

M TECH (TEXTILE TECHNOLOGY)

Proposed Syllabus

(To be commenced from 2013 -2014 session)

West Bengal University of Technology

1st Semester

Theory						
Code	Subject	Contact periods per week				Credit
		L	T	P	Total	
TTM101	Advanced Engineering Mathematics	3	1	0	4	4
TTM102	Compulsory :Physical Properties of Textile Fibres	4	0	0	4	4
TTM103	Compulsory : Advances in Yarn Formation Technology	4	0	0	4	4
TTM104	Compulsory : Advances in Fabric Formation Technology	4	0	0	4	4
TTM105 A/B/C	Elective I A. Smart Textile B. Advanced Garment Manufacturing Technology C. Advanced Computer Application in Textile	4	0	0	4	4
	Total of Theory					20
Practical						
TTM 193	Advanced Fibre and Yarn Testing Lab	0	0	3	3	2
TTM 194	Advanced Fabric Testing Lab	0	0	3	3	2
Sessional	Seminar I	0	2	0	2	2
						6
	Total Credit of 1 st Semester					26

2nd Semester

Theory						
Code	Subject	Contact periods per week				Credits
		L	T	P	Total	
TTM201	Compulsory: Design of Experiments and Statistical Techniques	3	1	0	4	4
TTM202	Compulsory :Textured Yarn Technology	4	0	0	4	4
TTM203	Compulsory : Theory of Textile Structure	4	0	0	4	4
TTM204 A/B/C	Elective II A. High Performance Fibres and Industrial Textiles B. Technical Textile C. Nano Technology in Textiles	4	0	0	4	4
TTM205 A/B/C	Elective III A. Non Woven and Speciality Textiles B. Clothing Science and Advances in Chemical processing C. Geo-synthetics D. Energy Management in Textile Industry	4	0	0	4	4
	Total of theory					20
Practical						
TTM291	Design of Experiments and Statistical Analysis Lab	0	0	3	3	2
Sessional	Seminar II	0	2	0	2	2
	Comprehensive Viva-voce					4
	Total Credit of 2 nd Semester					28

3rd Semester

Theory						
Code	Subject	Contact periods per week				Credits
		L	T	P	Total	
TTM 301	Compulsory : Project Management & Entrepreneurship Development	4	0	0	4	4
TTM 302 A/B/C	Elective IV A. Bio Technology application in Textiles B. Soft computing Theory and Practice C. Advanced Knitting Technology	4	0	0	4	4
Sessional						
	Defense of dissertation (Part-I)	0	0	0	0	4
	Dissertation (Part I)	0	0	0	20	10
	Total Credit of 3 rd Semester					22

4th Semester

Theory						
Code	Subject	Contact periods per week				Credits
		L	T	P	Total	
Sessional						
TTM 481	Dissertation (Completion)	0	2	0	24	14
TTM 482	Post-submission defence of dissertation					8
	Total Credit of 4 th Semester				24	22
	Grand Total of Credits					98

DETAIL SYLLABUS (PROPOSED)

First Semester

Advanced engineering mathematics

Code : TTM 101

Contacts : 3-1-0

Credit : 4

Complex Variables: Elements of set theory, Set notations, Applications of set theory, Open & Closed Sets. Review of Complex variables, Conformal mapping and transformations, Functions of complex variables, Integration with respect to complex argument, Residues and basic theorems on residues.

Numerical Analysis: Introduction, Interpolation formulae, Difference equations, Roots of equations, Solutions of simultaneous linear and non-linear equations, Solution techniques for ODE and PDE, Introduction to stability, Matrix eigen value and eigen vector problems.

Optimization Technique: Calculus of several variables, Implicit function theorem, Nature of singular points, Necessary and sufficient conditions for optimization, Elements of calculus of variation, Constrained Optimization, Lagrange multipliers, Gradient method, Dynamic programming.

Probability and Statistics: Definition and postulates of probability, Field of probability, Mutually exclusive events, Bayes' Theorem, Independence, Bernoulli trial, Discrete Distributions, Continuous distributions, Probable errors, Linear regression, Introduction to non-linear regression, Correlation, Analysis of variance.

References :

1. Sen, M. K. and Malik, D. F.-Fundamental of Abstract Algebra, Mc. Graw Hill
2. Khanna, V. K. and Ghandri, S. K.- Course of Abstract Algebra, Vikash Pub.
3. Halmos, T. R.-Naive Set Theory, Van Nostrand
4. Scarborough, J. B.-Numerical Mathematical Analysis, Oxford University Press
5. Cone, S. D.-Elementary Numerical Analysis, Mc. Graw Hill.
6. Mukhopadhyay ,P.-Mathematical Statistics ,New Central Book Agency
7. Kapoor, V. K and Gupta, S.C.-Fundamental of Mathematical Statistics, Sultan Chand and Sons.
8. Uspensky, J. V.-Introduction to Mathematical Probability, Tata Mc. Graw Hill
9. Dreyfus, S. E.-The Art and Theory of Dynamic Programming –Theory and Applications, Academic Press.

Physical properties of fibre

Code : TTM 102

Contacts : 4-0-0

Credits : 4

Introduction to fibre structure and requirements of fibre forming polymers. Moisture sorption and desorption in fibres, sorption isotherms, Heat of sorption, theories of moisture sorption. Mechanical properties: Mechanism of deformation in fibres. Principles of elasticity and viscoelasticity. Creep and stress relaxation. Boltzmann superposition principle. Dynamic mechanical properties. Model theory of visco-elasticity. Time- temperature superposition principle. Stress- strain behaviour of textile fibres. Fibre friction, its nature, theory, application and measurement. Birefringence and its measurement. Thermal transition and its importance. Thermal conductivity. Dielectric properties of fibre. Static

electricity and measurement of static charge in fibres. Fibre micro structure, x-ray analysis, IR spectroscopy and SEM.

References :

1. Meredith R, The Mechanical Properties of Textile Fibres, North Holland Publishing Co; Amsterdam 1959.
2. Morton W E and Hearle J W S, Physical Properties of Textile Fibres, 1st reprint, The Textile Institute, Manchester, 1986.
3. Gupta V B and Kothari V K, "Manufactured Fibre Technology" 1st Ed., Chapman and Hall, London, 1997.
4. Hearle JWS, Polymers and their properties, Vol. I, John Wiley and Sons, NY, 1982.

Advances in yarn formation technology

Code : TTM 103

Contacts : 4-0-0

Credits : 4

Role of air currents in blowroom / Aerodynamic characteristics of blow room machineries, critical design aspects of modern blowroom machinery. Critical design aspects in different zones of modern card, Transfer efficiency and quality. Factors affecting transfer efficiency. Configuration and disorder of fibres in a card sliver. Fibre fractionation at comber, factors affecting fractionation in a comber. Design developments in modern comber.

Role of fibre friction in drafting, measurement and study of factors affecting drafting force. Design significance of modern draw frames and speed frames. Design & development of modern ring frame. Design aspects of unconventional spinning machines, such as rotor, dref, air jet, twist less, wrap, self-twist. Application of microprocessors in spinning.

References :

1. Carl A Lawrence, "Fundamentals of Spun Yarn Technology", CRC Press.
2. Grosberg P and Iype C, "Yarn Production-Theoretical Aspects", 1st Ed., The Textile Institute, UK, 1999.
3. Klein W, "Manual of Textile Technology- New spinning Systems", Vol.5, 1st Ed., The Textile Institute, UK, 1993.
4. Chattopadhyay R, "Advances in Technology of Yarn Production", 1st Ed., NCUTE, New Delhi, 2002.
5. Chattopadhyay R & Rengasamy R S, " Spinning : Drawing, Combing and Roving", 1st Ed, NCUTE, New Delhi, 1999.

Advances in fabric formation technology

Code : TTM 104

Contacts : 4-0-0

Credits : 4

Overview of developments in design and operation of winding, warping, sizing and weaving machines. Study of yarn tension control in unwinding and winding. Modern Warping machine controls. Modern sizing machine controls.

Theory and design of loom mechanisms – Study of modern picking mechanisms, warp and cloth control, selection mechanisms etc.

Overview of developments in design and operation of modern knitting machines, control mechanisms in knitting machines, knitting mechanics.

Overview of developments in design and operation of modern non-woven machines.

References :

1. Principles of Weaving by Marks and Robinson
2. Textiles (The Motivate Series) by A. Wayne
3. Weaving Conversion of Yarn to fabric by Lord & Mohammed
4. Preparatory to Weaving and Weaving Machinery by Ormerod and Snochldhelm
5. Shuttleless Weaving by Talavasek & Svaty
6. Textile Mathematics Volume III by J.E. Booth
7. Yarn Preparation – by R. Sengupta, Popular Prakashan, Bombay
8. Shuttleless Weaving by J.J. Vincent
9. Winding – Silver Jubilee Monograph by BTRA
10. Sizing – Materials, Methods, Machinery by Ajgaonkar, Talukdar & Wadekar
11. Weaving – Machinery, Mechanisms, management by Talukdar, Srimalu & Ajgaonkar
12. Ajgaonkar D.B., “Knitting Technology”, Universal Publishing Corporation (1998)
13. Spencer D.J., “Knitting Technology”, Textile Inst., 2001
14. Raz, S., Flat Knitting, The Generation, Meiesnbach GMBH hainstrasse 18, D – 8600, Bamberg/ Germany (1991)
15. Gulrajani M.L., “Non wovens”, The Textile Association (India) publication 1996.
16. Birrell V., The Textile Arts, Harper & Prothers Publications, New York 1999.
17. Denise Musk, Machine Knitting, B.T. Batsford Ltd., London 1999
18. Wilhelm Albrecht et al., “ Non Woven fabrics”, WILEY – VCH Verlag GmBH & Company, Germany, 2003.

Smart textiles

TTM 105 A

Contacts : 4-0-0

Credits : 4

Smart technology for textiles and clothing - introduction and overview, electrically active polymer materials – application of non-ionic polymer gel and elastomers for artificial muscles, Heat-storage and thermo-regulated textiles and clothing, Thermally sensitive materials

Mechanical properties of fibre Bragg gratings, Optical responses of FBG sensors under deformations, Smart textile composites integrated with fibre optic sensors, Embroidery and smart textiles, Adaptive and responsive textile structures (ARTS), Wearable technology for snow clothing, Bio-processing for smart textiles and clothing, Tailor-made intelligent polymers for biomedical applications, Textile scaffolds in tissue engineering

References:

1. “Handbook of Industrial Textiles”, Ed. Sabit Adanur, Technomic Publishing Co. INC
2. “Handbook of Technical Textiles”, Ed. A R Horricks and S C Anand, Woodhead Publication Ltd, Cambridge, 2000
3. “ Textiles for protection, Ed. Richard A. Scott, Woodhead Publication Ltd, Cambridge, U.K.
4. “ Wearable Electronics and Photonics, Ed. Xiaoming Tao, Woodhead Publication Ltd, Cambridge
5. Zhang Y P, Hu H P, Kong X D., Phase Change Heat Storage Theory and Application, Hefei University of Science & Technology of China Publishing House, 1996

Advanced garment manufacturing technology

Code : TTM 105 B

Contacts : 4-0-0

Credits : 4

Introduction: Garment classification for men, women, children and uniforms - fabrics selection for garments - properties of fabric finishes (fundamental and decorative) - specifications and testing.

Pattern making: Body Measurements- Methods of pattern development - flat pattern technique — shapes – fittings - commercial patterns — pattern alteration - Planning, Drawing and reproduction of patterns.

Fabric cutting: Lay planning and Preparation for cutting - marking - pinning - cutting techniques and cutting machines.

Stitching:

Classification of stitches and seams - lining – interlining - Sewing machine- Types and applications - parts and their function of a sewing machine - timed sequence for stitch formation - sewing aids – bobbin winding - stitch length selection - feed pressure - stitch patterns - Types and Selection of sewing threads.

Garment processing: Processing of grey fabric garments - processing of bleached fabric garments.

Garment dyeing: Chemicals and machines for garment dyeing.

Garment finishing : Light finishing - pre-cure, post cure, and two stage resin finishing techniques - heat Treatment - Printing of Garments: STP Technique - Printing equipments.

Production and processing of heavy weight garments like denim, gabardine

References:

1. Cooklin.G, Introduction to Clothing Manufacture, Blackwell Science, 1991
2. Bray.N. Dress Pattern Designing - The Basic Principles of cut and Fit Blackwell Science, 1996.
3. Peggat H., " The complete dress maker", Marshall coverdish, London.
4. Peggat H., " Introduction to dress making", Marshall coverdish, London.
5. Winks. I .M., Clothing Sizes International Standardisation, The Textile Institute, Due Summer

Advanced computer applications in textiles

Code :TTM 105 C

Contacts : 4-0-0

Credits : 4

Artificial Neural Networks

Biological Neuron & their artificial models, Models of artificial neural neuron, Neural processing, learning & adaptation, Neural Network learning rules, Multilayer feed forward networks, Generalised error back pro-projection training algorithm, application of ANN in textiles : Yarn strength prediction using ANN. Case study.

E-Commerce

The scope of electronic commerce, definition of electronic commerce, E-commerce and the trade cycle, Electronic markets, Electronic data interchange, Internet Commerce, Business Strategy in E-commerce, The value chain, supply chain, Porter's value chain model. Inter organization value chains, Business to business E-commerce, Inter organizational transaction, The credit transaction trade cycle. Advantages & disadvantages of Electronic markets. Application of E-commerce in textile industries.

Introduction To ERP

Introduction to ERP, Basic ERP concepts, Justifying ERP Investments, RISK of ERP, Benefits of ERP.

ERP and technology

ERP and Related Technologies, Business Intelligence (BI), Business Process Reengineering (BPR), Product Life Cycle Management, Supply Chain Management (SCM), Customer Relationship Management (CRM).

SAP

Architecture of SAP R/3, SAP Integrated- Analysis, Implementation, and Design, Three-Tier Architecture, Need of Multi-tier Architecture, Integrating Environments.

References :

- 1) Introduction to Artificial Neural Systems – J.M Zurada, Jaico Book.
- 2) E-Commerce – David Whiteley, TMH.
- 3) ERP Demystified - Alexis Leon, TMH
- 4) Enterprise Resource Planning – Alexis Leon, TMH.
- 5) Information Technology for Management,- Turban-McLean. Wetherbe
- 6) SAP R/3 SAP Architecture, Administration, Basis, ABAP

Advanced Fibre and Yarn Testing Lab

Code : TTM 191

Contacts : 0-0-3

Credits : 2

Suggested topics are (not exclusive):

1. Cross-sectional study of textile fibres
2. Measurement of di-electric constant of textile fibres
3. Assessment of stress-strain behaviour of textile fibres and yarns.
4. Fibre-to-fibre friction measurement
5. Measurement of creep and stress relaxation phenomena of textile yarns
6. Assessment of nep count of carded web
7. Determination of yarn packing coefficient
8. Determination of migration behaviour of fibres in spun yarn using tracer fibre technique.
9. Determination of fibre orientation in slivers

Advanced fabric testing lab

Code : TTM 192

Contacts : 0-0-3

Credits : 2

Suggested topics are (not exclusive) :

1. Measurement of thermal resistance in fabric
2. Assessment of Water vapour permeability in woven and knitted fabric
3. Determination of fabric poisson ratio
4. Assessment of Stress-strain behaviour of fabric
5. Wrinkle recovery test of fabric
6. Application of image analysis technique for evaluation of various fabric parameters
7. Assessment of Wicking behaviour of fabric
8. Study of fabric – to –metal friction behaviour using inclined principle

Second Semester

Design of experiments and statistical techniques

Code : TTM 201

Contacts : 4-0-0

Credits :4

Sampling techniques, sample size, Control charts and their applications, Concept of Acceptance Sampling. Principles of experimental design. Selecting a statistical design. Running experiments in Blocks, Latin squares. Factorial Designs & Analysis. Fractional factorial experiments. Use of replicates. Statistical principles in data analysis. Fitting data. Linear regression with one, and several variables. Polynomial models. ANOVA. Orthogonal Array Experimentation, Taguchi's Loss Function, Signal to Noise Ratios (Nominal the Best, Higher the Better and Lower the Better Types), Simple and Multiple Regression Analysis, Response Surface Methodology. Techniques of optimisation, test of significance and model lack of fit, use of replicates, use of computers and software package.

References :

1. Montgomery D.C., "Introduction to Statistical Quality Control", John Wiley and Sons, Inc., Singapore, 2002, ISBN: 997151351X.
2. Leaf G.A.V., "Practical Statistics for the Textile Industry, Part I and II", The Textile Institute, Manchester, 1984, ISBN:0900739517.
3. Douglas C. Montgomery, "Design and analysis of experiments", John Wiley & Sons, Inc, Singapore, 2000, ISBN 9971 51 329 3
4. Ronald D. Moen, Thomas W. Nolan, Lloyd P. Provost, "Quality improvement through planned experimentation", McGraw-Hill, 1998, ISBN 0-07-913781-4

Textured yarn technology

Code :TTM 202

Contacts :4-0-0

Credits : 4

Principles of texturing and modern classification; False twist texturing process- mechanisms and machinery, optimization of texturing parameters, structure-property correlation of textured yarns; Draw-texturing- the need and fundamental approaches; Friction texturing- the need and development, mechanics of friction texturing, latest development in twisting devices, optimization of quality parameters. Noise control in texturing. Air jet texturing - Principle, mechanisms, development of jets and machinery, process optimization and characterization, air jet texturing of spun yarns. Air interlacement - Principle and mechanism, jet development and characterization. Bulk continuous filament yarns - Need, principle, technology development. Hi-bulk yarns - Acrylic Hi-bulk yarn production, mechanism and machines involved, other such products. Solvent and chemical texturing - Need, texturing of synthetic and natural fibres.

References :

1. 'Advances in false Twist Texturing Processes' – Shirley Institute
2. 'Texturing Today' – Shirley Institute
3. 'Yarn Texturing in the 1980's Shirley Institute
4. Textured Yarn Technology Vol I : Production, Properties and Processing – Monsanto
5. A Guide to Crimping/Texturing Technology – Gandhi & Talele

6. Draw Textured Yarn Technology – Monsanto
7. Textured Yarn Technology (Vol 6) : Development & Innovations (Progress in Textiles Series : Science & technology) – Edited by Dr. V.K. kothari, IAFL Publications.

Theory of textile structure

Code : TTM 203

Contacts : 4-0-0

Credits : 4

Elements of yarn geometry. Geometry of helix and its application to yarn structure. Geometry of folded yarns. Translation of fibre properties into yarn behaviour. Theories of yarn irregularity and blend irregularity. Theories of machines of yarn structure under tension, compression, bending and shearing. Fibre migration characteristics of spun and continuous filament yarns. Concept of similar yarns. Effect of properties of constituent fibres and blend composition on the behaviour of composite yarns.

Theories of cloth setting. Geometry of woven fabrics based on the assumption of flexible rigid Threads. Application of fabric geometry in fabric weaving and processing. Later modifications to Peirce's fabric geometry. Use of weavability graphs. Effect of yarn properties and their configuration in fabric on fabric properties such as extensibility. Stiffness and drape. Distribution of stress in fabrics under elongation, beginning, buckling and shearing. Effect of fabric relaxation on its properties.

High performance fibres and industrial textiles

Code : TTM 204 A

Contacts : 4-0-0

Credits : 4

Production, properties & structure of glass, Boron, silica, Carbon, Graphite, Aramid, Polyblend, Polybenzimidazole fibres, Polyphemylene sulphide fibre.

End use of these fibres and conversion of these fibres to composite material & industrial fabric like coated fabric ,inflatable structure ,filter fabrics, belting & cords , Geo-textiles, military application, Insulation ,Protective clothing ,3-D & multi axial fabric.

Technical textile

Code : TTM 204 B

Contacts : 4-0-0

Credits : 4

General Overview :

Definition and scope for technical textiles, brief idea about technical fibres, role of yarn and fabric construction, composite material

Medical Textiles:

Introduction and classification of Medical Textiles. Fibres used for medical applications. Medical Drapes and Linen. Implantables – sutures, soft tissue implants, hard tissue implants, vascular implants. Nonimplantables – surgical dressing, bandages. Extracorporeal devices, Tissue Engineering. Healthcare and Hygiene products. Super absorbent polymers, hydrogels.

Protective Textiles:

Different types of protective clothing. Functional requirements of defense clothing including ballistic protection, parachute, temperature and flame retardant clothing. Chemical and Biological protective clothing. Water proof breathable fabric.

Technical Textiles in Apparel Sector:

Introduction to Smart Technology for textile and clothing. Areas of application of smart textile. Pathogen barrier fabric, fibres used for pathogen barrier application. Clothing for extreme climatic conditions - wearable technology for snow clothing, high altitude clothing. Electromagnetic radiation protective clothing.

Other Applications:

Sportech – Sport uniforms, sporting equipments, textiles in sport surfaces

Agrotech – General applications and fibres used in agriculture, horticulture, fishing and animal husbandry

Buildtech – Architectural membranes, hoardings and signages, awnings and canopies.

Packtech. Ropes and cordages. Canvas covers and tarpaulins.

References:

1. "Handbook of Industrial Textiles", Ed. Sabit Adanur, Technomic Publishing Co. INC
2. "Handbook of Technical Textiles", Ed. A R Horrrcks and S C Anand, Woodhead Publication Ltd, Cambridge, 2000
3. "Textiles for protection, Ed. Richard A. Scott, Woodhead Publication Ltd, Cambridge,
4. "Wearable Electronics and Photonics, Ed. Xiaoming Tao, Woodhead Publication Ltd, Cambridge

Nanotechnology in textiles

Code : TTM 204 C

Contacts : 4-0-0

Credits : 4

Introduction to Nanotechnology : Concept of nanoscale and Historical background of nanotechnology, Fundamental concepts of nanotechnology - Bottom-up approaches, Top down approaches, Functional approaches.

Synthesis and Properties of Nanoparticles : Synthesis of Fullerenes and various forms of carbon. Synthesis of nano metal particles by various chemical, physical and biological methods. Properties of nano particles like organic and inorganic materials in various chemical forms.

Characterization of Nanoparticles : X-Ray Diffraction, Transmission Electron Microscopy and Spectroscopy; Scanning electron microscopy (SEM); Transmission electron microscopy (TEM); Energy-dispersive x-ray spectroscopy (EDS), Small-Angle X-Ray Scattering (SAXS), The Cone Calorimeter (CC), The Mass Loss Calorimeter (MLC).

Electrospinning of Nanofibers : Principles of electrostatic atomization, Electrospinning and electrospinning by the capillary method, Electrospinning and Electrospinning by the charge injection method, Controlling fiber orientation, Producing noncontinuous or short yarns, Producing continuous yarns. Various applications of nanofibres viz, tissue engineering, filter media

Nanocomposites : Carbon nanotube / nanofibre polymer composites, development of functional polymer nanocomposites, Nano filled polypropylene nanocomposites and Dyeable PP.

Nanoengineered Textiles : Nanolayer deposition/coating of polymer films through viz. grafting, plasma and self assembled for various applications like Conductive textiles, Antimicrobial textiles, Self cleaning textiles, Moisture absorbing textiles, Improved hydrophilicity, colourability and wear resistance, UV- blocking textiles, Controlled release of active agents.

References :

1. Principles of Nanotechnology by Phani Kumar
2. Nanofibres & Nanotechnology in Textiles by P.J. Brown & K. Stevens.
3. New Millennium Fibres by G.O. Phillips & M.Takigami.
4. Analytical Electrochemistry in Textiels by P. Westbroek, G. Priniotakis & P. Kiekens.
5. Smart Textiles for Medicine & Healthcare by L. Van Langenhove.

6. The Nanoscope, Encyclopedia of Nano Science & nanotechnology Vol.-I to VI, Dr. Parag Diwan & Ashish Bharadwaj.
7. Nanotechnology in Fibres matures : A New Perspective, Textile Progress,
8. The Textile Institute by Rajesh D. Anandiwala.
9. Electrospinning and Nano-textiles – Soumendra Patra, Lambert Academic Publishing, Germany 2012

Non – wovens & specialty textiles

Code : TTM 205 A

Contacts : 4-0-0

Credits : 4

Non-wovens: Classifications of Non-woven fabrics - Raw materials. Principles of web forming – Role of cross lapper. Web bonding techniques - chemical, mechanical, thermal, air-bonding, spun bonding, needle punching, hydro entanglement processes. Structure of Non-woven fabrics - Macro structure, Structural elements - their arrangement, bonding and binding. Homogeneity of non-wovens. Evaluation of Non-woven fabrics. End uses and Technoeconomics. Felts and in the process of Felting – technical considerations of felting. Decorative techniques in non-woven production.

Narrow fabrics : Classification and Definition - Preparatory processes. Fabric Production - Conventional shuttle looms, Endless Tape Looms, Circular Hose Pipe looms. Shuttleless Looms - Catch thread and flat knitting edge looms; Multi colour Needle Jacquard looms.

Production of Industrial Tapes, Elastic Tapes, Zip fastener tapes; Woven and printed Laboratoryels. Stretch fabrics - classification and its production; Elastomeric stretch fabrics; Braided fabrics; - Tubular structures - Braiding Machine; Nets and Laces - Types and description of Lace Machines - Knitting of laces - Tricot Lace Machines. Flocked fabrics - The process of flocking.

Carpets - Non-pile carpet weaves and their looms. Tufted carpets and their production -Pile surfaced carpet weaves and their looms. Needle felt floor coverings.

References:

1. Gulrajani.M.L., "Non wovens", The Textile Association(India) publication 1996.
2. Birrell.V., The Textile Arts, Harper & Brothers Publications, New York, 1999.
3. Denise Musk, Machine Knitting, B.T.Batsford Ltd, London, 1999
4. Wilhelm Albrecht et al., " Nonwoven fabrics", WILEY - VCH Verlag GmbH & Company, Germany, 2003.
5. Russel.S, "Handbook of Nonwovens", The Textile Institute Publication, 2007.

Clothing science and advances in chemical processing

Code : TTM 205 B

Contacts : 4-0-0

Credits : 4

Brief review of different properties of fabrics and their importance in speciality cloth design. Objective measurement of hand value of fabrics – by Kawabata and FAST system.

Ergonomical aspects of design of clothes for specific purpose such as comfort. Functional finishing of garments. Tailorability of a textile fabric. Advances in pattern making and garment designing. Surface ornamentation of textiles and garments. Physical and chemical testing related to quality standard and performance of garments.

Development in chemical pre-treatments. New generation synthetic dyes and natural dyes. Modern techniques in dyeing. Wet processing of fabrics from micro fibres. Development in processing with enzymes/bio-chemical processing. Developments in functional finishes for apparel and technical textiles.

Effluent treatment processes and control of water pollution, testing of water pollution parameters.
Reduction of pollution load in textile wet processing.

References :

1. Clothing comfort by R.S. Norman
2. Technology of Textile Properties by M.A. Taylor
3. Dress Pattern Designing by N. Bray
4. Surface Characteristics of Fibres and Textiles – Edited by M.J. Schink
5. Handbook of Chemical specialities : Textile Fibre Processing, Preparation and Bleaching by J.E. Nettles
6. Chemical Processing of Fibres & fabrics : Fundamentals & Preparation/ Functional Finishes, Part A & B, edited by M.Lewin
7. Environmental Pollution Control Engineering by C.S. Rao

Geosynthetics

Code : TTM 205 C

Contacts : 4-0-0

Credits : 4

Fundamental of physical, chemical and mechanical properties affecting engineering behaviour of soil, identification, classifications, permeability, effective stress and pore water pressure, seepage of soils and design of filter criteria.

Geosynthetics types and functions, fibres used, material construction and manufacturing processes in case of geotextiles, composition of geomembrane and geogrids and their manufacturing, structure of geocomposites, testing of geocomposites with and without soil, evaluation of filtration and drainage functions, reinforcement, creep, moisture barrier characteristics, durability and ageing.

Geosynthetic and reinforced soil structures: Retaining walls, embankment, foundation.

Geosynthetics in roads and railways: separation, draining and filtering. Geosynthetics in environmental control: covers and liners, landslides, and erosion control.

References:

1. John N W M, "Geotextiles", Blakie, Chapman and Hall, New York, USA, 1987.
2. "Engineering with Geosynthetics", Ed. G V Rao and G V S Suryanarayana Raju, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1990.
3. Ranjan G and Rao A S R, "Basic and Applied Soil Mechanics", International Publishers, New Delhi, 2000.
4. Koerner R M, "Designing with Geosynthetics" Prentice –Hall, N J, USA, 1986.

Energy management in textile industry

Code : TTM 205 D

Contacts : 4-0-0

Credits : 4

Introduction: Concept of energy management — need for energy conservation — global energy scenario with specific reference to India— Demand side management (DSM) — Role of energy service companies (ESCOs)

Energy consumption analysis: Textile machines — Ancillaries — Component wise consumption — Specific energy consumption (UKG) — Cost of energy Vs sales value of textile product.

Energy conservation : Electrical and Thermal audit — Productive and ancillary machines — Preparatory, Spinning, Post spinning, Weaving and Wet processing machines — Ancillaries —

Humidification / Air conditioning, Lighting, Compressors and Boilers and Generators. Different types of fuels and their roles in energy conservation.

Energy efficient equipment: Energy efficient equipment for various processing machines and ancillaries — economics with pay back period and Return on Investment (ROI).

Energy instrumentation: Energy monitoring instruments — Analog, Digital and computerized instruments and measurement techniques — maintenance of instruments / equipment.

Application of non conventional energy sources: Solar energy: different type of collectors — photovoltaic cells. Wind energy, Bio energy, environmental impact on energy and co-generation by using different techniques.

References:

1. Kalyanaraman. A.R, "Energy conservation in Textile Industries", SITRA 1995
2. Palaniappan. C et al, "Renewable Energy applications to Industries", Narose Publishing House, New Delhi, 1998
3. Energy Management an FCRA Monograph, 1998
4. Pradeep Chaturvedi & Shalini Joshi, "Strategy for energy conservation in India", Concept publishing Co., New Delhi, 1995

Design of experiments and statistical analysis lab

Code : TTM 291

Contacts :0-0-3

Credit : 2

1. Testing of hypothesis or Test of significance –difference between mean (t-test)
2. Test of significance – difference between proportion defectives
3. Test of significance – difference between variance : chi square test
4. Test of significance – difference between variance : F – test
5. Representation of experimental data & test results – histogram, scatter diagram, fitting of normal distribution, binomial distribution etc.
6. Plotting of control charts : defectives, average, defects, range etc.
7. Application of analysis of variance : one way ANOVA
8. Application of analysis of variance : two way ANOVA
9. Experimental design techniques : Box Behnken design
10. Experimental design techniques : Box Hunter design
11. Fitting of simple regression with one independent variable
12. Fitting of polynomial regression

Third Semester

Project management & entrepreneurship development

Code : TTM 301

Contacts : 4-0-0

Credits : 4

Project Planning : Project Management scenario; Project Asset – issues & problems; Gantt Chart & LOB; Network Analysis; PERT / CPM, Resource Monitoring & Control.

Project Buying : Projects Procurement Process, Life – cycle Costing, Project Cost Reduction methods, Project Stores, Organization & HRD issues, Computerization.

Investment Feasibility Studies : Managing Project Resources Flow; Project Cost – Capital & Operating; Forecasting Income, Estimation of Investment & ROI, Project Evaluation, Financial Sources, Appraisal Process.

Issues in Project Management : Project Audit, Project Monitoring & MIS, Cost Control, Real Time Planning, Intangibles. Project Management : Case Studies.

Entrepreneurship : Meaning & concept; psychological & social factors; conditions needed for entrepreneurship; role of government; qualities of a prospective entrepreneur. Entrepreneurial Skills : Creativity , problem solving, decision making, communication, leadership quality.

Information : Assistance from different organizations in setting up a new venture; technology parks; industrial corporations; directorate of industries / cottage and small scale industries, SISI, Khadi & Village Industries Commission, DGS & DNSIC, DGFT, how to apply for assistance – procedure, forms, procedures for obtaining contract from Railways, Defence, P & T etc., SIDBI.

Preparation of Project Report : Product/service selection; feasibility report preparation

Case Studies : Diagnostic case studies of successful / unsuccessful entrepreneurs; key variables explaining success/ failures

References :

1. Chandra, Prasanna – Projects (6th Edition); TMH
2. Clements and Gido – Effective Project Management; Thomson Learning
3. Clifford F. Gray and Erik W. Larson – Project Management (3rd edition); TMH
4. Donald F. Kuratko and Richard M. Hodgetts – Entrepreneurship (7th edition); Thomson Learning
5. Gopalkrishnan & Ramamoorthy - Text Book of Project Management; McMillan
6. Nicholas – Project Management for Business and Technology (2nd edition); Pearson Education
7. Roy, Rajeev – Entrepreneurship; Oxford University Press (OUP)

Bio – technology application in textile

Code : TTM 302 A

Contacts : 4-0-0

Credits : 4

Industrial bio-technology : Industrial microbial products – applications, primary metaboloids and secondary metaboloids, Enzymes & Proteins – sources and applications, cell and enzyme immobilization, Industrial plant products – production of enzymes and polysaccharides.

Environmental bio-technology : Detailed study about pollution and its control in textile processing industries. Waste water treatment systems – Anaerobic & Aerobic systems, Bio-degradation – Micro organism in pollution control; Bio mass production; waste as renewable sources of energy — Production of bio gas production of hydrocarbon – Hydrogen fuel.

Enzymes used in textile industry : Enzymes for desizing, scouring & bleaching Enzyme activity – initiation, propagation and termination reactions – reaction conditions – properties of substrates and results of enzyme treatment. Enzyme activity of amyloglucosidase, pectinase, glucose oxiclase, peroxidases and other enzymes used for bleaching decolourisation of textiles using laccases. Bio-Polishing enzymes such as cellulases. Biowashing enzymes using cellulase proteases for scouring of animal fibres, degumming of silk and modification of wool properties.

Evaluation of enzyme treated fabrics : Weight loss, Whiteness index, Absorbency, Tensile strength, Handle of fabric and Abrasion resistance. SEM analysis and other structure related studies.

Bio – processing in textiles : Bio-bleaching, combined bio - processing, bio washing, bio polishing, Denim fading, anti odour and anti microbial finishes, bio finishing and other applications.

References:

1. Betrabet S.M. BTRA Seminar, Book of papers (Jan 1994)
2. Tyndall R.M and Raligh N.C. AATCC Book of papers (1991)
3. Asfert L.O and Videback.T Intl Textile Bulletin – Dyeing / Printing / Finishing

Soft computing theory & practice

Code : TTM 302 B

Contacts : 4-0-0

Credits : 4

Introduction to soft computing and its constituents, Introduction to fuzzy sets and its importance in real life. Definition, basic operators, Tnorm, S-norm, other aggregation operators. Fuzzy relation, implications, cylindrical extension, projection and composition, Approximate reasoning, compositional rule of inference, rule based system, term set, fuzzification, reasoning, defuzzification, different fuzzy models (MA/TS)- some applications of fuzzy rule based system.

Introduction to artificial neural networks, basic models like Hopfield networks, multilayer perceptron and learning vector quantization networks, self-organizing feature maps-their properties and applications.

Genetic Algorithms (GA) - features and applications. Studies of Hybrid (neuro-fuzzy, fuzzy-neural and fuzzy -GA) systems and applications

References :

1. Goldberg - Genetic algorithm, Pearson 2003
2. Freeman - Neural Networks, Pearson 2003
3. Jang - Neuro-fuzzy and soft Computing, Pearson 2003
4. Timothy Ross – Fuzzy Logic, John Wiley & Sons

Advanced knitting technology

Code :TTM 302C

Contacts :4-0-0

Credits : 4

Knitting structures

Classification – comparison with woven structures – plain single jersey – end uses – double jersey – Ride Interlock – end uses, Purl knitting – end uses – flat knitting - Tricot warp knitting – end uses – Raschel warp knitting and simplex warp knitting – end uses – special knit structures.

Knitting machines

Classification – Weft knitting and warp knitting – comparison – circular – flat – straight bar – tricot – Raschel – simplex, Knitting elements – needles – sinkers – cylinder – dials – cams – compound needle, jack raising cam – stitch cam – counter cam – Guard cam timing diagrams – elements of cam design.

Properties of knitted structures

Fabric geometry general terms – stitch density – representation of weft knitted structures – representation of warp knitted structures – comparison of single knit and double knit structures – stitches and their properties – properties of Rib and interlock structures and comparison of other structures – Spirality and other defects of knitted structures – tightness factor.

Knitting cycle

Single jersey m/c; Double jersey m/c- plain and Jacquard m/c, Purl m/c, single and double bed flat knitting machine, single and double straight bar m/c, tricot, raschel & simplex m/c – passage of materials and knitting action and mechanism of operation.

Patterning devices

Principles of selection – effect of positive yarn feeding mechanism – autostop motions – fabric take up mechanism, patterning in weft and warp knitting – pattern needles and chain links – tension control – relation between loop length and construction – fabric relaxation and shrinkage.

Knitting dynamics & special knits

Mathematical analysis of yarn tension and forces involved – effect of cam shape – increase in number of feeder – increase in linear speed – needle breakages and their control. Elastometric yarn knitting and pile knitting.

References:

1. Ajaonkar.D.B., "Knitting Technology" ., Universal publishing corporation (1998)
2. Spencer, D.J., "Knitting Technology", Text. Inst., 2001
3. Raz., S., Flat Knitting, The Generation,, Meisenbach GMBH Hainstrasse 18, D-8600, Bamberg/Germany (1991)
4. Bamberg/Germany (1991)
5. Raz., S., Flat Knitting, Universal Maschinenfabrick, Flachstrick-maschinen, D-73641, Westhausen, Germany, (1993).
7. Iyer.C Bernd.M, Wolfgang,S, Circular Knitting", Meisenbach GMBH Hainstrasse 18, D-8600, Bamberg/Germany, 1995.

List of Elective Subjects

Sl. No	Subject Code	Name of the Subject
Elective I		
01	TTM 105 A	Smart Textile
02	TTM 105 B	Advanced Garment Manufacturing Technology
03	TTM 105 C	Advanced Computer application in Textile
Elective II		
04	TTM 204 A	High Performance Fibres and Industrial textiles
05	TTM 204 B	Technical Textile
06	TTM 204 C	Nano Technology in Textiles
Elective III		
07	TTM 205 A	Non Woven and Speciality Textiles
08	TTM 205 B	Clothing Science and Advances In Chemical Processing
09	TTM 205 C	Geo-synthetics
10	TTM 205 D	Energy Management in Textile Industry
Elective IV		
11	TTM 302 A	Bio Technology Application in Textiles
12	TTM 302 B	Soft computing Theory and Practice
13	TTM 302 C	Advanced Knitting Technology