufacture", The Textile Institute, Manchester, 1994.
6. Henshaw D.E., "Worsted Spinning", Textile Progress, The Textile Institute, Manchester, 1981.

**PTTT9027      PROCESS CONTROL IN MAN-MADE FIBRE YARN  
PRODUCTION**

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**UNIT I** **13**

Polyester, viscose, acrylic, lyocell fibres – fibre characteristics and effects on yarn spinning performance; objectives of blending, measures of blending, selection of blend ratio; different mechanics of blending; effect of fibre properties and blend composition on yarn properties

**UNIT II** **5**

Processing of manmade fibres in short staple system; tinting; RH and temperature control at preparatory and spinning; generation of static electricity and its influence on spinning processing; control of static generation

**UNIT III** **9**

Blending at blow room; blow room – conditioning, opening, speeds and settings, process related problems and remedies; carding – selection of wires, speeds and settings, neps removal and process related problems and remedies

**UNIT IV** **9**

Blending at draw frame; number of passages; calculations of number of doubling and sliver linear density for each component; roller lapping – causes and remedies; speed frame – process parameters, process related problems and remedies

**UNIT V** **9**

Ring frame – process parameters, process related problems and remedies; yarn faults; rotor spinning – selection of fibres, material preparation, machine and process parameters; spinning of dyed fibres – process related problems and remedies

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. Klein W., “Man-made fibres and their processing”, The Textile Institute, Manchester, 1994.
2. Salhotra K.R., “Spinning of manmades and blends on cotton system”, The Textile Association India, Bombay, 1983.
3. Garde A.R. and Subramaniam T.A., “Process control in spinning”, ATIRA Publications, Ahmedabad, 1989.

**UNIT I YARN GEOMETRY****13**

Idealized helical yarn structure; yarn count and twist factors, twist contraction; packing of fibers in yarns; measurement of packing density and radial packing density of yarn; measurement of yarn diameter; ideal migration, tracer fiber technique, characterization of migration behavior, migration in blended yarns, mechanisms of migration, effect of various parameters on migration behavior.

**UNIT II MECHANICS OF CONTINUOUS FILAMENT YARNS****9**

Analysis of tensile behavior; prediction of breakage; analysis of yarn mechanics by energy method; observed extension and breakage of continuous filament yarns; mechanics of torque in filament yarns

**UNIT III MECHANICS OF STAPLE FIBRE YARNS****5**

Theoretical analysis; fiber obliquity and slippage; influence of fiber length, fineness and friction; strength of blended yarns - Hamburger's model

**UNIT IV WOVEN FABRIC GEOMETRY AND DEFORMATION****13**

Elements of woven fabric geometry; Pierce and Olofsson models - form factor; jamming of threads, cover factor; crimp interchange, degree of set; modification to Pierce model - race track, saw tooth and bilinear models, extension behavior of woven fabric; prediction of modulus, tensile properties in bias direction; other fabric deformation - shear, buckling, bending and compression; fabric handle

**UNIT V NONWOVEN AND KNITTED STRUCTURES****5**

Geometry of plain knitted structure, mechanics of non-woven fabrics

**TOTAL: 45 PERIODS****REFERENCES:**

1. Hearl J. W. S., "Structural Mechanics of Fibers, Yarns and Fabrics", Wiley-Interscience, New York, 1969, ISBN: 0471366692.
2. Hearle J. W. S., John J., Thwaites. and Jafargholi Amirbayat., "Mechanics of Flexible Fibre Assemblies", Sijthoff and Noordhoff, 1980, ISBN : 902860720X.
3. Goswami B. C., "Textile Yarns: Technology, Structure and Applications", Wiley-Interscience – New York, 1977, ISBN: 0471319007.
4. Jinlian Hu., "Structure and Mechanics of Woven Fabrics", Woodhead Publishing Ltd., 2004, ISBN: 1855739046.
5. Hassan M. Berery., "Effect of Mechanical and Physical properties on Fabrics Hand", Woodhead publishing Ltd., 2005, ISBN : 13: 978 – 1- 85573 -9185.

**UNIT I****5**

Introduction to wrap knitting; warp knitted loop structures; comparison of weft and warp knitted loop structures; elements of warp knitted loop – courses and wales, open loop, closed loop; warp knitting elements- timing of knitting elements, principles of chain link motion, designation of chain links for simple patterns and chain notations, pattern disc, guide bar movement mechanism, needle bar movement mechanism, sinker bar movement mechanism

**UNIT II****13**

Two bar, three bar fabrics – chain notation and quality particulars, Tricot pattern fabrics using partially threaded warp threads; Atlas lapping and their derivatives; inlaid lappings, pleated structures; requirements of machine element and lapping sequence; patterns produced using pile sinker devices; Terry pile fabric production – machine element requirement and lapping sequences; cut pile fabrics and machines used for cut pile; use of spandex fibre in tricot warp knitted patterns; electronic guide bar control use in tricot warp knitting machine and its advantages over conventional chain link system

**UNIT III****13**

Principles of Raschel warp knitting, elements of Raschel machine, timing of knitting elements; simple Raschel structures, main emphasis on net structures, lapping diagram and chain notations; different types of guides used in Raschel knitting machine; Multi bar Raschel technology – principles, development of figuring, type of basic structures used in multi bar patterns; fixing of guide fingers based on the lay out of design grouping of guide bars; setting the shog rows for multi bar patterns; principle involved in summery aggregate patterning mechanism used in multi bar technology; use of string bar control systems in multi bar machines; production of power net using Raschel knitting machine; uses of fabrics produced using multibar warp knitting machines

**UNIT IV****5**

Positive let off system; mechanical and electronic let off system; run in value based on the lapping diagram; take up system; mechanical and electronic take up mechanism; threading procedure in warp knitting; warping procedure and production calculation; scheduling; theoretical concepts of warp knitted loop configuration

**UNIT V****9**

Principles of jacquard warp knitted patterns; color coding of lapping sequences; working principle of mechanical jacquard and electronic jacquard; various principles involved in jacquard patterning techniques; use of multibar technology with jacquard in creating warp knitted patterns; uses of fabrics produced using jacquard warp knitting machines; principle of double needle bar patterning; machine elements of double needle bar machines; patterning techniques adapted in double needle bar machines - plush, shawl and fringes, multi tubular net fabrics, sack fabrics etc.; uses of fabrics produced using double needle bar machines

**TOTAL: 45 PERIODS****REFERENCES:**

1. Thomas D.G.B., "An Introduction to Warp Knitting", Merrow Publishing Company, UK., 1971, ISBN-13: 9780900541070
2. Sam Raz, "Warp Knitting Production", Melliland Textilberichte GmbH, Heidelberg, Germany, 1987, ISBN:3-87529-022-4





<b>PTTT9031</b>	<b>COLOUR SCIENCE, MEASUREMENT AND ITS APPLICATIONS</b>	<b>L T P C</b>
		<b>3 0 0 3</b>
<b>UNIT I</b>	<b>COLOUR SCIENCE</b>	<b>13</b>
Perception of color – mechanism of color vision, color vision theories, defects in color vision, color vision tests; additive and subtractive color mixing; confusion in color perception; Beer's Law, Lambert's Law and Kubelka - Munk's simplified model of theory of interaction of matter and radiation		
<b>UNIT II</b>	<b>COLOUR ORDER SYSTEMS</b>	<b>9</b>
Description of color; various color order systems; CIE system and its components; illuminants; standard observer; chromaticity diagram		
<b>UNIT III</b>	<b>COLOUR MATCHING</b>	<b>9</b>
Reflectance curves of dyed samples; application of the Kubelka - Munk theory to color matching; techniques of computer color matching; prediction of color recipe; limitations of computer color matching		
<b>UNIT IV</b>	<b>METAMERISM</b>	<b>5</b>
Illuminant metamerism; observer metamerism; geometric metamerism; assessment of metamerism; metamerism in textiles		
<b>UNIT V</b>	<b>COLOUR DIFFERENCE MEASUREMENTS AND COLOUR ASSESSMENT IN TEXTILES</b>	<b>9</b>
Visual colour assessment; variables, standard conditions and methods of visual assessment; instrumental colour assessment; colour difference equations and measurements (LAB/LUV scales); pass fail standards		

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. Shah H. S. and Gandhi R. S., "Instrumental colour measurement and computer aided colour matching for textiles", Mahajan Book Publication, 1990.
2. Park J., "Instrumental Colour formulation: A Practical guide", Woodhead Publishing, 1993, ISBN 0 901956 54 6.
3. Choudhury A. K. R., "Modern concepts of colour and appearance", Oxford and IBH Publishing Ltd, 2000.
4. Sule A. D., "Computer colour analysis", New Age International Publishers, 2002.
5. Mc Laren K., "The color science of Dyes & Pigments", Adam Hilger Ltd., 1983, ISBN 0-85274-426-9.

<b>PTTT9032</b>	<b>FABRIC AND GARMENT FINISHING</b>	<b>L T P C</b>
		<b>3 0 0 3</b>
<b>UNIT I</b>		<b>13</b>
Garment dyeing - selection of fabrics, selection of garment accessories, fabric and sewing thread selection, selection of dyes; garment - dyeing machinery		
<b>UNIT II</b>		<b>9</b>
Washing - stone washing, acid washing, enzyme washing, bio polishing, emerisation; bleaching; laser fading; ozone fading		

<b>UNIT III</b>	<b>9</b>
Finishing - optical brightening; mercerization; liquid ammonia treatment	
<b>UNIT IV</b>	<b>9</b>
Stiffening; softening; crease resistant and crease retentive finish; anti-static finish; anti-bacterial finish; waterproofing; flame proofing; soil release finish; mildew and moth proofing	
<b>UNIT V</b>	<b>5</b>
Stain removal; care labels; laundering equipment and procedures.	

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. Harrison P. (ed.), "Garment Dyeing: Ready to wear fashion from the dye house", The Textile Institute, U.K., 1988 ISBN: 1870812131.
2. Noemia D' Souza, "Fabric Care", New Age International (P) Ltd Publisher.,Chennai ,1998, ISBN: 81-224-1143-6.
3. Hall A.J., "Textile Finishing", Elsevier Publishing Co. Ltd., 1986.
4. Marsh J.T., "An Introduction to Textile Finishing", Chapman and Hall Ltd., London, 1979.
5. Shenai V.A., "Technology of Textile Finishing", Sevak Publications, Bombay, 1995.
6. Perkins W.S., "Textile Coloration and Finishing", Carolina Academic Press, 1995.

<b>PTTT9033</b>	<b>SYNTHETIC FIBRE COLOURATION</b>	<b>L T P C</b> <b>3 0 0 3</b>
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<b>UNIT I</b>	<b>MASS COLOURATION</b>	<b>9</b>
Different methods of mass colouration, mass colouration of polymers - polyester, nylon, acrylic and polypropylene		
<b>UNIT II</b>	<b>PRETREATMENTS</b>	<b>9</b>
Pretreatments for polyester, nylon, acrylic and polypropylene fabrics, pretreatments for blends - polyester/cotton, polyester/wool, acrylic/wool and acrylic /cotton		
<b>UNIT III</b>	<b>DYEING OF POLYESTER AND POLYPROPYLENE</b>	<b>9</b>
Different mechanisms of dyeing polyester, dyeing of textured polyester, differentially dyeable polyester and its blends, carrier free dyeable polyester; dyeing of polyester blends - polyester/cotton and polyester/wool; dyeing of unmodified and modified polypropylene		
<b>UNIT IV</b>	<b>DYEING OF NYLON AND ACRYLIC</b>	<b>9</b>
Dyeing of nylon with acid and disperse dyes, dyeing of polyamide blends, differentially dyeable nylon and its blends; dyeing of acrylic with cationic and disperse dyes, dyeing of acrylic blends, differentially dyeable acrylic and its blends		

**UNIT V PRINTING 9**

Different styles of printing polyester, polyamide and polypropylene fabrics; transfer printing – different systems of transfer printing, heat transfer printing, advantages and limitations

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. Gulrajani M.L., "Dyeing Polyester and its blends", IIT, Delhi, 1987.
2. Burkinshaw S.M., "Dyeing of synthetic fibres", Blackie, 1995.
3. Shore J., "Blends dyeing ", SDC, U.K, 1998. ISBN: 090195446740
4. Datye K.V. and Vaidhya A.A., "Chemical processing of synthetic fibers and blends", Wiley-Interscience Publication, 1984.
5. Burkinshaw S.M., "Chemical Principles of Synthetic Fibre Dyeing", Textile Insitute Publication, 1995.

**PTTT9034 PROCESS CONTROL IN TEXTILE CHEMICAL PROCESSING L T P C  
3 0 0 3**

**UNIT I 9**

Quality control tests for dyes, chemical auxillaries and finishing agents

**UNIT II 13**

Quality control tests in singeing, desizing, scouring, bleaching and mercerisation; process control aspects in the above processes

**UNIT III 9**

Quality control tests in dyeing and printing; concept of CCM in quality control; process control in dyeing and printing

**UNIT IV 9**

Quality Control tests in finishing treatments; process control in above treatments

**UNIT V 5**

Quality control tests for eco-labelling; process control measures to achieve eco-standards

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. Shenai V.A., "Textile Fibres", Vol.1, Edn.3, Sevak Publications, Mumbai, 1995.
2. Shenai V.A., "Chemistry of Dyes and Principles of Dyeing ", Vol. 2, Edn.3, Sevak Publications, Mumbai, 1995.
3. Shenai V.A., "Technology of Bleaching and Mercerizing", Vol. 3, Edn. 3, Sevak Publications, Mumbai, 1995.
4. Shenai V.A., "Technology of Printing", Vol. 4 Edn.3, Sevak Publications,Mumbai, 1995.
5. Shenai V.A., "Technology of Dyeing", Vol. 6, Edn.3, Sevak Publications, Mumbai, 1995.
6. Shenai V.A., "Evaluation of Textile Chemicals", Vol. 8, Edn.3, Sevak Publications, Mumbai, 1995.





**UNIT I FIBRES, YARNS AND FABRICS FOR PROTECTIVE GARMENTS 9**

Selection of fibres-suitability and properties of high performance fibres for various protective clothing, chemical composition and physical structure, characteristics and working of various fibres according to different end uses like thermal protection, ballistic protection, anti-microbial protection, Protection against cold etc.

Yarn and fabric (knitted, woven and Non-woven) parameters, their methods of production, effect of structure on their performance; use of composite materials in yarn and fabric formation used for protective end uses

**UNIT II CHEMICAL FINISHES FOR PROTECTIVE GARMENTS 9**

Use of coated fabrics – different types of finishes like fire retardant finishes, for different textile materials, water repellent finishes, anti-microbial finishes; chemical finishes against radiation and chemicals – method of application of those finishes; machines and techniques used for such applications; protective finishes for health care garments

**UNIT III PROTECTIVE GARMENTS IN OTHER APPLICATIONS 9**

Protective fabrics used in the medical field and in hygiene; military combat clothing; protective fabrics against biological and chemical warfare; textiles for high visibility

**UNIT IV GARMENT CONSTRUCTION 9**

Garment construction - method of construction of garments according to various protective end uses like protection against cold, heat, chemical, ballistic protection etc.; use of different fabric type - knitted, woven, and Non-woven; coated / laminated in protective applications different places; use of inter lining and composites

**UNIT V EVALUATION OF PROTECTIVE GARMENTS 9**

Evaluation of protective fabrics - desirable properties of protective textiles, method of testing for thermal protective performance, water, cold, abrasion and wear resistance; evaluation of resistance in to mildew, ageing, sunlight, chemical, electrostatic and electrical resistivity, impact properties; ASTM standards for protective garments

**TOTAL: 45 PERIODS****REFERENCES:**

1. Adanur S., "Wellington sears handbook of Industrial textiles", Technomic publishing co inc, 1995, ISBN : 1 – 56676 – 340 – 1.
2. Pushpa Bajaj and Sengupta A.K., "Protective clothing", The Textile Institute, 1992, ISBN :1-870812 – 44-1.
3. Chellamani K.P. and Chattopadhyay D., "Yarns and Technical Textiles", SITRA, 1999.
4. Scott R.A., "Textiles for protection", Woodhead Publishing Limited, Cambridge, UK, ISBN :1-85573-921-6, 2005.
5. Saville.B.P., "Physical testing of textiles", Woodhead Publishing Limited, Cambridge, UK, ISBN :1-85573-367-6, 1999.
6. Fan Q., "Chemical Testing of Textiles", Woodhead Publishing Limited, Cambridge, UK, ISBN :1-85573-917-8, 2005.
7. Long A.C., "Design and manufacture of Textile Composites", Woodhead Publishing Limited, Cambridge, UK, ISBN : 1-85573-744-2, 2005.

8. Fung W., "Coated and laminated textiles", Woodhead Publishing Limited, Cambridge, UK, ISBN :1-85573-576-8, 2002.
9. Horrocks A.R. and Anand S.C., "Handbook of Technical Textiles", Woodhead Publishing Limited, Cambridge, UK, ISBN :1-85573-385-4, 2004.
10. Anand S.C., Kennedy J.F., Mirafab M. and Rajendran S., "Medical textiles and biomaterials for health care", Woodhead Publishing Limited, Cambridge, UK, ISBN: 1-85573-683-7, 2006.

**PTTT9038 INDUSTRIAL ENGINEERING FOR TEXTILE AND APPAREL INDUSTRIES**

**L T P C  
3 0 0 3**

<b>UNIT I</b>	<b>5</b>
Industrial Engineering - evolution, functions, role of industrial engineer	
<b>UNIT II</b>	<b>13</b>
Methods study – introduction, techniques of recording; method analysis techniques; principles of motion economy; method study in garment manufacture; ergonomics-importance, workplace design, fatigue	
<b>UNIT III</b>	<b>13</b>
Work measurement – introduction; time study – equipment and procedure; standard data; predetermined time standards; work sampling techniques; incentive wage system; work measurement applied to garment industry	
<b>UNIT IV</b>	<b>5</b>
Site selection for textile industry; plant layout - types of layouts suitable for textile industry, methods to construct layout; line balancing	
<b>UNIT V</b>	<b>9</b>
Statistical Process Control – data collection; concept of AQL, control charts in quality control; process capability	
<b>TOTAL: 45 PERIODS</b>	

**REFERENCES:**

1. Khanna O. P. and Sarup A., "Industrial Engineering and Management", Dhanpat Rai Publications, New Delhi, 2005.
2. "Industrial engineering manual for textile industry ", Wiley Eastern (P) Ltd., New Delhi, 1988.
3. "Introduction to work study ", ILO, Geneva, 1989.
4. Enrick N. L., "Time study manual for Textile industry", Wiley Eastern (P) Ltd., 1989.
5. Chuter A. J., "Introduction to clothing production management", Black well science, U. S. A., 1995.
6. Richard I. Levin. and David S. Rubin., "Statistics for Management", 7<sup>th</sup> edition, Prentice Hall of India Pvt. Ltd., New Delhi, 1997.
7. David M. Levine, Timothy C. Krehbiel and Mark L. Berenson., "Business Statistics: A First Course", Pearson Education Asia, New Delhi, 2<sup>nd</sup> edition, 2000.
8. Panneerselvam R., "Production and Operation Management", Prentice Hall of India, 2002.







<b>UNIT I</b>	<b>LINEAR PROGRAMMING</b>	<b>13</b>
Formulation of LP problem; solution of LP problem - graphical method, simplex method, dual simplex method; solution to pure and mixed integer programming problem by Branch and bound algorithm		
<b>UNIT II</b>	<b>TRANSPORTATION PROBLEM</b>	<b>9</b>
Northwest corner, least cost, Vogel's approximation method; application of optimality test; solution to assignment problems, unbalanced assignment, infeasible assignment problems		
<b>UNIT III</b>	<b>INVENTORY CONTROL</b>	<b>5</b>
ABC analysis; fixation of inventory level, EOQ (Wilson's Formula), problems related to above theoretical aspects		
<b>UNIT IV</b>	<b>PERT / CPM</b>	<b>9</b>
CPM and PERT networks - finding critical path, probability and cost consideration in the project scheduling		
<b>UNIT V</b>	<b>GAME THEORY AND QUEING THEORY</b>	<b>9</b>
Game theory – two person zero sum games, saddle point, Dominance rule, graphical method. matrices method; Queuing theory – basic elements of queuing model, single and multi channel models- infinite number of customers and infinite calling source		
<b>TOTAL: 45 PERIODS</b>		

**REFERENCES:**

1. Heizer J. and Render B., "Production and Operations Management", Prentice Hall, New Jersey, 1993, ISBN: 0-205-14048-3.
2. Hamdy A. and Taha, "Operations Research an introduction", Maxmillan Publishing Company, New York, Third Edition, 1982.
3. Panneerselvam R., "Operations Research", Prentice Hall of india, 4<sup>th</sup> print, 2003.
4. Hamdy A. and Taha, "An introduction to Operations Research", Maxmillan Publishing Company, New York, V<sup>th</sup> edition, 1996.
5. Narayan Bhat U., "Elements of Applied Stochastic processes", John Wiley and Sons, New York, 1972.
6. Fredrick S., Hiller and Gerald J Liberman., "Introduction to Operations Research", Industrial Engineering Series, International edition, McGraw-Hill, New York, 1995.

<b>UNIT I</b>	<b>9</b>
Factors of production; environmental and social concerns of operations; design of production system; forecasting in production and operation management – various qualitative and quantitative techniques	
<b>UNIT II</b>	<b>9</b>
Capacity planning – single stage system, multistage system; facility planning – objectives; different types of layouts, developing process layout, product layout; job design techniques	
<b>UNIT III</b>	<b>9</b>
Aggregate production planning – procedure, importance; scheduling in operation management – mass production system, batch and job shop	
<b>UNIT IV</b>	<b>9</b>
Material management – material planning, purchase, stores, material handling and disposal; inventory models – basic inventory model, gradual replacement model, basic model with backlogging, bulk discount model, independent demand system for multiple products, models with uncertain demand, multiple period model; MRP-objectives, elements of MRP, MRP computation, implementation	
<b>UNIT V</b>	<b>9</b>
Concepts - Total Productive Maintenance, Autonomous Maintenance, Just In Time, Total Quality Management, Automated Technology, Hard Technology, Soft Technology, Hybrid Technology, CIM, CAD, GT, CAM, CAPP, robotic FMS; application of MIS in production and operations management	

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. Buffa E.S. and Sarin R.K., "Modern Production / Operations Management", John Wiley & Sons. Inc., 1994.
2. Taha H.A., "Operations Research: An Introduction", Prentice Hall of India, New Delhi, 1997.
3. Adam Jr. E.E. and Elber R.J., "Production and Operations Management", Prentice Hall of India, New Delhi, 1997.
4. Chary S.N., "Production and Operations Management", Tata McGraw-Hill, New Delhi, 1988.
5. Narasimhan S.L., Mcleavy, D.W. and Billington P.J., "Production Planning and Inventory Control", Prentice Hall of India, New Delhi, 1997.
6. Grant Ireson., "Factory Planning & Plant Layout", Prentice Hall, New Jersey, 1952.

**UNIT I****9**

Human resource development systems – concepts and structure; personnel management-characteristics, objectives, functions and operations; organization chart; role of personnel managers in the organisation, apparel units

**UNIT II****9**

Man power planning – objectives, planning for future; methods of recruitment, process of recruitment and induction; training - objectives, methods; management development – concepts, objectives and techniques; career planning and development; man power planning, recruitment and training in the apparel industry

**UNIT III****9**

Job analysis, description, evaluation, hierarchy of human needs - creating motivation, types of motivation; job enrichment; performance measurement – objective, methods; wage policy; industrial pay structure - components, laws and methods of payment; methods of wage fixation; laws governing employees benefits and welfare; wage, salary administration and type of motivation applied in apparel industry

**UNIT IV****9**

Factories Acts - Industrial Disputes Acts, Payment of Wages Act, Minimum Wages Act, Payment of Bonus Act, Workmen Compensation Act, Employees State Insurance Act, Employees Provident Fund Act, Payment of Gratuity Act; employee discipline – disciplinary actions, rules and procedures; suspension, dismissal and retrenchment – rules and procedures; grievances handling

**UNIT V****9**

Role of trade unions – goals and objectives, Indian context; Trade Union Act; collective bargaining-concepts, functions, position in India; industrial disputes – problems and solutions; industrial democracy; workers participation in management

**TOTAL: 45 PERIODS****REFERENCES:**

1. Peter F. Drucker., "Management task, responsibilities, practices", Allied Publishers, Kolkatta, 1992.
2. Dayal S., "Industrial relations systems in India", Sterling Publishers Pvt Ltd., New Delhi, 1980.
3. Yoder D. and Paul Standohar D., "Personal management and industrial relations", Prentice Hall of India Pvt. Ltd, New Delhi, 1984.
4. Tripathi P.C., "Personal management and industrial relations", Sultan Chand and Sons, New Delhi, 1988.
5. Monappa, Arun, Saiyaddain and Mirza S., "Personnel management", Tata McGraw Hill, Bombay, 1983.
6. Misra S.N., "Labour and Industrial Laws", Pioneer Publications, New Delhi, 1983.
7. Ramaswamy E.A. and Uma Ramaswamy., "Industry and labour", Oxford, New Delhi, 1981.



**REFERENCES:**

1. Gray S., "CAD/CAM in clothing & Textiles", Gower Publishing, England, 1998.
2. Stephen Gray, "CAD/CAM in Clothing and Textiles", Gower Publishing Limited, 1998, ISBN 0-566-07673X.
3. Aldrich W., "CAD in Clothing and Textiles", 2<sup>nd</sup> edition, Blackwell Science, 1992, ISBN: 0-63 -3893 -4.
4. Shah H. S. and Gandhi R. S., "Instrumental colour measurements and computer aided colour matching for textiles," Mahajan Book Publications, 1990.
5. Hamdy A. and Taha, "Operations Research an introduction", Maxmillan Publishing Company, New York, Third Edition, 1982.
6. Panneerselvam R., "Operations Research", Prentice Hall of india, 4<sup>th</sup> print, 2003.

**PTGE9021****PROFESSIONAL ETHICS IN ENGINEERING****L T P C  
3 0 0 3****UNIT I ENGINEERING ETHICS 9**

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories

**UNIT II ENGINEERING AS SOCIAL EXPERIMENTATION 9**

Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study

**UNIT III ENGINEER'S RESPONSIBILITY FOR SAFETY 9**

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk - Chernobyl Case Studies and Bhopal

**UNIT IV RESPONSIBILITIES AND RIGHTS 9**

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) - Discrimination

**UNIT V GLOBAL ISSUES 9**

Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct

**TOTAL: 45 PERIODS****TEXT BOOKS:**

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York (2005).
2. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics Concepts and Cases", Thompson Learning, (2000).

**REFERENCES:**

1. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, (1999).
2. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, (2003)
3. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, (2001)
4. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, "Business Ethics – An Indian Perspective", Biztantra, New Delhi, (2004)
5. David Ermann and Michele S Shauf, "Computers, Ethics and Society", Oxford University Press, (2003)

**PTTT9046 INDUSTRIAL MANAGEMENT FOR TEXTILE AND APPAREL INDUSTRIES****L T P C  
3 0 0 3**

**UNIT I** **9**  
Factory location - factors determining location of factory, steps in location – subjective, qualitative and quantitative methods; plant layout – types, flow and activity analysis, suitable layout for textile industry

**UNIT II** **9**  
Work environment - importance, factors affecting work environment - lighting, ventilation, humidification and air-conditioning, sanitation, noise and pollution control; ergonomics – importance, application in garment unit; production planning and control - objectives, functions - routing, scheduling, dispatching and follow up; limitations; PPC in textile industry; inventory management and control - ABC Analysis - VED classification - stock levels – EOQ

**UNIT III** **9**  
Principles of management; management by objective; management by crisis; management by exception; personal management – scope and objective, importance in textile industry; job description and specification; manpower planning, recruitment and selection; tests and interview techniques - recruitment for different levels for a spinning, weaving, chemical processing mill and garment unit

**UNIT IV** **9**  
Employee training - need, steps in training programmes, methods of training, training evaluation applied to spinning, weaving mill and garment unit; performance appraisal - meaning, purposes, methods, ethics in appraisal; employee communication – mode, barriers; employee motivation – theory, practice in garment units; job transfer and promotion, layoff and retrenchment, dismissal and discharge; job enlargement and job enrichment;

**UNIT V** **9**  
Work Study - concept, importance, basic work study procedure; labor productivity measurement, ways of improving; wage and salary administration – purpose; methods of wage payment - time, piece, incentive systems – different plans; industrial relations - importance, participants in industrial relations, workers participation in management, collective and productivity bargaining; employee morale - definition, types, factors

affecting employee morale, methods of measuring morale, improving morale; employee welfare – concept, labour welfare practices in India

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. Buffa E.S. and Sarin R.K., "Modern Production / Operations Management", John Wiley & Sons. Inc., 1994.
2. Adam Jr. E.E. and Elber R.J., "Production and Operations Management", Prentice Hall of India, New Delhi, 1997.
3. Narasimhan S.L., Mcleavy, D.W. and Billington P.J., "Production Planning and Inventory Control", Prentice Hall of India, New Delhi, 1997.
4. Peter F. Drucker., "Management task, responsibilities, practices", Allied Publishers, Kolkatta, 1992.
5. Dayal S., "Industrial relations systems in India", Sterling Publishers Pvt Ltd., New Delhi, 1980.
6. Yoder D. and Paul Standohar D., "Personal management and industrial relations", Prentice Hall of India Pvt. Ltd, New Delhi, 1984.
7. Monappa, Arun, Saiyaddain and Mirza S., "Personnel management", Tata McGraw Hill, Bombay, 1983.
8. Misra S.N., "Labour and Industrial Laws", Pioneer Publications, New Delhi, 1983.
9. Punekar, S. D. and Deodhar S. B., "Labour Welfare, Trade Unionism and Industrial Relations", HPH, 2003.
10. Khanna O. P. and Sarup A., "Industrial Engineering and Management", Dhanpat Rai Publications, New Delhi, 2005.