

ANNA UNIVERSITY : : CHENNAI 600 025

UNIVERSITY DEPARTMENTS

R – 2008

B.TECH. APPAREL TECHNOLOGY

III TO VIII SEMESTERS CURRICULUM AND SYLLABI

SEMESTER III

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
MA 9211	<u>Mathematics III</u>	3	1	0	4
CY 9211	<u>Organic Chemistry</u>	3	0	0	3
CY 9213	<u>Instrumental Methods of Analysis</u>	3	0	0	3
CE9215	<u>Mechanics of Solids</u>	3	0	0	3
EE 9213	<u>Electrical Drives and Controls</u>	3	0	0	3
AT9201	<u>Introduction to Apparel Technology</u>	3	0	0	3
TT 9201	<u>Physical Structure and Properties of Fibres</u>	3	0	0	3
PRACTICAL					
EE 9214	<u>Electrical Eng. Lab</u>	0	0	3	2
CY 9214	<u>Instrumental Methods of Analysis Lab</u>	0	0	4	2
TOTAL		21	1	7	26

SEMESTER IV

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
MA 9261	<u>Probability and Statistics</u>	3	1	0	4
CH9204	<u>Basic Mechanical Engineering</u>	3	0	0	3
AT 9251	<u>Yarn Manufacture</u>	4	0	0	4
AT 9252	<u>Fabric Manufacture</u>	3	0	0	3
TT 9253	<u>Fabric Structure</u>	3	0	0	3
AT 9254	<u>Garment Production Machinery</u>	3	0	0	3
PRACTICAL					
CH 9257	<u>Mechanical Eng. Lab</u>	0	0	4	2
AT 9257	<u>Textile Manufacturing Lab</u>	0	0	3	2
TOTAL		19	1	7	24

SEMESTER – V

CODE No.	COURSE TITLE	L	T	P	C
THEORY					
TT 9304	<u>Chemical Processing of Textiles and Apparels I</u>	3	0	0	3
TT 9305	<u>Knitting Technology</u>	4	0	0	4
AT 9301	<u>Fundamentals of pattern Making</u>	3	0	0	3
AT 9302	<u>Garment Construction I</u>	4	0	0	4
TT 9043	<u>Personnel Management in Apparel Industry</u>	3	0	0	3
	<u>Elective I</u>	3	0	0	3
PRACTICAL					
AT 9303	<u>Technical Seminar</u>	0	0	2	1
TT 9308	<u>Cloth Analysis Laboratory</u>	0	0	3	2
AT 9304	<u>Garment Production Machinery Laboratory</u>	0	0	3	2
TOTAL		20	0	8	25

SEMESTER VI

CODE No.	COURSE TITLE	L	T	P	C
THEORY					
TT 9351	<u>Chemical Processing of Textiles and Apparels II</u>	3	0	0	3
TT 9352	<u>Quality Assessment of Textile Products</u>	3	0	0	3
AT 9351	<u>Pattern Making, Grading and Marker Planning</u>	3	0	0	3
AT 9352	<u>Garment Construction II</u>	3	0	0	3
TT 9355	<u>Financial Management for Textile and Apparel Industries</u>	3	0	0	3
	Elective II	3	0	0	3
PRACTICAL					
TT 9407	<u>Textile Chemical Processing Laboratory</u>	0	0	3	2
TT 9358	<u>Textile Quality Evaluation Laboratory</u>	0	0	3	2
AT 9357	<u>Pattern Making Laboratory</u>	0	0	3	2
GE 9371	<u>Communication skills and soft skills lab</u>	0	0	2	1
TOTAL		18	0	11	25

SEMESTER VII

CODE No.	COURSE TITLE	L	T	P	C
THEORY					
TT 9401	<u>Total Quality Management for Textile and Apparel Industries</u>	3	0	0	3
GE 9261	<u>Environmental Science and Engineering</u>	3	0	0	3
AT 9401	<u>Apparel Production Planning and Process Control</u>	3	0	0	3
TT 9404	<u>Clothing Science</u>	3	0	0	3
	Elective III	3	0	0	3
	Elective IV	3	0	0	3
PRACTICAL					
AT 9407	<u>Garment CAD Laboratory</u>	0	0	2	1
AT 9408	<u>Garment Construction Laboratory</u>	0	0	3	2
AT 9409	<u>Industrial Training*</u>	0	0	0	1
TOTAL		18	0	5	22

* Students should undergo industrial training for **Four weeks training, two each** at the end of 4th and 6th Semester.

SEMESTER VIII

CODE No.	COURSE TITLE	L	T	P	C
THEORY					
	Elective V	3	0	0	3
	Elective VI	3	0	0	3
PRACTICAL					
AT 9451	<u>Project Work</u>	0	0	12	6
TOTAL		6	0	12	12

TOTAL CREDITS : 189

LIST OF ELECTIVES

CODE NO.	COURSE TITLE	L	T	P	C
GE 9023	<u>Fundamental of Nano Science</u>	3	0	0	3
AT 9021	<u>Clothing Care</u>	3	0	0	3
AT 9022	<u>Fashion Design and Illustration</u>	3	0	0	3
TT 9037	<u>Protective Garments</u>	3	0	0	3
AT 9023	<u>Indian Ethnic Design Development</u>	3	0	0	3
AT 9024	<u>Leather Apparel Technology</u>	3	0	0	3
AT 9025	<u>Garment Accessories and Embellishments</u>	3	0	0	3
TT 9035	<u>CAD and CAM for Textiles and Apparels</u>	3	0	0	3
TT 9036	<u>Quality Assurance in Garment Industry</u>	3	0	0	3
AT 9026	<u>Apparel Marketing and Merchandising</u>	3	0	0	3
AT 9027	<u>Sewing and Fancy yarn Production</u>	3	0	0	3
TT 9354	<u>Bonded Fabrics</u>	3	0	0	3
AT 9028	<u>Eco-Friendly Dyes and Chemicals</u>	3	0	0	3
AT 9029	<u>Fundamentals of Colour Science</u>	3	0	0	3
TT 9353	<u>Technical Textiles</u>	3	0	0	3
GE 9021	<u>Professional Ethics in Engineering</u>	3	0	0	3
TT 9038	<u>Industrial Engineering for Textile and Apparel Industries</u>	3	0	0	3
TT 9041	<u>Operations Research</u>	3	0	0	3
AT 9030	<u>Apparel EXIM Management</u>	3	0	0	3
TT 9042	<u>Production and Operations Management</u>	3	0	0	3
AT 9031	<u>Product Engineering and Plant Layout</u>	3	0	0	3
AT 9032	<u>Enterprise Resource Planning</u>	3	0	0	3
AT 9033	<u>Supply Chain and Customer Relationship Management</u>	3	0	0	3
AT 9034	<u>Management Information System</u>	3	0	0	3
TT 9046	<u>Industrial Management for Textile and Apparel Industries</u>	3	0	0	3

AIM

To learn fundamental and applied aspects of organic chemistry towards different applications.

OBJECTIVES

- To acquire knowledge about chemical bonding, hybridization, bond fission, different types of chemical reactions and their mechanism, isomerism in organic molecules, synthesis of organic compounds and various applications of organic products.

UNIT I STRUCTURAL CONCEPT OF ORGANIC MOLECULES 5

Nature of bonding (covalent, hydrogen) – atomic orbitals – hybridization – electronegativity – conjugation – mesomerism and resonance – hyper-conjugation – inductive effect.

UNIT II REACTION AND THEIR MECHANISM 10

Homolytic bond fission – free radicals – heterolytic bond fission – electrophiles, carbonium ion, nucleophiles – acids and bases – Bronsted - Lowry concept, Lewis concept, strength of acids and bases. Substitution reactions – S_N1 , S_N2 , S_Ni , Addition reactions – carbon – carbon (double bond), Addition of dienes – carbon – oxygen (double bond), carbon – carbon (triple bond) – poly addition reactions, Elimination reactions – E1, E2, Condensation – simple and polycondensation, Redox reactions.

UNIT III ISOMERISM 6

Structural isomerism – stereoisomerism – optical isomerism – racemic mixture – resolution, racemisation – asymmetric synthesis, Walden Inversion. Geometrical isomerism – cis, trans isomerism, syn, anti isomerism – determination of configuration of geometrical isomers – tautomerism.

UNIT IV HYDROCARBONS AND THEIR CLASSIFICATION 10

Alkanes – alkenes – alkynes – alicyclic compounds – Bayers-strain theory - Hydrocarbons related to petrol, diesel, kerosene, lube oil and waxes. Benzene and its homologues – aromatic substitution, Friedal - Crafts reactions, Kolbe's synthesis – Riemer – Tiemann reaction, Benzoin condensation, Perkin reaction, Beckmann rearrangement, Claisen condensation, Hoffmann rearrangements.

UNIT V SYNTHETIC ORGANIC CHEMISTRY 7

Synthesis of different types of compounds – alcohol – aldehyde – carboxylic acid – ester – ether – nitrocompounds – amines – amides (industrial methods only). Synthetic reagents – acetoacetic ester – malonic ester and Grignard reagent.

APPLIED ORGANIC CHEMISTRY 7

Polysaccharides – starch and cellulose – Proteins – amino acids and peptides – Dyes and dyeing – colour and constitution – classification of dyes based on chemical constitution and applications.

TOTAL : 45 PERIODS

TEXT BOOKS

- B.S. Bahl and Arun Bahl, "Essentials of Organic Chemistry", S.Chand and Company, New Delhi (2005).
- 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

- R.T. Morrison and R.N. Boyd "Organic Chemistry" VI Edition, Prentice Hall of India Pvt. Ltd., New Delhi (2000).
- I L Finar "Organic Chemistry", Volume – I, IX Edition, Pearson Education (Singapore) Pte. Ltd., New Delhi (2004).
- I L Finar "Organic Chemistry", Volume – II, VII Edition, Pearson Education (Singapore) Pte. Ltd., New Delhi (2004).

AIM

To know the principle and importance of various analytical instruments used for the characterization of various materials

OBJECTIVES

- To have thorough understanding of theory, instrumentation and applications of analytical equipments used in industries for testing quality of raw materials, intermediates and finished products
- To know the importance of analytical instrumentation during the purification, compounding and formulating the finished product

UNIT I INTRODUCTION TO SPECTROSCOPICAL METHODS OF ANALYSIS 12

ELECTROMAGNETIC RADIATION: Various ranges, Dual properties, Various energy levels, Interaction of photons with matter, absorbance & transmittance and their relationship, Permitted energy levels for the electrons of an atom and simple molecules, Classification of instrumental methods based on physical properties

QUANTITATIVE SPECTROSCOPY: Beer -Lambert's law, Limitations, Deviations (Real, Chemical, Instrumental), Estimation of inorganic ions such as Fe, Ni and estimation of Nitrite using Beer -Lambert's Law

UNIT II UV AND VISIBLE SPECTROSCOPY 12

Various electronic transitions in organic and inorganic compounds effected by UV, and Visible radiations, Various energy level diagrams of saturated, unsaturated and carbonyl compounds, excitation by UV and Visible radiations, Choice of solvents, cut off wavelengths for solvents, Lamda max and epsilon max rules, Woodward -Fieser rules for the calculation of absorption maxima (Lamda max) for dienes and carbonyl compounds, Effects of auxochromes and effects of conjugation on the absorption maxima, Different shifts of absorption peaks(Batho chromic, hypsochromic, hypochromic), Multicomponent analysis (no overlap, single way overlap and two way overlap), Instrumentation for UV and VISIBLE spectrophotometers (source, optical parts and detectors), Photometric titration (Experimental set -up and various types of titrations and their corresponding curves), Applications of UV and VISIBLE spectroscopies

UNIT III IR , RAMAN AND ATOMIC SPECTROSCOPY 10

Theory of IR spectroscopy, Various stretching and vibration modes for diatomic and triatomic molecules (both linear and nonlinear), various ranges of IR (Near, Mid, Finger print and Far) and their usefulness, Instrumentation (Only the sources and detectors used in different regions), sample preparation techniques, Applications. Raman spectroscopy: Theory, Differences between IR and Raman. Atomic absorption spectrophotometry: Principle, Instrumentation (Types of burners, Types of fuels, Hollow cathode lamp, Chopper only) and Applications, Various interferences observed in AAS (Chemical, radiation and excitation) Flame photometry: Principle, Instrumentation, quantitative analysis (Standard addition method and internal standard method) and applications
Differences between AAS and FES.

UNIT IV THERMAL METHODS 5

Thermogravimetry: Theory and Instrumentation, factors affecting the shapes of thermograms (Sample Characteristics and instrumental characteristics), thermograms of some important compounds ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, $\text{CaC}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$, MgC_2O_4 , Ag_2CrO_4 , Hg_2CrO_4 , AgNO_3 etc), applications. Differential thermal analysis: Principle, Instrumentation and applications, differences between DSC and DTA. Applications of DSC (Inorganic and Polymer samples)

UNIT V CHROMATOGRAPHIC METHODS 6

Classification of chromatographic methods, Column, Thin layer, Paper, Gas, High Performance Liquid Chromatographical methods (Principle, mode of separation and Technique). Separation of organic compounds by column and Thin layer, mixture of Cu, Co and Ni by Paper, separation of amino acids by paper, estimation of organic compounds by GC and HPLC

TOTAL : 45 PERIODS

REFERENCES

1. Willard, H.H., Merritt.I.I., Dean J.a., and Settle,F.A., Instrumental methods of analysis, Sixth edition, CBS publishers,1986
2. Skoog D.A and West D.M, Fundamentals of Analytical Chemistry, Saunders -college Publishing, 1982.
3. Banwell, G.C., Fundamentals of molecular spectroscopy, TMH,1992.
4. A.I. Vogel's Quantitative Inorganic analysis . V Edition
5. Day R.A Underwood A.L Qualitative Inorganic analysis (A. I. Vogel). V Edition, Prentice-Hall of India (P) Ltd, NewDelhi
6. Sharma, B.K., Instrumental Methods of Analysis, Goel publishing House,1995
7. Kalsi .P.S. Spectroscopy of organic compounds, 6th Edition, New Age International Publishers,2006
8. William Kemp, Organic Spectroscopy, 3rd Edition, Palgrave publishers, 2007
9. Sathya Narayana. D. N. Vibrational Spectroscopy, First Edition 2004 and Reprint 2005, New Age International publishers.

CE9215

MECHANICS OF SOLIDS

L T P C
3 0 0 3

AIM

To given them knowledge on structural, Mechanical properties of Beams, columns.

OBJECTIVES

- The students will be able to design the support column, beams, pipelines, storage tanks and reaction columns and tanks after undergoing this course. This is precursor for the study on process equipment design and drawing.

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 9

Rigid bodies and deformable solids – forces on solids and supports – equilibrium and stability – strength and stiffness – tension, compression and shear stresses – Hooke's law and simple problems – compound bars – thermal stresses – elastic constants and poisson's ratio – welded joints – design.

UNIT II TRANSVERSE LOADING ON BEAMS 9

Beams – support conditions – types of Beams – transverse loading on beams – shear force and bending moment in beams – analysis of cantilevers, simply – supported beams and over hanging beams – relationships between loading, S.F. and B.M. In beams and their applications – S.F.& B.M. diagrams.

UNIT III DEFLECTIONS OF BEAMS 9

Double integration method – Macaulay's method – Area – moment theorems for computation of slopes and deflections in beams – conjugate beam method

UNIT IV STRESSES IN BEAMS 9

Theory of simple bending – assumptions and derivation of bending equation ($M/I = F/Y = E/R$) – analysis of stresses in beams – loads carrying capacity of beams – proportioning beam sections – leaf springs – flitched beams – shear stress distribution in beams – determination of shear stress in flanged beams.

UNIT V TORSION**9**

Torsion of circular shafts – derivation of torsion equation ($T/J = C/R = G\theta/L$) – stress and deformation in circular and hollow shafts – stresses and deformation in circular and hollow shafts – stepped shafts – shafts fixed at both ends – stresses in helical springs – deflection of springs – spring constant

COLUMNS

Axially loaded short columns – columns of unsymmetrical sections – Euler's theory of long columns – critical loads for prismatic columns with different end conditions – effect of eccentricity.

TOTAL : 45 PERIODS**TEXT BOOKS**

1. Junarkar, S.B., Mechanics of Structure Vol. 1, 21st Edition, Character Publishing House, Anand, Indian, (1995)
2. William A.Nash, Theory and Problems of Strength of Materials, Schaum's Outline Series. McGraw Hill International Editions, Third Edition, 1994.

REFERENCE

1. Elangovan, A., Thinma Visai Iyal (Mechanics of Solids in Tamil), Anna University, Madras, 1995.

EE9213**ELECTRICAL DRIVES AND CONTROLS****L T P C
3 0 0 3****UNIT I INTRODUCTION****9**

Fundamentals of Electrical Drives, advantages of Electrical Drives. Choice of an Electric Drive – characteristics of loads. Components of an Electric Drive: Electrical Motors – power converters (AC to DC, DC to DC, DC to AC, AC to AC) – Control units (Fuses, Switches, Circuit breakers, contactors and relays). Equations governing motor load dynamics – equilibrium operating point and its steady state stability.

UNIT II HEATING AND POWER RATING OF MOTOR DRIVE**9**

Load diagram, heating and cooling of motors – classes of motor duty. Determination of rating for continuous, intermittent and short time duty cycles.

UNIT III POWER CONVERTERS**9**

Control rectifiers – single phase and three phase circuits – choppers – step up and step down choppers – A.C. Voltage controllers. Single phase and three phase A.C. Voltage controllers, Inverters: Voltage source and current source inverters (Elementary Treatment only).

UNIT IV D.C. MOTOR DRIVE**9**

D.C. Motor: Types, speed – torque characteristics. Starting – braking – speed control: Armature voltage – field current control – Ward Leonard methods – Four-quadrant operation. Converter fed separately excited D.C. motor drive – chopper fed D.C. motor drive (Continuous current operation only).

UNIT V A.C. DRIVES**9**

Principle of operation of 3 phase induction motor – equivalent circuit – Slip – torque characteristic – starting methods: star – Delta starter, Auto transformer starter, Rotor resistance starter, Speed control: Stator voltage control, frequency control, rotor resistance control, slip-power recovery scheme. Inverter fed 3-phase induction motor drive: v/f control, Rotor resistance control, slip-power recovery controls.

TOTAL : 45 PERIODS

TEXT BOOKS

1. G.K. Dubey, Power Semi Conductor Controller Drives. Prentice Hall of India 1989.
2. S.K.Pillai, A First Course on Electrical Drives. Wiley Eastern Ltd., 1993.

REFERENCES

1. P.C. Sen – Principles of Electric Machines and Power Electronics. John – Willey and Sons – 1997.
2. S.K. Bhattacharya and Brijinder Singh, Control of Electrical Machines, New Age International Publishers.

AT9201	INTRODUCTION TO APPAREL TECHNOLOGY	L T P C
		3 0 0 3
UNIT I		9
Introduction to Indian apparel industry; past and present trends; organizational structure and sectors of the garment industry.		
UNIT II		9
Pre – production planning; types of samples and sample approval; types of patterns; inspection of patterns; procurement of garment accessories; grading, marker planning, spreading and cutting.		
UNIT III		9
Types of apparel products; basic garment components; stitch/seam identification; stitch types and uses; seam types and uses; sewing machinery and its working aids.		
UNIT IV		5
Labels; linings; interlinings; wading; lace braids; elastics; hook and loop fastening; shoulder pads; zip fasteners; buttons.		
UNIT V		13
Introduction to garment fusing; types of fusing materials; methods and components of fusing machinery; garment dyeing; printing; finishing; pressing and packing.		
TOTAL : 45 PERIODS		

TEXT BOOKS

1. Richard M. Jones, "The Apparel Industry", Blackwell Science, U.K., 2006.
2. Kantilal, "Apparel Industry in India", NICTAS Publication, Ahmedabad, 1990.
3. Harrold Carr and Barbara Latham, "The Technology of Clothing Manufacture" Blackwell Science, U.K., 1994.
4. Cooklin. G., "Introduction to Clothing Manufacture", Blackwell Science, U.K., 1991.

REFERENCES

1. ChutterA. J., "Introduction to Clothing Production Management", Blackwell Science, U.K., 1991.
2. Harold Carr, "The Clothing Factory", Clothing and Footwear Institute, 1972.
3. Miller, E., "Textile Properties and Behaviour in Clothing use", Batsford Publication, 1992.
4. Cooklin G., "Fusing Technology", The Textile Institute, Manchester, 1990.
5. Diamond, J.E, "Fashion Apparel and Accessories", Delmar Publication, 1994.

UNIT I STRUCTURAL INVESTIGATION OF FIBRES 12

Study of natural and man-made fibres – physical, chemical and morphological structure; study of investigation techniques – scanning electron microscope, X-ray diffraction, infrared radiation and dichroism.

UNIT II MOISTURE ABSORPTION IN FIBRES 6

Moisture absorption behaviour of natural and man-made fibres; influence of fibre structure, relative humidity and temperature; heat of sorption – integral and differential, their relation; factors influencing heat of sorption; conditioning of fibres – mechanism, factors influencing conditioning.

UNIT III MECHANICAL PROPERTIES OF FIBRES 10

Tensile characteristics – stress-strain relations, influence of humidity and temperature on tensile characteristics; elastic properties – elastic recovery and its relation to stress and strain of fibres; mechanical conditioning and its influence on elastic recovery of fibres; torsional rigidity of fibres – measurement techniques; flexural rigidity of fibres – measurement techniques.

UNIT IV OPTICAL PROPERTIES AND FRICTIONAL PROPERTIES 7

Luster index; refractive index and its measurement; birefringence, factors influencing birefringence; friction and its measurement, comparison of fibres, directional friction in wool.

UNIT V ELECTRICAL AND THERMAL PROPERTIES 10

Electrical resistance of fibres– measurement, factors influencing electrical resistance; dielectricity–factors influencing dielectricity; static electricity–measurement, problems and elimination techniques; thermal conductivity, thermal expansion and contraction, melting.

TOTAL : 45 PERIODS

TEXT BOOKS

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.

REFERENCES

1. Hearle J. W. S. Lomas B. and Cooke W. D., "Atlas of Fibre Fracture and Damage to Textiles", The Textile Institute, 2nd Edition, 1998, ISBN: 1855733196.
2. Raheel M. (ed.), "Modern Textile Characterization Methods", Marcel Dekker, 1995 ISBN:0824794737.
3. Mukhopadhyay S. K., "The Structure and Properties of Typical Melt Spun Fibres", Textile Progress, Vol 18, No 4, Textile Institute, 1989. ISBN: 1870812115.
4. Mukhopadhyay S. K., "Advances in Fibre Science" The Textile Institute., 1992, ISBN: 1870812379.
5. Hearle J.W.S., "Polymers and Their Properties, Vol.1. Fundamentals of structures and mechanics", Ellis Horwood, England, 1982.
6. Greaves P.H. and Aville B.P., "Microscopy of Textile Fibres", Bios Scientific, U.K., 1995.
7. Saville "Physical Testing of Textiles", M. K. Book Distributors, 1998.

AIM

To provide the practical knowledge and control methods of electrical machines

OBJECTIVE

To impart practical knowledge on

- I. Characteristic of different machines
 - II. Method of speed control of machines
 - III. Measurement of various electrical parameters
1. Study of DC & AC Starters
 2. Study of Transducers
 3. Wheatstone Bridge and Schering Bridge
 4. ADC and DAC Converters
 5. Speed Control of DC Shunt Motor
 6. Load Test on DC Shunt Motor
 7. OCC & Load Characteristics of DC Shunt Generator
 8. Load Test on Single-Phase Transformer
 9. Load Test on Three-Phase Induction Motor
 10. Load Test on Single-Phase Induction Motor.

TOTAL : 45 PERIODS

1. Precision and validity in an experiment using absorption spectroscopy .
2. Validating Lambert-Beer's law using KMnO_4
3. Finding the molar absorptivity and stoichiometry of the Fe (1,10 phenanthroline)₃ using absorption spectrometry.
4. Finding the pKa of 4-nitrophenol using absorption spectroscopy.
5. UV spectra of nucleic acids.
6. Chemical actinometry using potassium ferrioxalate.
7. Estimation of SO_4^{2-} by nephelometry.
8. Estimation of Al^{3+} by fluorimetry.
9. Limits of detection using aluminium alizarin complex.
10. Chromatography analysis using TLC.
11. Chromatography analysis using column chromatography.

TOTAL : 60 PERIODS

TEXT BOOKS

1. Skoog, D.A. etal. "Principles of Instrumental Analysis", 5th Edition, Thomson / Brooks – Cole, 1998.
2. Braun, R.D. "Introduction to Instrumental Analysis", Pharma Book Syndicate, 1987.
3. Willard, H.H. etal. "Instrumental Methods of Analysis", 6th Edition, CBS, 1986.
4. Ewing, G.W. "Instrumental Methods of Chemical Analysis", 5th Edition, McGraw-Hill, 1985.

AIM

This course aims at providing the required skill to apply the statistical tools in engineering problems.

OBJECTIVES

- The students will have a fundamental knowledge of the concepts of probability.
- Have knowledge of standard distributions which can describe real life phenomenon.
- Have the notion of sampling distributions and statistical techniques used in management problems.

UNIT I RANDOM VARIABLES**9 + 3**

Discrete and Continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma, Weibull and Normal distributions - Functions of a random variable.

UNIT II TWO-DIMENSIONAL RANDOM VARIABLES**9 + 3**

Joint distributions – Marginal and Conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III TESTING OF HYPOTHESIS**9 + 3**

Sampling distributions - Tests for single mean, proportion, Difference of means (large and small samples) – Tests for single variance and equality of variances – χ^2 -test for goodness of fit – Independence of attributes – Non-parametric tests: Test for Randomness and Rank-sum test (Wilcoxon test).

UNIT IV DESIGN OF EXPERIMENTS**9 + 3**

Completely randomized design – Randomized block design – Latin square design - 2^2 - factorial design.

UNIT V STATISTICAL QUALITY CONTROL**9 + 3**

Control charts for measurements (\bar{X} and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

L: 45, T: 15, TOTAL : 60 PERIODS**TEXT BOOKS**

1. Milton, J. S. and Arnold, J.C., “Introduction to Probability and Statistics”, Tata McGraw Hill, 4th edition, (2007).
2. Johnson, R.A. and Gupta, C.B., “Miller and Freund’s Probability and Statistics for Engineers”, Pearson Education, Asia, 7th edition, (2007).

REFERENCES

1. Devore, J.L., “Probability and Statistics for Engineering and the Sciences”, Thomson Brooks/Cole, International Student Edition, 7th edition, (2008).
2. Walpole, R.E., Myers, R.H., Myers, S.L. and Ye, K., “Probability and Statistics for Engineers and Scientists”, Pearson Education, Asia, 8th edition, (2007).
3. Ross, S.M., “Introduction to Probability and Statistics for Engineers and Scientists, 3rd edition, Elsevier, (2004).
4. Spiegel, M.R., Schiller, J. and Srinivasan, R.A., “Schaum’s Outline of Theory and Problems of Probability and Statistics”, Tata McGraw Hill edition, (2004).

AIM

To impart knowledge on thermodynamics and thermal engineering power generating units such as engines and theory of machines

OBJECTIVE

- Students should learn thermodynamics and thermal engineering to understand the principles behind the operation of thermal equipments like IC engines and turbines etc., Students should be able to appreciate the theory behind operation of machinery and be able to design simple mechanisms

UNIT I LAWS OF THERMODYNAMICS 10

Basic concepts and hints; Zeroth law; First Law of Thermodynamics - Statement and application; Steady flow energy equation-problems- Second law of Thermodynamics – Kelvin - Plank statement and Clausius statement- problems; Limitations; Heat Engine, Refrigerator and Heat Pump, Available energy, Equivalence entropy; Reversibility: Entropy charts; Third law of Thermodynamics - Statement.

UNIT II HEATING AND EXPANSION OF GASES 6

Expressions for work done, Internal energy and heat transfer for Constant Pressure, Constant Volume, Isothermal, Adiabatic and Polytropic processes-Derivations and problems; Free expansion and Throttling process.

UNIT III AIR STANDARD CYCLES 6

Carnot cycle; Stirlings cycle; Joule cycle; Otto cycle; Diesel cycle; Dual combustion Cycle-Derivations and problems.

UNIT IV I.C. ENGINES, STEAM AND ITS PROPERTIES AND STEAM TURBINES 12

Engine nomenclature and classification; SI Engine; CI Engine; Four Stroke cycle, Two stroke cycle; Performance of I.C.Engine; Brake thermal efficiency; Indicated Thermal Efficiency, Specific fuel consumption.

Steam - Properties of steam; Dryness fraction; latent heat; Total heat of wet steam; Dry steam; Superheated steam. Use of steam tables; volume of wet steam, volume of superheated steam; External work of evaporation; Internal energy; Entropy of vapour, Expansion of vapour, Rankine cycle.

Steam turbines – Impulse and Reaction types - Principles of operation.

UNIT V SIMPLE MECHANISM, FLY WHEEL, DRIVES AND BALANCING 11

Definition of Kinematic Links, Pairs and Kinematic Chains; Working principle of Slider Crank mechanism and inversions; Double slider crank mechanism and inversions. Flywheel-Turning moment Diagram; Fluctuation of Energy.Belt and rope drives; Velocity ratio; slip; Creep; Ratio of tensions; Length of belt; Power Transmitted; gear trains-types.Balancing of rotating masses in same plane; Balancing of masses rotating in different planes.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Nag, P.K., " Engineering Thermodynamics ", II Edition, Tata McGraw Hill Publishing Co., Ltd., 1995.
2. Rajput, R .K, "Thermal Engineering", Laxmi publications (P) Ltd, 2001.
3. Khurmi R.S., and Gupta J.K, "Theory of Machines", Eurasia Publishing House (P) Ltd., 2004.

REFERENCES

1. Smith, " Chemical Thermodynamics ", Reinhold Publishing Co., 1977.
2. Bhaskaran, K.A., and Venkatesh, A., " Engineering Thermodynamics ",Tata McGraw Hill, 1973.
3. Pandya A. and Shah, " Theory of Machines ", Charatakar Publishers, 1975.
4. Khurmi R.S., and Gupta J.K, "Thermal Engineering", S.Chand & Company (P) Ltd.,2001.
5. Kothandaraman and Dhommkundwar,": A course in Thermal Engineering (SI Units)", Dhanpat Rai and Sons, Delhi (2001)

UNIT I PREPARATION OF YARN FOR WEAVING 9

Process flow diagram for different types of fabrics; objects of winding: principles of cheese and cone winding machines; yarn clearing – mechanical, optical and electronic clearers; knotters and splicers; faults in wound packages; winding sewing threads; classification of faults.

UNIT II PREPARATION OF BEAM FOR WEAVING 9

Objects of warping, material flow in beam warping and creels used in warping machines; sectional warping machines; objects of sizing; sizing materials and recipe used for different types of fibres; overall view of size preparation equipment; sizing machines; combined dyeing and sizing; need for drawing-in operation; manual and automatic drawing-in, leasing, knotting and pinning machines.

UNIT III INTRODUCTION TO WEAVING 13

Principle of weaving with hand and power looms; passage of material; various motions - primary, secondary and auxiliary motions; plain power loom driving; timing of motions; principles of tappet, dobby and jacquard shedding mechanisms; limitations of various shedding mechanisms; types of shed; shedding by dobby and jacquard; principles of weft insertion by shuttle, projectile, jet and rapier; selvages used in shuttle less looms; centre selvage mechanisms; multi-phase weaving systems; beat up mechanism, sley eccentricity.

UNIT IV SECONDARY AND AUXILIARY MOTIONS IN PLAIN LOOMS 5

Take-up and let-off motions used in power looms; warp protectors; warp and weft stop motions; automation in weaving machines.

UNIT V DEFECTS IN WOVEN FABRICS 9

Defects in woven fabrics, their causes and remedies; point system of grading.

TOTAL : 45 PERIODS**TEXT BOOKS**

1. Marks R. and Robinson T.C., "Principles of weaving", The Textile Institute, Manchester, 1989, ISBN: 0 900739 258.
2. Talukdar M. K., Sriramulu P. K. and Ajgaonkar D. B., "Weaving: Machines, Mechanisms, Management", Mahajan Publishers, Ahmedabad, 1998, ISBN: 81-85401-16-0
3. Lord P. R. and Mohamed M. H., "Weaving: Conversion of yarn to fabric", Merrow, 1992, ISBN: 090409538X
4. Ormerod A. and Sondhelm W. S., "Weaving: Technology and operations", Textile Institute, 1995, ISBN: 187081276X
5. Ajgaonkar D. B., Talukdar M.K. and Wadekar., "Sizing – Materials, Methods and Machines", 2nd Edition, Mahajan Publishers, Ahmedabad. 1999.

REFERENCES

1. "Weaving: The knowledge in technology", Proceedings of Weaving Conference 1998, Textile Institute, ISBN: 18770372182.
2. Booth J. E., "Textile Mathematics" Volume 3, The Textile Institute, Manchester, 1977, ISBN: 090073924X
3. "Yarn Preparation: A Hand Book", Textile Institute, Manchester, 1992, ISBN: 1853390429.
4. Vangheluwe L., "Air- jet weft insertion", Textile Progress, Vol. 29, No 4, Textile Institute Publication, 1999, ISBN; 1870372255.
5. Lunenschloss J., Albrecht W. and David Sharp, "Non-woven Bonded Fabrics", Ellis Harwood Ltd, New York, 1985, ISBN: 0-85312-636-4.
6. "Weaving: The knowledge in technology", Textile Institute, Manchester, 1998, ISBN: 18703721.

TT9253	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

TEXT BOOKS

1. Grosicki Z. J., "Watson's Textile Design and Colour", Vol.1, Butterworths London, 1989.
2. Grosicki Z. J., "Watson's Advanced Textile Design and Colour", Vol.II, Butterworths, London, 1989
3. Wilson J., "Handbook of Textile Design", Textile Institute, Manchester, 2001,ISBN:1 85573 5733
4. Horne C.E., "Geometric Symmetry in Patterns and Tilings", Textile Institute, Manchester, 2000, ISBN:1 85573 4923.

REFERENCES

1. Seyam A. M., "Structural Design of Woven Fabrics, Theory and Practice", Textile Institute, Manchester, 2002, ISBN: 1 87037 2395.
2. Georner D, "Woven Structure and Design, part 1:Single Cloth Construction", WIRA, 1986.
3. Georner D, "Woven Structure and Design, Part 2: Compound Structures", BTT6, 1989.

AT9254	GARMENT PRODUCTION MACHINERY	L T P C 3 0 0 3
UNIT I		5
Introduction to spreading machines; spreading surfaces, spreading machines – manual, automated; fabric control devices – tensioning, positioning devices, width indicators, end treatment devices.		
UNIT II		9
Introduction to cutting; cutting equipment – cutting table, shears and scissors; cutting machine – portable cutting knives, vertical reciprocating straight knives, round knives, basic components of portable knives; power system; stationary cutters – band knives, die cutting, servo cutters; specialized cutting machines – strip cutters; transferring marks – edge marks, hot notcher, internal marks; automatic electronic controlled cutter.		

UNIT III **13**
Basic sewing machine – primary and secondary parts of the sewing machine; machine beds – flat, raised, submerged; feed of arm; mode of operation – handle, peddle, electric current, computerized machine, computer and electronic based machine; types of stitches – lock and chain stitch machine; types of motor – eddy current, clutch motor, induction motor, DC servo motor; lubrication systems – manual, automatic, semi automatic, centralized wick system, greasing; different types of belts and pulleys.

UNIT IV **9**
Different types of loppers – blind loppers, dummy loppers; shuttles – types; shuttle direction – clock wise and anti clock wise direction; feed mechanisms; needles – types, pressure foot, folder, guides; analyzing and comparing the different types of industrial sewing machines.

UNIT V **9**
Pressing machinery – introduction, in process pressing, finish pressing; elements of pressing- steam, pressure; types of pressing equipment – buck presses, iron pressing, block or die pressing, form pressing, steamers, steam tunnels; boilers, steam tunnels, vacuum systems; advanced pressing equipments.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Jacob Solinger, “Apparel Production Handbook”, Reinhold Publications, 1998.
2. Carr H and Latham B., “The Technology of Clothing Manufacturing”, Blackwell Science, U.K.,1994
3. Ruth E. Glock, Grace I. Kunz, “Apparel Manufacturing, Sewn Product Analysis”, fourth edition, Pearson Education, ISBN: 8177580760

REFERENCES

1. Laing R.M., Webster J, “Stitches & Seams”, The Textile Institute, India, 1998.
2. Shaeffer Claire, “Sewing for the Apparel Industry”, Prentice Hall, New Jersey, 2001.
3. Singer, “Sewing Lingerie”, Cy DeCosse Incorporated, 1991.
4. Patty Brown & Janett Rice “Ready-To-Wear Apparel Analysis’, third edition, Prientice-Hall,Inc., New Jersey,ISBN:0130254347

CH9257

MECHANICAL ENGINEERING LAB

L T P C
0 0 4 2

AIM

To impart practical knowledge in operating IC engines and conduct experiments. To understand test procedures in testing material for engineering applications

OBJECTIVES

- Students will be able to understand Power-generating units such as engines and operate IC engines and conduct tests. They will be able to appreciate the theory behind the functioning of engines. Material properties, their behavior under different kinds of loading and testing can be visualized.

LIST OF EXPERIMENTS *

1. Port timing diagram
2. Valve timing diagram
3. Study of 2,4 stroke I C Engines
4. Load test on 4-stroke petrol engine
5. Performance test on 4-stroke single cylinder diesel engine
6. Performance test on 4-stroke twin cylinder diesel engine

7. Heat balance test on diesel engines
8. Tension test
9. Compression test
10. Deflection test
11. Hardness test (Rockwell and Brinell)
12. Spring test
13. Torsion test
14. Impact test

TOTAL : 60 PERIODS

* Minimum 10 experiments shall be offered

AT9257

TEXTILE MANUFACTURING LAB

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

LIST OF EXPERIMENTS

1. Yarn numbering systems
2. Material passage and production calculation in ginning machine
3. Material passage and production calculation in scutcher
4. Material passage, draft and production calculation in carding
5. Material passage, draft and production calculation in comber
6. Material passage, draft and production calculation in draw frame
7. Material passage, draft, twist and production calculation in speed frame
8. Material passage, draft, twist and production calculation in ring frame
9. Material passage in rotor spinning machine
10. Study of winding machine
11. Study of warping machine
12. Study of shedding mechanism and calculation of loom speed
13. Study of picking mechanism and calculation of shuttle maximum and average speed
14. Study of beat-up and loom timing of primary motion
15. Study of auxiliary mechanisms

TOTAL : 45 PERIODS

TT 9304

CHEMICAL PROCESSING OF TEXTILES AND APPARELS I

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

UNIT I STRUCTURE AND PROPERTIES

5

Chemical structure and chemical properties of cotton, flax, wool, silk, viscose, polyester, nylon, acrylic, polypropylene and polyurethane

UNIT II GREY PREPARATION – I

9

Singeing; desizing - hydrolytic and oxidative techniques; scouring - natural and synthetic fibres; application of biotechnology

UNIT III GREY PREPARATION – II

9

Mercerization - action of alkali on cellulose, cold and hot mercerization; bleaching; heat setting

UNIT IV PROCESSING MACHINES 13
 Loose stock machine; hank and package machines; yarn singeing machine - gas singeing machine; shearing and raising machines; kiers; mangles; jigger; winch; jet and soft flow machines; yarn mercerizer, chain and chainless mercerizers; continuous scouring and bleaching machines; washing ranges, hydro extractors; detwisters; dryers; stenters and stretching devices

UNIT V FINISHING 9
 Calendering; crease proofing; anti-shrinking; softening; felting and non-felting of wool; application of biotechnology

TOTAL : 45 PERIODS

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

TT 9305 KNITTING TECHNOLOGY L T P C
4 0 0 4

UNIT I INTRODUCTION 6
 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 12
 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 18
 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 12
 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 12
 Basic principles; machine classification; preparation of yarns for warp knitting; production of elementary structures

L : 45 , T : 15 , TOTAL : 60 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.
3. Spencer D.J., "Knitting Technology", III Ed., Textile Institute, Manchester, 2001, ISBN: 1 85573 333 1.
4. Samuel Raz., "Flat Knitting: The new generation", Meisenbach GmbH, Bamberg, ISBN: 3-87525-054-0.
5. Samuel Raz., "Warp Knitting production", Melliand Textilberichte, GmbH, Rohrbacher, 1987, ISBN: 3-87529-022-4
6. Gajjap B.J., "Handbook of warp Knitting Technology", Textile Institute, Manchester, 2004, ISBN: 1 85573 7701

AT 9301

FUNDAMENTALS OF PATTERN MAKING

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

UNIT I

9

Anthropometry measurement; size chart preparation; figure analysis; body ideals - body proportions, height and weight distribution

UNIT II

9

Study of body measurement for all age groups - infant, children, women and men

UNIT III

9

Fundamentals of pattern making and terminology - notches, grain, grain line, construction line, perforations, centre front line, front to back bias, true bias, breast line, waist line, seat line, seam allowance, jog seam, dart, dart points, distinction of dart excess, dart shape at pattern edge

UNIT IV

9

Principles of pattern constructions - drafting, draping and flat pattern

UNIT V

9

Commercial patterns - definition - merits – demerits and study of different sizes; fabric and its relationship on pattern making

TOTAL : 45 PERIODS

REFERENCES

1. Cooklin G., "Introduction to clothing manufacture", Blackwell Scientific Publications, U.K., 1990.
2. Cooklin G., "Master patterns and grading for women's outside", Blackwell Scientific Publications, 1995, ISBN: 0 – 632- 03915 – 9.
3. Cooklin G., "Master patterns and grading for men's outside", Blackwell Scientific Publications, U.S.A., 1992.
4. Gillian Holman., "Pattern cutting made easy", Blackwell Scientific Publications 1997, ISBN: 0- 7134 – 8093- 9.
5. Natalie Bray., "More dress pattern designing", Blackwell Scientific Publications 1986, ISBN: 0-632-01883- 6.

UNIT I**12**

Introduction - lay planning, marker making and methods, types of marker; spreading – types and modes, fabric design concepts, effect of fabric parameters; record keeping in cutting room; cutting equipment- cutting table, cutters, marking equipment.

UNIT II**12**

Operation break down chart – machines, man power and material flow for shirts, trousers, jackets, blouses, skirts and T- shirts.

UNIT III**12**

Garment construction – Introduction to inter, intra and interlacement loops; stitches and seams - definitions and classifications as per ISO standards, method of making the stitch classes; different types of machine beds; types of motors; types of loopers; shuttles; feed mechanisms; needles and work-aids; quality of seams and stitches.

UNIT IV**12**

Production tools - cost, labour, supervision, quality control, productivity and production and floor layout; manual system – make through system, batch system, section and process system, progressive bundle system, straight line, zigzag system; mechanical system – selective conveyor belt system, unit production system, quick response system, just in time.

UNIT V**12**

Pressing - need, types and means; pressing equipment; methods of pressing - pleating, permanent press; types of folding - dead man folding stand; packing ratio; packing specifications; multi model transport.

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

1. Carr H., "The technology of clothing manufacture" Blackwell Publisher, U. K., 2004.
2. Ruth E. Glock., "Apparel manufacturing sewn product analysis", Blackwell Scientific Publisher, Prentice Hall, New Jersey, 2005, ISBN-10: 0131119826.
3. Cooklin G., "Introduction to clothing manufacture", Blackwell publisher, U.K., 1994.
4. Hunter A. J. C., "Introduction to clothing production management", Blackwell Publisher, U.K., 2004.
5. Jacop Solinger., "Apparel manufacturing hand book", Litton Educational Publishing, Kentucky, 1980.

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.

TT 9308

CLOTH ANALYSIS LABORATORY

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

Analysis of construction details like design, draft, peg plan, ends per inch, picks per inch, count of warp and weft yarns, warp and weft crimp, cover factor and cloth area density for the following woven fabrics.

1. Plain and its derivatives
2. Twill and its derivatives
3. Satin
4. Sateen
5. Honeycomb (ordinary and Brighton)
6. Huck-a-back
7. Extra warp and extra weft figuring
8. Pile fabrics (warp and weft)
9. Welts and Piques
10. Backed fabrics
11. Gauze and Leno
12. Double cloth
13. Crepe
14. Tapestry
15. Mock-leno
16. Bedford cord.

TOTAL : 45 PERIODS

LIST OF EXPERIMENTS

1. Study on various components in spreading machine
2. Study on types of spreading machines
3. Study on effect of fabric designs on spreading process
4. Lay preparation
5. Study on different cutting machines
6. Analyzing the various parts of the sewing machine
7. Study on working mechanism of lock stitch machine
8. Study on working mechanism of chain stitch machine
9. Stitch length variation on lock and chain stitch machines
10. Tension variation studies in sewing machines
11. Study on feeding systems in sewing machines
12. Study on pressing machine
13. Study on pressing temperature on various textile fabrics

TOTAL : 45 PERIODS**UNIT I DYEING****18**

Adsorption isotherms; dye-fibre interaction; properties and application of direct, azoic, vat, sulphur and reactive dyes; properties and application of acid, mordant, metal-complex, disperse and basic dyes; dyeing of blends

UNIT II PRINTING**9**

Methods and styles of printing; printing machines; constituents of printing paste; printing with direct, reactive, acid and disperse dyes; printing with pigments

UNIT III ASSESSMENT OF COLOR AND FINISHES**13**

Theories of colour measurement, Beer–Lambert’s law and Kubelka-Munk theory; whiteness and yellowness indices and lustre measurement; assessment of finishes- crease proofing, anti-shrinking, softening; assessment of eco-friendliness of textiles

UNIT IV KNITS AND GARMENTS**5**

Finishing of knits- machines and processes; Garment dyeing and washing

TOTAL : 45 PERIODS**REFERENCES**

1. Trotman E. R., “Dyeing and chemical technology of textile fibres”, B.I Publishing Pvt Ltd, New Delhi, 1994.
2. Shenai V. A., “Chemistry of dyes and principles of dyeing”, Sevak Publications, Mumbai, 1995.
3. Shore J., “Colourants and auxiliaries: Volume I Colorants”, Woodhead Publishing Ltd 2002, ISBN 0 901956 77 5
4. Shore J., “Colourants and auxiliaries: Volume II Auxiliaries”, Woodhead Publishing Ltd, 2002, ISBN 0 901956 78 3
5. Cegerra J. Puente P. And Valladepars J., “The Dyeing of Textile Materials”, Textile Institute, Manchester, 1993.
6. Shenai V. A., “Technology of Printing”, Sevak Publications, Mumbai, 1996.
7. Miles W. C., “Textile Printing”, Woodhead Publication, 2003, ISBN 0 901956 76 1
8. Johnson A., “The Theory of Colouration of Textiles”, SDC, Second edition, 1989, ISBN 0 901956 481
9. Shah H. S. and Gandhi R. S., “Instrumental colour measurement and computer aided colour matching for textiles”, Mahajan Book Publication, 1990.

TT 9352	QUALITY ASSESSMENT OF TEXTILE PRODUCTS	L T P C 3 0 0 3
UNIT I		9
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		
UNIT II		13
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		
UNIT III		9
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		
UNIT IV		5
Moisture and thermal properties; colour fastness testing – washing, light, rubbing, perspiration; shrinkage and dimensional stability		
UNIT V		9
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.

AT 9351	PATTERN MAKING, GRADING AND MARKER PLANNING	L T P C 3 0 0 3
UNIT I		9
Pattern making - methods and preparation; basic blocks for men, women, infants and children		
UNIT II		9
Flat pattern techniques - pivot and slash spread methods, single dart series, double dart series, parallel dart, graduating dart; conversion of darts to tucks; pleats and gathers		

UNIT III **9**
 Pattern making for special fabrics – inner garments and sports wear; pattern alteration techniques for shirt, skirt, trousers - length, width, front and back

UNIT IV **9**
 Grading of pattern – definition, principle, types and importance; grading to one size up or down; grading to four size up or down; grading of interlinings; interfacing materials - types and properties

UNIT V **9**
 Planning, drawing and reproduction of marker; methods of marker planning; marker planning for special fabrics - knit, check, stripe, printed, plain, velvet, lace and stretch fabrics

TOTAL : 45 PERIODS

REFERENCES

1. Cooklin G., "Introduction to clothing manufacture", Blackwell Scientific Publications, U.K., 1990.
2. Cooklin G., "Master patterns and grading for women's outsize", Blackwell Scientific Publications, U. K., 1995, ISBN: 0 – 632- 03915 – 9.
3. Shoben Martin., "Grading" Batsford Publication, U. K., 1998.
4. Goulbourn Margaiitha., "Introducing pattern cutting, grading and modeling", Batsford Publication, U. K., 1998.
5. Bane Allyne., "Flat pattern design", McGraw Hill Publications, USA., 1993.
6. Aldrich Winfred., "Metric pattern cutting", Backwell Science Publications, 3rd Edition, U.K., 1995.

AT 9352 **GARMENT CONSTRUCTION II** **L T P C**

3 0 0 3

UNIT I **9**
 Analysis of the components of various types of men, women and children garments

UNIT II **9**
 Different measuring systems; standard measurement charts; specifications sheet; draping methods; advanced pattern making - 3D body scanner; eight head theory – introduction, applications

UNIT III **9**
 Men's wear – shirts, pants, trousers, jeans, jackets and jerkins, blazers and coats

UNIT IV **9**
 Women's wear – ladies blouses, shirts, pants, trousers, and jeans, casual wear

UNIT V **9**
 Children's wear – sizes, measurements, garments for infants, children's and teens

TOTAL : 45 PERIODS

REFERENCES

1. Aldrich W., "Metric pattern cutting", Blackwell Publisher, U.S.A., 2005.
2. Cooklin G., "Pattern grading for women's wear", Blackwell Publisher, U.S.A., 2004.
3. Cooklin G., "Pattern grading for men's wear", Blackwell publisher, U.S.A., 2001.
4. Ruth E. Glock., "Apparel manufacturing sewn product analysis", Pearson Edition, Prentice Hall, Iowa State University, U.S.A., 2005.
5. Jacop Solinger., "Apparel manufacturing hand book", Litton Educational Publishing., New York, 1980.

6. Aldrich., "Metric pattern cutting for children's wear and baby wear", Blackwell Publisher, U.S.A., 2004.
7. Singer, "Sewing lingeries", Creative Publishing International., 2001.
8. Cooklin G., "Pattern grading for womens clothes – The technology of sizing", Blackwell Publisher, U.S.A., 2004.
9. Fan J., "Clothing appearance and fit: science and technology", Woodhead Publishing, England, 2004.
10. Kathy Illam., "Body mapping", Krause Publications, Iola, W. I., 1999.

TT 9355 FINANCIAL MANAGEMENT FOR TEXTILE AND APPAREL INDUSTRIES

L T P C

3 0 0 3

UNIT I

5

Costing - concepts; classification of costs; preparation of cost sheet; costing of yarn, fabric and garment

UNIT II

9

Depreciation – method of computing depreciation; techniques of investment analysis - payback period method, accounting rate of return, DCF methods - IRR, NPV, PI

UNIT III

9

Cost of capital; equity, debt, convertible debentures, preference share capital; capital structure; dividend policy; short, intermediate and long term financing

UNIT IV

5

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

UNIT V

17

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, 8th Edition, 1999.
2. Bhav 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) 12th 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, 5th edition, 2001.

LIST OF EXPERMENTS

1. Acid and enzymatic desizing of cotton grey fabrics
2. Sodium Hypochlorite and Hydrogen peroxide bleaching of cotton fabrics
3. Degumming of silk
4. Dyeing of cotton with direct dyes.
5. Dyeing of cotton with reactive dyes.
6. Dyeing of polyester with disperse dyes.
7. Dyeing of P/C blends with reactive/disperse dyes.
8. Crease Proofing of cotton using free formaldehyde resins.
9. Studies on shrinkage of fabrics
10. Determination of Yellowness, Whiteness Indices of grey and bleached fabrics.
11. Determination of absorbance of dye solution and K/S value of dyed fabrics.
12. Determination of washing, rubbing, perspiration and light fastness ratings
13. Printing with pigments.
14. Identification of fibre and blend analysis
15. Identification of dyes.

TOTAL : 45 PERIODS**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

LIST OF EXPERIMENTS

1. Anthropometry analysis
2. Development of basic bodice blocks (men , women, infants and children)
3. Flat pattern making and dart manipulation
4. Sleeves - basic sleeve, elongated armhole sleeve, short fitted and puff
5. Necklines - scooped built up and cowl necklines
6. Facings - for different shaped necks and armholes
7. Collars- convertible and non- convertible, mandarin, wing, roll over and other types
8. Plackets
9. Pockets
10. Grading of patterns
11. Marker planning by CAD

TOTAL : 45 PERIODS**GE 9371 COMMUNICATION SKILLS AND SOFT SKILLS LABORATORY****L T P C
0 0 2 1****AIM**

To enhance the overall capability of students and to equip them with the necessary Communication Skills and Soft Skills that would help them excel in their profession.

OBJECTIVES

- To equip students of engineering and technology with effective speaking and listening skills in English.
- To help them develop their soft skills and interpersonal skills, which will make the transition from college to workplace smoother and help them excel in their job.
- To enhance the performance of students at Placement Interviews, Group Discussions and other recruitment exercises.

1. PC based session**A. Career Lab (15 periods) Viewing and discussing audio-visual materials****1. Resume / Report Preparation / Letter Writing: (3)**

Letter writing – Job application with Resume - Project report - Email etiquette.

2. Presentation skills: (3)

Elements of effective presentation – Structure of presentation - Presentation tools – Body language.

3. Soft Skills: (3)

Time management – Stress management – Assertiveness – Negotiation strategies, Psychometrics - Analytical and logical reasoning.

4. Group Discussion: (3)

Group discussion as part of selection process, Structure of group discussion – Strategies in group discussion – Mock group discussions.

5. Interview Skills: (3)

Kinds of interviews – Interview techniques – Corporate culture – Mock interviews.

TOTAL : 45 PERIODS

II. Class Room Session

1. **Resume / Report Preparation / Letter writing:** Students prepare their own resume and report. (9)
 2. **Presentation Skills:** Students make presentations on given topics. (12)
 3. **Group Discussion:** Students participate in group discussions. (12)
 4. **Interview Skills:** Students participate in Mock Interviews (12)
- Note:** Classroom sessions are practice sessions.

REFERENCES

1. Prakash P, Verbal and Non-Verbal Reasoning, Macmillan India Ltd., 2nd Edition, New Delhi, 2004.
2. John Seely, The Oxford Guide to Writing and Speaking, Oxford University Press, New Delhi 2004.
3. Paul V Anderson, Technical Communication, Thomson Wadsworth , 6th Edition, New Delhi, 2007.
4. Edgar Thorpe and Showick Thorpe, Objective English, Pearson Education, 2nd Edition, New Delhi 2007.
5. David Evans, Decision maker, CUP, 1997

LAB REQUIREMENT

1. Teacher console and systems for students.
2. English Language Lab Software
3. Tape recorders

TT 9401 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, PDSA 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”, (5th 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

GE 9261**ENVIRONMENTAL SCIENCE AND ENGINEERING****L T P C
3 0 0 3****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", 2nd 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)

**AT 9401 APPAREL PRODUCTION PLANNING AND PROCESS CONTROL L T P C
3 0 0 3**

UNIT I INTRODUCTION 9

Control parameters; apparel production parameters; planning and lead-time; product development; steps from prototype to production model; importance of pre-production activities; introduction to timetable concepts; product data management; understanding and interpretation of specification sheet

UNIT II OPERATION 9

Operation sequence development; garment breakdown with machine and attachment details; development of production grid for garment construction; development of production flowchart

UNIT III PRODUCTION 9

Bundle tickets- guidelines for bundle ticket design, functions of bundle tickets, bundle ticket control; different manufacturing systems; make through and assembly line manufacturing - advantages and disadvantages; lay lot planning - numerical exercises on lay lot planning to optimize cutting cost; bundling, ticketing and cutting room control formats.

UNIT IV PRODUCTION, PLANNING AND CONTROL 9

Production planning and control; capacity calculation for cutting, sewing and finishing; determination of machine requirements for new factory; line balancing - determination and allocation of manpower, machine for balanced production in existing plant for a given target

UNIT V QUALITY CONTROL 9

Quality in product development; quality assurance during product development – methods to avoid problems during pattern making, garment construction and other areas; inspection procedures; work-study in garment industry – methods to control time and cost

TOTAL : 45 PERIODS

REFERENCES

1. Chuter A.J., "Introduction to Clothing Production Management", Blackwell Scientific Publications, Oxford, 2001.
2. David J., Tyler, "Materials Management in Clothing Production", Blackwell Scientific Publications Professional Books, Oxford, 2001.
3. Li Y., "Denim apparel design, manufacture and finishing", Textile Institute, Manchester, 2004, ISBN: 1 85573 692 6.
4. Chuter A.J., "Quality management in the clothing and textile industry", Textile Institute, Manchester, 2002, ISBN: 1 87037 248 4.

**TT 9404 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.

**AT 9407 GARMENT CAD LABORATORY L T P C
0 0 2 1**

LIST OF EXPERIMENTS

1. Introduction to various tools in the CAD system for creating patterns
2. Men's basic patterns
3. Women's basic patterns
4. Children's basic patterns
5. Dart placement
6. Pattern modification and correction
7. Grading the basic patterns
8. Marker planning and marker efficiency
9. Study on digitizer

TOTAL : 45 PERIODS

**AT 9408 GARMENT CONSTRUCTION LABORATORY L T P C
0 0 3 2**

1. Body measurement
2. Size chart preparation
3. Drafting method
4. Draping method
5. Paper pattern
6. Seams – study and preparing seams for various garments
7. Stitches – Lock stitch, chain stitch and over lock stitch
8. Study of button holing and button sewing machine
9. Preparing basic block – Pattern creation and cutting the fabric
10. Assembling the basic block patterns

TOTAL : 45 PERIODS

AT 9409

INDUSTRIAL TRAINING

L T P C
0 0 0 1

Each student should undergo implant training in apparel industry for four weeks, two weeks each at the end of IV semester and VI semester. Students have to submit a report before the VII semester examination. Faculty in-charge will evaluate the report and award credits.

AT 9451

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.

GE9023

FUNDAMENTALS OF NANOSCIENCE

L T P C
3 0 0 3

AIM

To make the students understand the importance , relevance and potentialities of this emerging field of study.

OBJECTIVES

- Study the basic nano technology and nano science.
- Understand interdisciplinary nature of this field.
- Understand the importance role of physics, chemistry, biology.
- Recognize that the rules of nano science are fundamentally different than those we experience.
- Study the basic fabrication strategies of nano science.

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 charecterisation of surfaces & Interfaces", 2nd 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.

**AT 9021 CLOTHING CARE L T P C
3 0 0 3**

UNIT I SOAPS AND DETERGENTS 9

Study of laundry equipment and laundry reagents – soaps, detergents; cleaning action of soaps; indigenous cleaning agents – rita nut, shikkai, green gram, bran solution; study of modern and industrial cleaning agents

UNIT II LAUNDERING AND STAIN REMOVAL 9

Principles of laundering; stain removal; various solvents for removing blood, tea, rust, oil / grease stain etc.

UNIT III WASHING 9

Different methods of washing; application of friction by hand rubbing and scrubbing; tumble wash; study of different types of house hold / industrial washing machines - rotary, swirling, pressure, tumble wash etc.

UNIT IV DRYING 9

Mechanism of drying and different methods of drying garments

UNIT V FASTNESS TO LIGHT AND WASH 5

Assessment of light and wash fastness; methods to improve light and wash fastness

UNIT VI CARE LABELS, PRESERVATION OF TEXTILES 4

Use of care labels and standards / norms for care labels; measures to preserve textiles

TOTAL : 45 PERIODS

REFERENCES

1. Dantyagi S., "Fundamentals of Textile and their care", Oriental longmans Ltd, New Delhi, 1980.
2. Denlkar, "Household Textiles and laundry work", Atma Ram and Sons, New Delhi, 1993.

AT 9022	FASHION DESIGN AND ILLUSTRATION	L T P C 3 0 0 3
UNIT I		5
Introduction to fashion illustration		
UNIT II		9
Fashion model drawing; basic human proportion; body figures and shape sketching postures		
UNIT III		9
Elements of fashion – fashion, style, change, acceptance, taste, fads, classics, boutique, croquis, fashion trend, couture, designer, pret - a – porter, and silhouette		
UNIT IV		13
Fashion origin; evolution; fashion of different eras; fashion theories; traditional fashion adoption; reverse adoption; mass dissemination		
UNIT V		9
Fashion psychology – clothing, first impression, role of socio – psychological aspects of clothing		

TOTAL: 45 PERIODS

REFERENCES

1. Bush G., "Psychology of Clothing", London, 1990.
2. Ireland Patrick John, "Fashion Design Drawing and Presentation", B.T. Batsford, London, 1996.
3. Seaman Julian, "Professional Fashion Illustration", B.T. Batsford, London, 1995.
4. Allen and Seaman, "Fashion Drawing – The Basic Principles", B.T. Batsford, London, 1994.
5. Drake and Nicholas, 'Fashion Illustration', Thames and Hudson, New York, 1994.

TT 9037	PROTECTIVE GARMENTS	L T P C 3 0 0 3
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.

**AT 9023 INDIAN ETHNIC DESIGN DEVELOPMENT L T P C
3 0 0 3**

UNIT I 9

Designing elements of Indian ethnic design; source for basic sketching; religion and mythology; arts and crafts; architecture; historical textiles

UNIT II 9

Painting – ancient paints and cave painting; designer tools and workspace; painting tools and techniques; equipment for design generation

UNIT III 9

Process of design – motif development, geometrical, simplified, materialized, stylized; ornamental enlargement and reduction of motifs; color harmony; color schemes and combinations

UNIT IV 9

Combining of motifs; placement and repeats of all over patterns; creating design and its application on garments using various techniques either by weaving, knitting, painting and embroidery

UNIT V **9**
Ethnic design for hand embroidery, hand painting, and printing computed aided ethnic design.

TOTAL : 45 PERIODS

REFERENCES

1. Elizabeth M. Townshed, "Early American Embroidery Designs", Crafts and Hobbies, USA, 1985.
2. Manzini Ezio, "The Material of Invention", MIT Press, Cambridge, 1989.
3. Gillow J. and Barnard N., "Traditional Indian Textiles" Thames and Hudson, New York, 1993.
4. Harvey J., "Traditional Textiles of Central Asia", Thames and Hudson, New York, 1986.

AT 9024 **LEATHER APPAREL TECHNOLOGY** **L T P C**
3 0 0 3

UNIT I MATERIAL **9**
Classification of leather goods and garments; selection of materials, grading and assorting of leathers for leather goods and garments; property requirements for leather and lining materials; accessories for Leather goods and garments

UNIT II CUTTING AND CLICKING **9**
Introduction of hand cutting; preparation of knives & tools; clicking machines-mechanical and pneumatic / hydraulic; pattern interlocking / nesting for material optimization

UNIT III ASSEMBLY AND STICHING **9**
Introduction to various sewing machines-flat bed, cylinder bed & special type m / c; different feed mechanisms; basic sewing practice; various types of assembly techniques for leather goods and garments

UNIT IV PATTERN DESIGNING **9**
Basic design development-measurements / sizing chart for men, women and children; adaptation of styles to basic blocks; pattern development for leather goods, pattern grading for leather garments; CAD application for leather goods and garments design and production.

UNIT V ORGANISATION **9**
Feasibility reports for leather goods and garments production; machinery requirement/plant layout, process scheduling and line balancing; quality control measures in leather products manufacture; packaging methods and practices; costing, pricing and marketing procedures-for domestic, international markets.

TOTAL : 45 PERIODS

REFERENCES

1. "Pattern Making Manual - Women's Garments", ESMOD, Paris, 1991.
2. "Fashion Drawing Method", ESMOD, Paris, 1992.
3. Winifred Aldrich, "Metric Pattern cutting for Menswear", BSP Professional Books, London, 1990.
4. "Grading Manual", ESMOD, Paris, 1994.
5. "Training in Tanning Techniques and Leather Goods Manufacture-Course material", CLRI, Madras, 1990.
6. "Skiving Manual", I Ed., CLRI, Madras, 1994.

**AT 9025 GARMENT ACCESSORIES AND EMBELLISHMENTS L T P C
3 0 0 3**

UNIT I **5**
Introduction to garment accessories

UNIT II **9**
Garment value addition – importance and types; market survey of value addition and surface ornamentation; samples and prices and their use in boutiques

UNIT III **13**
Introduction to traditional embroideries of India; basic embroidery stitches – chain stitch, button hole stitch, herringbone stitch, feather stitch, lazy daisy, double knot stitch, interlacing stitch, stem stitch, French knot stitch

UNIT IV **9**
Hand embroidery; different types of embroidery machines; history and origin; colors used; motifs used; fabrics used; stitches used; limitations of hand embroidery; kaustic embroidery; kasida, kathiwar; Sind; chickankari; zardosai; tribal embroideries

UNIT V **9**
Printing – introduction; different methods – block printing, roller, screen, discharge, resist and pigment; styles of printing - batik, tie and dye, patch work, appliqué work, bead work

TOTAL : 45 PERIODS

REFERENCES

1. Shailaja D. Naik, “Traditional Embroideries of India”, API Publishing Corporation, New Delhi, 1996.
2. Shella Paine, “Embroidered Textiles”, Thames and Hudson Ltd., U. S. A., 1990.

**TT 9035 CAD AND CAM FOR TEXTILES AND APPARELS L T P C
3 0 0 3**

UNIT I BASIC CONCEPTS **9**
Developments in computers and information technology; networking- hardware and software; overview of CAD and CAM and their application in various fields of textiles

UNIT II DESIGN SOFTWARE BASICS **9**
AUTOCAD and its emulators; specific software for textile applications; CIE color system and the true color representation; concepts of image processing; graphics – basics, raster, vector graphics and file formats, virtual reality modeling

UNIT III COMPUTER AIDED DESIGN **5**
Weave patterns, printable designs - generation using computers, CAD / CAM in garment manufacturing; complete pattern design system in preparation for grading, marker making and pattern manipulation

UNIT IV COMPUTER AIDED MANUFACTURING **13**
Control theory, instrumentation and control loops, system analysis of computer controller machines in spinning, weaving, processing and garment industry; robots in textiles, computerized on-line and off- line testers

UNIT V MANAGEMENT 9

Computer applications for management function, management information system in garment industry; EDI in garment technology; concept of Enterprise Resource Planning (ERP) and computerization in exports / documentation.

TOTAL : 45 PERIODS

REFERENCES

1. Vesant C. E., "Computer Aided Design and Manufacture", Ellis Harwood-England, 1983.
2. Gray S., "CAD/CAM in clothing & Textiles", Grower Publishing, England, 1998.
3. Sigmon D.M., Grady P.L and Winchesters S.L. "Computer Integrated Manufacturing and total quality management", Textile Progress, Vol. 27, No.4, Text.Inst, ISBN: 1870372166.
4. Stephen Gray, "CAD/CAM in Clothing and Textiles", Gower Publishing Limited, 1998, ISBN 0-566-07673X.
5. Compilation of Papers Presented at the Annual World Conference, "Computers in the World of Textiles", 1984, Hong Kong, The Textile Institute, ISBN: 0-0900739-69X.
6. Aldrich W., "CAD in Clothing and Textiles", 2nd edition, Blackwell Science, 1992, ISBN: 0-63 -3893 -4.
7. Jacob Solinger, "Apparel Manufacturing Handbook", VanNostrand and Reinhold Company, 1980, ISBN: 0-442-21904-0.

**TT 9036 QUALITY ASSURANCE IN GARMENT INDUSTRY L T P C
3 0 0 3**

UNIT I 9

Design satisfaction tests - fabric specification, cloth defects, various point systems, shrinkage potential

UNIT II 13

Garment specification; manufacturing specification; name of operation and associated details in respect of sewing, dyeing and washing of garments; Style features, trims specification, stitch specification, size scale; garment dimensions and tolerances; quality of trims and accessories.

UNIT III 9

Defects in garments and their remedies - A, B and C zones in a garment with respect to defects

UNIT IV 9

Quality management concepts; quality control and inspections; S.Q.C.; acceptance sampling; T.Q.M.; I.S.O.

UNIT V 5

Laboratory testing for quality and performance

TOTAL : 45 PERIODS

REFERENCES

1. Pradip V. Mehta., " Managing quality in the apparel industry ", New Age International, Chennai, 1998.
2. Sigmon D.M., Grady P.L., and Winchester S.C., " Computer Integrated Manufacturing and Total Quality Management", Textile Progress, The Textile Institute, Manchester, 1998.
3. Laing R.M. and Webster J., " Stitches and Seams ", The Textile Institute, Manchester, 1998.
4. Glock R.E. and Kunz G.I., " Apparel Manufacturing: Sewn Product Analysis ", Prentice Hall, 1995.
5. Mehta P.V., " An Introduction to Quality Control for the Apparel Industry ", Marcel Dekker, 1992.
6. Cooklin G., " Garment Technology for Fashion Designers ", Blackwell Science, 1997.

UNIT I ORGANIZATION OF THE APPAREL BUSINESS 9

Introduction to apparel industry; organization of the apparel industry; types of exporters; business concepts applied to the apparel industry; international trade

UNIT II MARKETING 9

Functional organization of an apparel firm; responsibilities of a marketing division; marketing objectives and strategies; marketing research; types of markets; Retail and wholesale strategies for merchandise distribution; retailers' sourcing flows and practices; marketing plan; labeling and licensing

UNIT III MERCHANDISING 9

Definition of merchandising; functions of merchandising division; role and responsibilities of a merchandiser; different types of buyers; communications with the buyers; awareness of current market trends; product development line planning – line presentation

UNIT IV SOURCING 9

Need for sourcing; sourcing materials; manufacturing resources planning; principles of MRP; overseas sourcing; sourcing strategies; supply chain and demand chain analysis; materials management for quick response; JIT technology

UNIT V DOCUMENTATION 9

Order confirmation; various types of export documents; pre-shipment and post-shipment documentation; terms of sale, payment and shipment; export incentives; foreign exchange regulation acts; export management risk; export finance

TOTAL : 45 PERIODS**REFERENCES**

1. Elaine Stone, Jean A. Samples, "Fashion Merchandising", McGraw Hill Book Company, New York, 1985, ISBN: 0-07-061742-2.
2. Shivaramu S., "Export Marketing" – A Practical Guide to Exporters", Wheeler Publishing, Ohio, 1996, ISBN: 81-7544-166-6.
3. Sinha D., "Export Planning and Promotion", IIM, Calcutta, 1989.
4. Tuhin K. Nandi, "Import-Export Finance", IIM, Calcutta, 1989.
5. Jarnow J.A., Guerreiro M., Judelle B., "Inside the Fashion Business", MacMillan Publishing Company, New York, 1987, ISBN: 0-02-360000-4.

UNIT I 13

Sewing thread - characteristics required for different applications in the garment industry; types of sewing thread and their production method; specifying sewing threads

UNIT II 5

Effect of quality of sewing thread on sewing performance; testing of sewing threads

UNIT III 13

Fancy yarns – definition, classification; basic principles; production-plying technique, spinning technique; design and construction of profiles – spiral, gimp, loop, snarl, knop, cover, slub, chenille, combination of profiles.

UNIT IV**14**

Chemical processing – singeing, preparatory, dyeing and finishing for sewing thread; chemical processing of fancy yarns

TOTAL: 45 PERIODS**REFERENCES**

1. Gong R.H. and Wright, "Fancy yarns -their manufacture and applications", Woodhead publishing limited, England, 2002.
2. Carl A Lawrence, "Fundamentals of spun yarn technology", CRC Press, Florida, USA, 2003.
3. Carr H., "The technology of clothing manufacture' Blackwell Publisher, U.K., 2004.
4. Ruth E. Glock., "Apparel manufacturing sewn product analysis", Prentice Hall, New Jersey, 2005, ISBN-10: 0131119826.
5. Jacop Solinger, "Apparel manufacturing hand book", Litton Educational Publishing, 1980.

TT 9354**BONDED FABRICS****L T P C****3 0 0 3****UNIT I INTRODUCTION****5**

Definitions and classification of bonded fabrics; fibres and their characteristics for the production of bonded fabrics, uses; production methods and consumption of non-wovens

UNIT II WEB FORMING**9**

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

UNIT III BONDING**13**

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

UNIT IV FINISHING**9**

Dry finishing – shrinkage, wrenching and creping, calendaring, perforating, slitting and splitting; wet finishing – washing, dyeing, printing; softening, flame proofing; coating; laminating; flocking

UNIT V EVALUATION**9**

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.

AT 9028	ECO FRIENDLY DYES AND CHEMICALS	L T P C
		3 0 0 3
UNIT I		9
Constitution of dyes and finishing agents; German legislation; list of banned dyes and chemicals		
UNIT II		9
Alternative dyes and chemical and their structures; identification by chromatographic techniques		
UNIT III		9
Finishes – banned items and allowable dosages; alternatives to finishes		
UNIT IV		9
Eco friendly dry cleaning agents, pigments, bleaching agents and solvents; guidelines to dyestuff manufacturers		
UNIT V		9
Application areas of eco friendly dyes and chemicals		
		TOTAL : 45 PERIODS

REFERENCES

1. "Are Textiles finishing the environment?", The Textile Institute, Manchester, 1990.
2. "Finishers and the environment – Solutions", The Textile Institute, Manchester, 1993.
3. Reife A and Freeman H.S., "Environmental Chemistry of dyes and pigments", Wiley, New York, 1996, ISBN: 0471589276.

AT 9029	FUNDAMENTALS OF COLOUR SCIENCE	L T P C
		3 0 0 3
UNIT I	COLOUR SCIENCE	9
The 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 and Munk's simplified model of theory of interaction of matter and radiation		
UNIT II	COLOUR ORDER SYSTEMS	9
Description of color; various color order systems; CIE system and its components; illuminants; standard observer; chromaticity diagram		
UNIT III	COLOUR MATCHING	9
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		
UNIT IV	METAMERISM	9
Illuminant metamerism; observer metamerism; geometric metamerism; assessment of metamerism; metamerism in textiles		
UNIT V	COLOUR DIFFERENCE MEASUREMENTS AND COLOUR ASSESSMENT IN TEXTILES	9
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. Wright W. D., "The Measurement of Color", Adam Hilger Ltd., London, 1989.
2. Kuehni R. G., "Computer Colorant Formulation", Lexington Books, London, 1995.
3. McLaren K., "The Color Science of Dyes & Pigments", Adam Hilger Ltd., Bristol, 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 13

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 14

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.

AIM

To sensitize the engineering students on blending both technical and ethical responsibilities.

OBJECTIVES

- Identify the core values that shape the ethical behavior of an engineer.
- Utilize opportunities to explore one's own values in ethical issues.
- Become aware of ethical concerns and conflicts.
- Enhance familiarity with codes of conduct.
- Increase the ability to recognize and resolve ethical dilemmas.

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)

TT 9038 INDUSTRIAL ENGINEERING FOR TEXTILE AND APPAREL INDUSTRIES**L T P C
3 0 0 3**

UNIT I	5
Industrial Engineering - evolution, functions, role of industrial engineer	
UNIT II	13
Methods study – introduction, techniques of recording; method analysis techniques; principles of motion economy; method study in garment manufacture; ergonomics-importance, workplace design, fatigue	
UNIT III	13
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	
UNIT IV	5
Site selection for textile industry; plant layout - types of layouts suitable for textile industry, methods to construct layout; line balancing	
UNIT V	9
Statistical Process Control – data collection; concept of AQL, control charts in quality control; process capability	

TOTAL : 45 PERIODS**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", 7th 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, 2nd edition, 2000.
8. Panneerselvam R., "Production and Operation Management", Prentice Hall of India, 2002.
9. Edward S. Buffa and Rakesh Sarin., "Modern Production and Operations Management", John Wiley & sons, U. S. A., 1987.
10. Lee J. Krajewski and Larry P. Ritzman., "Operations Management: Strategy and Analysis", Addison Wesley, 2000.
11. Chase., Aquilano and Jacobs., "Production and Operations Management", Tata McGraw- Hill, New Delhi, 8th Edition, 1999.

TT 9041

OPERATIONS RESEARCH

L T P C

3 0 0 3

UNIT I LINEAR PROGRAMMING

13

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

UNIT II TRANSPORTATION PROBLEM

9

Northwest corner, least cost, Vogel's approximation method; application of optimality test; solution to assignment problems, unbalanced assignment, infeasible assignment problems

UNIT III INVENTORY CONTROL

5

ABC analysis; fixation of inventory level, EOQ (Wilson's Formula), problems related to above theoretical aspects

UNIT IV PERT / CPM

9

CPM and PERT networks - finding critical path, probability and cost consideration in the project scheduling

UNIT V GAME THEORY AND QUEING THEORY

9

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

TOTAL: 45 PERIODS

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, 4th print, 2003.
4. Hamdy A. and Taha, "An introduction to Operations Research", Maxmillan Publishing Company, New York, Vth 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.

AT 9030

APPAREL EXIM MANAGEMENT

L T P C

3 0 0 3

UNIT I

14

Exim policy of India – introduction, customs act, other acts relating to export/import; customs formalities; export documentation; import documentation; benefits -100% export oriented units, export processing zones, special economic zones; export incentives, duty drawback; import licenses.

UNIT II

13

Foreign exchange – concept; Methods of International Payment Settlement - International Commercial Terms, Letter of Credit, Demand Guarantees and Standby Letter of Credit, Exchange Control Regulations for imports and exports; Export Financing - Pre-shipment finance - Post Shipment Finance; EXIM Bank of India

UNIT III

9

Shipping - general information, insurance, documentation, types of containers and ships; air transportation - documentation; packaging – types, cost

UNIT IV **9**
 Textile policy – ready made garments; export statistics; testing and certification of goods; international care labelling code; marketing – identifying customers, role of export promotion councils.

TOTAL: 45 PERIODS

REFERENCES

1. John D. Daniels and Lee Radebangh H., "International Business", Pearson Education Asia, New Delhi, 2000.
2. Richard M. Hodgetts and Fred Luthans, "International Management", Irwin McGraw-Hill, New York, 2000.
3. Adrian Buckley, "Multinational Finance", Prentice Hall of India, 3rd edition-1998.
4. Levi, "International Finance", Tata McGraw-Hill, New Delhi, 3rd Edition, 1997.
5. Charles W. L. Hill, "International Business", Irwin McGraw Hill, New York, 2001.
6. Anand K. Sundaram and Stewart Black I., "The International Business Environment", Prentice Hall of India, New Delhi, 2001.
7. Michael R. Czinkota, Ilkka A. Ronkainen and Michael H. Moffeff, "International Business", Harcourt Thompson Learning, Singapore, 2002.
8. Don Ball and Wendell McCulloch, "International Business", Irwin McGraw-Hill, New York, 1999.
9. Roger Bennett, "International Business", Pearson Education of India, New Delhi, 1999.

TT 9042 **PRODUCTION AND OPERATIONS MANAGEMENT** **L T P C**
3 0 0 3

UNIT I **9**
 Factors of production; environmental and social concerns of operations; design of production system; forecasting in production and operation management – various qualitative and quantitative techniques

UNIT II **9**
 Capacity planning – single stage system, multistage system; facility planning – objectives; different types of layouts, developing process layout, product layout; job design techniques

UNIT III **9**
 Aggregate production planning – procedure, importance; scheduling in operation management – mass production system, batch and job shop

UNIT IV **9**
 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

UNIT V **9**
 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.

**AT 9031 PRODUCT ENGINEERING AND PLANT LAYOUT L T P C
3 0 0 3**

UNIT I PRODUCT ANALYSIS 5
Relationship between quality and construction of a sewn product; geometric principles of draping, drafting and industrial patterns; product specifications

UNIT II PRODUCTION CONTROL AND ENGINEERING 9
Industrial engineering concepts; development and application of standard data for pre-costing and factory scheduling; basic production systems; production control charts; manufacturing information system - systems and procedures.

UNIT III PRODUCTION MANAGEMENT ANALYSIS 9
Analysis of techniques for material utilization and cutting of raw materials for all types of sewn products; principles and methods of costing; evaluation of equipment for examining; spreading, cutting, marking and ticketing; solution of production problems in spreading, cutting and cost control.

UNIT IV PLANT LAYOUT 13
Types of production layout; criteria for evaluation of a plant layout; determining minimum space requirement, calculation grid, plant size location; basic production line layout; Government regulations for plant layout.

UNIT V TIME AND MOTION STUDY 9
General approach for making a time and motion study- preliminary data for time and motion study sheet; sewing work study; principles of work cycle timing methods, objectives of time study, statistical approaches, statistical calculation of time study; operator efficiency distributions; evaluating motion study data; principles for improving sewing and pressing operations.

TOTAL: 45 PERIODS

REFERENCES

1. Jacob Solinger, "Apparel Manufacturing Handbook", Van Nostrand Reinhold Company, New York, 1980.
2. Bethel, Tann, Atwater and Rung, "Production Control", McGraw Hill Book Co., New York, 1948.
3. Biegel, John. E., "Production Control – A Quantitative Approach", Prentice Hall Inc, New Jersey, 2nd edition, 1971.
4. Apple J. M., "Plant Layout and Materials Handling" The Ronald Press Co., New York, 1950.
5. Immer John. R., "Layout Planning Techniques" McGraw Hill Book Co., New York, 1950.

AT 9032	ENTERPRISE RESOURCE PLANNING	L T P C 3 0 0 3
UNIT I		9
Enterprise Resource Planning - principle, framework, application and suitability in garment industry		
UNIT II		9
Client/Server architecture; technology choices; SCM, CRM – concepts		
UNIT III		9
ERP system packages - SAP, People soft, BAAN and Oracle – comparison; integration of different ERP applications; integration of ERP and internet		
UNIT IV		9
ERP implementation strategies – organisational and social issues; ERP implementation in a garment factory		
UNIT V		9
ERP procurement issues – market trends – outsourcing ERP – economics – hidden cost issues – ROI.		

TOTAL: 45 PERIODS

REFERENCES

1. Brady, "Enterprise Resource Planning", Thomson Learning, U.K., 2001.
2. Alexis Leon, "ERP Demystified", Tata McGraw-Hill Publishing Company limited, New Delhi, 2002.
3. Sadagopan. S, "ERP-A Managerial Perspective", Tata McGraw-Hill, New Delhi, 2001.
4. Jose Antonio Hernandez, "The SAP R/3 Handbook", Tata McGraw-Hill, New Delhi, 2001.
5. Vinod Kumar Crag and Bharat Vakharia, "Enterprise Resource Planning Strategy", Jaico Publishing house, Mumbai, 1999.
6. Garg and Venkitakrishnan, "ERPWARE, ERP Implementation Framework", Prentice Hall of India, New Delhi, 1999.
7. Vinod Kumar Grag and Venkitakrishnan N.K., "Enterprise Resource Planning", Prentice Hall of India, New Delhi, 2001.

AT 9033	SUPPLY CHAIN AND CUSTOMER RELATIONSHIP MANAGEMENT	L T P C 3 0 0 3
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UNIT I		5
Role of Supply Chain Management - scope and importance, customer driver strategies, logistics and competitive strategy		
UNIT II		9
Coordination and management of transportation - inventory, order processing, purchasing, warehousing, materials handling, packaging, customer service management; marketing and supply chain interface; finance and supply chain interface		
UNIT III		9
Distribution network planning and warehouse location; integrated supply, production, distribution policies and plans		

UNIT IV **13**
 Import-Export logistic management; export shipping, air transportation management – documentation, insurance, packaging and others; Foreign exchange – concept; Methods of International Payment Settlement; International Commercial Terms; Exchange Control Regulations for imports and exports

UNIT V **9**
 CRM – concept, technology considerations, operational, analytical, collaborative; implementation strategy; CRM software packages

TOTAL : 45 PERIODS

REFERENCES

1. Donald J. Bowersox and David J. Closs, “Logistical Management”, Tata McGraw-Hill Editions, New Delhi, 2000.
2. Jeremy F. Shapiro, “Modelling and Supply Chain”, Thomson Learning, U.K., 2001.
3. Monczka, Trend, Handfiled, “Purchasing and Supply chain management”, Thomson south- western college publishing, Kentucky, 2000.
4. Bligh, Philip; Douglas Turk, “CRM unplugged – releasing CRM's strategic value”, Hoboken: John Wiley & Sons, 2004, ISBN 0-471-48304-4.
5. David Taylor and David Brunt, “Manufacturing Operations and Supply Chain Management”, Vikas Thomson Learning, New Delhi, 2001.
6. Philippe - Pierre Dornier, “Global operations & logistics”, John Wiley & sons Inc, New York, 2002.
7. Sahay B.S., “Supply chain management for global competitiveness”, Macmillan India Ltd, Delhi, 2000.
8. David Hutchins, “Just in Time”, Jaico Publishing House, Mumbai, 2001.
9. David Simchi, Levi and Philip Kaminsk, “Designing and Managing the supply chain”, McGraw-Hill Companies Inc., New York, 2000.

AT 9034 **MANAGEMENT INFORMATION SYSTEM** **L T P C**
3 0 0 3

UNIT I **9**
 Decision making process - information required, models for decision making; types of information – spinning, composite textile and garment industry

UNIT II **9**
 Information system vs. management activities; strategy planning; information systems for operational control in spinning, weaving and apparel industry

UNIT III **9**
 Information resources; data communication concepts; overview of telecommunications – use; features of LAN, WAN, internet and modern systems

UNIT IV **18**
 Database Management Systems – introduction, components, data models; developing data base for various functions of spinning, weaving and garment industry; advantages and disadvantages of DBMS; analysis and design of information systems.

TOTAL : 45 PERIODS

REFERENCES

1. James A O'Brein, "Management Information Systems", Tata McGraw-Hill, New Delhi, 1999.
2. Kenneth C. Landon and Jane Price Landon, "Management Information Systems – Managing the Digital firm", Pearson Education, Asia, New Delhi, 2002.
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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**

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