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Group-1		
Sl. No.	Course	Course Title
1	16JTT11	Advanced Fibre Physics
2	16JTT23	Advanced Silk Technology
3	16JTT253	Advanced Manufactured Fibre

Group-2		
Sl. No.	**Course Code**	**Course Title**
1	16JTT152	Yarn Engineering
2	16JTT251	Fabric Engineering
3	16JTT24	Developments in Fabric Formation

Group-3		
Sl.	**Course**	**Course Title**
1	16JTT13	Advanced Wet Processing
2	16JTT22	Environmental Management for Textile
3	16JTT21	Advanced Textile and Apparel Testing
4	16JTT41	Advanced Apparel Production Technology

Group-4		
Sl. No.	**Course Code**	**Course Title**
1	16JTT151	Advanced Textile Mathematics
2	16JTT423	Marketing Management
3	16JTT424	Financial Management
4	16JTT252	Human Resource Management

Group-5		
Sl. No.	**Course Code**	**Course Title**
1	16JTT421	Friction in Textiles
2	16JTT154	Application of IT in Textiles
3	16JTT254	Variability and its Control

Group-6		
Sl. No.	**Course Code**	**Course Title**
1	16JTT153	Strategic management and Technology
2	16JTT422	Theory of Yarn Spinning
3	16JTT12	Advanced Knitting and Non-wovens

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01	16JTT11	Group-1	ADVANCED FIBER PHYSICS
Exam Hours:03		**Exam Marks:100**	

Module1.
Introduction to macromolecular physics: Modern concepts of fiber structure. Physical methods of structural characterization of fibers, viz., DGC, TEM, SEM, WAXS, SAXS, IRS, NMR, DSC and DTA.

Module2.
Deformation of elastic solid: Generalized Hook's Law, Component of Stress and strain. Linear visco-elastic behavior of fibers.

Module3.
Models: Boltzmann superposition principle. Study of dynamic mechanical properties and their investigation in study of fibers. Introduction tomechanical properties of fiber composites. Temperature dependence of visco-elastic behavior. Time-Temperature Equivalence and Superposition. WLF equation. Study of fiber stiffness and torsion.

Module4.
Moisture Properties: Study of molecular theory of moisture hysteresis, 2 and 3 phase moisture adsorption theories. Heat of sorption in textile fibers. Effect of moisture on mechanical properties of fibers.

Module5.
Fibre Properties: Study of optical properties, thermal, frictional, electrical, Di-electric and static properties of fibers.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

Polymer characterization - Hunt and James - Chapman and Hall, London, 1993

1. Mechanical properties of polymers - I M Ward
2. Mechanical properties of polymers - Nielson - Vol I, II, III.
3. Physical properties of fibers" - W.R. Morton and J.W.S Hearle
4. Characterization of polymers" - Campbell and White
5. Introduction to polymer visco-elasticity" - Aklonis

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As per 2017 Regulation

02	16JTT23	Group-1	ADVANCED SILK TECHNOLOGY
Exam Hours:03		**Exam Marks:100**	

Module1.

Structure and Properties: Silk Composition of silk, amino acid composition, moisture regain, micro structure of silk, chained structure of silk,crystalline structure of silk, optical proportion of silk. Mechanical and thermal properties of silk: Tensile properties, stress-strain characteristics of silk. Visco-elastic behavior of silk, creep and stress relaxation inverse stress relaxation. Dynamic mechanical behavior and thermal behavior.

Module2.

Indian Silk Industry and Process: Production of silk, quality of silk, problems and prospects. Present Scenario of Indian Silk IndustryProduction of silk produced by the other countries across the world and quality of silk produced by their Modern approach to silk cocoon production and cocoon characteristics evaluation. Recent developments in cocoon, stifling, sorting, grading, cooking and reeling. Technological developments in reeling machines and methods to increase the production of raw silk.

Module3.

Production of Spun Silk: Conversion and modern approach, prospects and application, Production of Indian cottage silk and its suitability forproducing traditional silk fabric with intricate designs. Production of soft silk, crepe, georgette, chiffon etc. Production of damasks and brocades and silk furnishing cloth.

Module4.

Dyeing and Finishing: Types of dye used, factors affecting dyeing behavior of silk, preparation of silk for dyeing. Recent developments in degumming,bleaching, dyeing. Dyeing of silk with reactive, direct and natural dyes. Finishing of silk fabrics: Types and methods, modern technologies involved to impart wrinkle resistant finish, stain repellant, antimicrobial finish and other specialty finishes applicable to silk and its blends. Developments in machineries, chemicals and auxiliaries used for silk dyeing and finishing.

Module5.

Developments: Processing of silk fibroin, filaments, hydrogels production of 3D sponges, membranes of silk, non wovens, fluorescent silks.Biomedical applications of silk such as in sutures, would heeling, tissue engineering, drug delivery systems. Silk fibre reinforced composites. Spider silk and their applications: Types of spider silk, chemical compositions, general properties, tensile properties and application of spider silk.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. **Silk – Processing, Properties and Applications -** K. Murugesh Babu, Woodhead Publishing Limited, UK, 2013.
2. **FAO** Manual on silk".
3. **Silk man companion" –** Central Silk Board, Bangalore
4. **Silk wet processing" -** Dr. M. L. Gulrajani, IIT Publication
5. **Silk Dyeing" -** Dr. V. A. Shenai, Sewak Publications.
6. **Silk Dyeing" -** Dr. V. A. Shenai, Sewak Publications- G H Hurst, Summer Press Publications
7. **The Technology of Clothing Manufacture" -** Harold Carr and Barbara Latham, Wiley, 1994
8. **Watsons Advanced Textile Design-** Z Grosicki
9. **Grammar of Textile Design" –** H Nisbet

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As per 2017 Regulation

03	16JTT253	Group-1	ADVANCED MANUFACTURED FIBRETECHNOLOGY

Exam Hours:03	Exam Marks:100

Module1.

Structural principles of fibre forming polymers. Rheology and hydrodynamics in MMF spinning. Development of fibre structure during man-made fibre spinning. Study of various variables in melt spinning and effect of various parameters on linear density of fibres.

Module2.

High speed melt spinning: One step (SP) and two step spinning (TSP) process. Study of fluid flow in spin line. Modifications to be done in spinning, mechanism for high speed melt spinning. Recent developments in dry and wet technology. Study of various types of spinnerettes, orifices used for MMF spinning. Mechanism of crystallization during MMF spinning.

Module3.

Melt spinning of Hollow, Multicomponent, Ultra-fine and Nano fibres. Spin finish application: Composition of spin finish, various methods of spin finish application, spin finish for staple fibre production.

Module4.

Detailed study of mechanism of heat setting of synthetic fibres. Study of property changes in synthetic fibres during heat setting. Study of various physical and chemical methods of modifications of PET, NYLON & Acrylic fibers.

Module5.

New fibres: Introduction to various high performance fibres, Kevlar-LCP behaviour, dry jet spinning of Kevlar fibres, Carbon fibres, raw materials, chemistry of production, surface treatments. Recent trends in production of high performance fibres like Boron, Silicon, Glass, PBT, PBZO, PBZT and aromatic polyesters. High tech fibres, biomimetric chemistry and fibres, biotechnology and fibres, electronics and fibres, fibres in sports, fibres in ocean.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. **"High Speed Fibre Spinning"** - Andrzej Ziabicki, Hiromichi Kawai, Krieger Publishing Company, 1991
2. **"Fundaments of fibre formation"** - Andrzej Ziabicki, Wiley, 1976
3. " **Manmade fibres: Science and Technology",** Vol. I, II and III – HF Mark, SM Atlas and E Cernia , Interscience Publishers, NY
4. " **Manufactured Fibre Technology"** – Ed.by V. B. Gupta and V K Kothari, Chapman and H all, London, 1997.
5. " **New Fibres"** - T. Hongu and G O Phillips, Ellis Horwood, New York 1990.
6. " **Carbon Fibres" Third Edition** - Donnet J. B, and others, Marcel Dekker, New York 1990.
7. **"Spinning of Man Made fibres and blends on cotton s ystems"** - K R Salhotra, The Textile Association, India 2004.

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PhD Coursework Courses – 2018 (Textile and Silk Technology)

As per 2017 Regulation

01	16JTT152	Group-2	YARN ENGINEERING
Exam Hours:03		**Exam Marks:100**	

Module1.

Importance of Yarns: Designing yarns for specific end-uses. Selection of fiber /filament, structure of fiber/filament, spun yarns, multifilamentyarns, textured yarns and micro denier multi filament. Yarn diameter derivation of Pierce, Grosberg and Dickson formulae. Functional properties of end products.

Module2.

Yarn Structure and yarn Regularity: Geometrical properties of single and folded yarns. Derivations of related equations. Open & hexagonalpacking and their merits and demerits. Twist contraction and retraction - practical applications. Twist migration and segment length in spun and filament yarns -Theoretical analysis of yarn irregularity - blend irregularity.

Module3.

Transfer of Force: Transmission of force from fiber to fiber in spun yarns - mechanism of yarn breakage.

Module4.

Relationship: Effect of fiber properties and their geometrical configuration on tensile properties of yarns. Concept of elongation.

Module5.

Blends: Effect of properties of constituent fibers and their composition on the behavior of blended Yarns.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. **Textile yarns" -** B.C. Goswamy, J.G. Martindale, Wiley Interscience
2. **Structural mechanics of fibres, yarns and fabrics"** - J.W.S. Hearle, P Grosberg, S. Backer, Wiley Interscience.
3. **Spun yarn technology" –** Oxtoby, Butter Worth.
4. **Technology of short staple spinning" –** Vol I, II, III, W. Klein, Textile Institute.

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PhD Coursework Courses – 2018 (Textile and Silk Technology)

As per 2017 Regulation

02	16JTT251	Group-2	FABRIC ENGINEERING
Exam Hours:03		**Exam Marks:100**	

Module1.

Engineering concepts: Textile properties and textile structure – engineering concepts and approach to textile Structure – classification ofmultidirectional textile structure – laminar and orthogonal. Classification and standardization of fabrics.

Module2.

Geometry of fabric structure: Pierce's basis and modified models – Painter –Adom's and Love's technique descriptive and mechanistic models. Kemp and Hamalton: Twin arc, Olofson – Snow dens and other models.

Module3.

Tensile deformations: Tensile deformation – heaps solution – pierces solution – geometrical solutions during extension of cloth – load extensional modules – tear – various Models.

Module4.

Other deformations: Bending and tensional deformations – buckling, she ar and drape of fabrics – theory various Models – behavior**.**

Module5.

Knit structures: Geometry of knitted fabrics – weft and warp knits – various models – applications. Mechanics of knitted fabrics – theory –behaviour**.**

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. **"Structural mechanics of fibres, yarns and fabrics"** Vol.I - J. W. S. Hearle, P. Grosberg, Stanley Backer, Wiley Intersci. New York.
2. **"Textile fibres, yarns and fabrics- a comparative survey of their behaviour with special reference to wool"** – E R Kaswell, Pub.Reinhold, 1953
3. **"Textile Mathematics" -** Vol I, II, III – J. E. Booth, Textile Institute
4. **"Woven Cloth Construction" -** A.T.C. Robinson & R. Marks, Textile Institute

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PhD Coursework Courses – 2018 (Textile and Silk Technology)

As per 2017 Regulation

03	16JTT24	Group-2	DEVELOPMENTS IN FABRIC FORMATION

Exam Hours:03 | **Exam Marks:100**

Module1.

Pre requisites: Pre requisites for successful installation of shuttle less looms, yarn quality norms for unconventional weaving, preparatoryprocess to unconventional weaving.

Module2.

Weft insertion methods: Weft insertion by projectile, rapier, air jet, water jet, weft insertion stages of different weaving machines. Weft insertion by other methods by multi-phase weaving. Study of unconventional selvedges, accumulators, shed geometry, weft consumption, weft unwinding tension.

Module3.

Controls: Productivity- its measurement and control. Material handling equipment and importance.

Module4.

Management: Management of loom shed, maintenance.

Module5.

Developments: Modern development in weaving machines projectile, rapier, air jet, water jet, QSC wider width machine. Techno economics of unconventional weaving machines.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. **"Principles of Weaving" –** R Marks and A T C Robinson &, Textiles Institute, Manchester, 1976
2. **"Modern Preparation and Weaving Machinery" –** A Ormerod - Butterworth, (Publishers) Limited, 1983
3. **"Shuttle-less Weaving Machines" -** Oldrich Talavasek & Vladimir Svaty - Elsevier Science, Oxford, 1981.
4. **"Handbook of W eaving"** – Sabit Adanur

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01	16JTT13	Group-3	ADVANCED WET PROCESSING
Exam Hours:03		**Exam Marks:100**	

Module1.
Dye-Fiber Interaction: Kinetics of Dyeing. The diffusion of dye inside the fiber. Fick's laws of diffusion. Theoretical basis for dye absorption.Theories of dyeing of protein and other fibers using suitable dyes.

Module2.
Regulations: Red listed textile chemicals, their sources and remedies. Pollution aspects of textile dyeing. Modern approaches to Eco-friendlywet processing of woven and knitted textiles. Eco-friendly dyes and their method of dyeing. Methods of analysis of formaldehyde, Pentachloro Phenol (PCP), chlorine compounds and heavy metals in processed and finished fabrics. Eco-labeling and various Eco-standards.

Module3.
Garment Dyeing: Modern developments in garment dyeing. Methods and machines. Low temperature dyeing of garments. Finishing ofgarments using different chemicals and auxiliaries.

Module4.
Finishing: Modern developments in finishing of natural and synthetic textiles. Finishing of textiles with various specialty chemicals.

Module5.
Developments: Modern developments in textile and garment printing, color measurement and computer colour matching concepts. Latest developments in natural dyes and their application on various fibers.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. **"Textile Colouration" -** C.L.BIRD.
2. **"Textile Printing" –** LWC Miles.
3. **"Chemical Technology of Textile fibers"** – ER Troatman.
4. **"Dyeing and printing with natural dyes"** - M.L.Gulrajani.
5. **"Eco-friendly Textile wet processing-coordinator" N CUTE Publication -** Dr. R.Ashokan
6. **"Environment Problems in chemical processing of Tex tiles, NCUTE Publication** - Dr.A.Asokan, Ms. Yogita
7. **"Finishing of Khadi Garments" -** Dr.R.B.Chavan, R.Chattopadhyay, R.P.Tewari, IIT Delhi.
8. **"Instrumental Colour measurement and computer aided colour matching for textiles -** H.S.Shah & R.S.Gandhi.

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PhD Coursework Courses – 2018 (Textile and Silk Technology)

As per 2017 Regulation

02	16JTT22	Group-3	ENVIRONMENTAL MANAGEMENT FOR TEXTILE INDUSTRY

Exam Hours:03	Exam Marks:100

Module1.

Water: Source of water and their characteristics- surface water, ground water, rain water etc. Constituents of water and their effects on textilewet processing. Colour, turbidity, suspended solids, dissolved solids, PH value, acidity, alkalinity, hardness, iron and manganese, copper, chlorine organic growth.

Module2.

Quality requirements: Quality requirements of water for silk reeling and textile processing. Conservation and reuse of water. Processingchemistry - fibres, chemicals, type of chemical processing.

Module3.

Textiles effluent: Introduction to textiles effluent, characteristics of textiles processing, dye manufacture and synthetic fibres formationindustries, reduction and pollution control at mill state. Methods and techniques used for effluent treatments.

Module4.

Standard regulations for effluents: Effluent testing parameters- colour and physical appearance, odour, temperature, PH value total suspendedsolids, total dissolved solids, BOD, COD.

Module5.

Environmental management: Objectives, environmental impact assessment (EIA), elements of EIA process. Important environmental laws.Environmental pollution control norms. Bio-technology and its application in environmental industries. Plasma treatments.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. **"Textile Effluents" -** Padma Vankar, NCUTE Publications, IIT, Delhi.
2. **"Eco friendly processing" -** NCUTE Publications.
3. **"Environmental problems in chemical processing of textiles" -** NCUTE Publications.
4. **"Waste water-An introduction to environmental pollution",** Dr. B.K. Sharma, Krishna Prakashan, Media (P) Ltd., Meerut.
5. **"Water pollution" -** V.P. Kudesia, Pragathi Prakashan, Meerut.

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As per 2017 Regulation

03	16JTT21	Group-3	ADVANCED TEXTILE AND APPAREL TESTING

Exam Hours:03	Exam Marks:100

Module1.

Advance Fibre and Yarn Testing Instruments: Study of High Volume Instrument (HVI). Advanced Fiber Information System (AFIS).Comparison of AFIS with HVI System, Yarn Hairiness and its measurement. Uster spectrograph and its analysis. Properties desired in export yarns.

Module2.

Advance Fabric Testing Instruments: Objective evaluation of fabric handle by KAWABATA Evaluation system, Fabric Assurance by SimpleTesting and fabric extractions force technique. The influence of chemical and mechanical finishes on fabric handle.

Module3.

Inspection: Introduction, raw material inspection, In-process Inspection - spreading, cutting, sewing, pressing and final inspection.

Module4.

Apparel Testing: Soil/Stain release testing, snagging, bonded and laminated apparel fabric, testing of fusible interlinings, buttons, zippers andsewing threads. Care labeling of apparel and textiles: American, International, British, Canadian and Japanese systems.

Module5.

Quality Control Program: Planning for the quality control program, inspection and analysis of data. Tools of quality control. ISO 9000 seriesstandards. Total Quality Management concepts.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. **"Principles of Textiles Testing" -** J.E. Booth.
2. **"Hand book of textile testing and quality control" -** B. Glover, D.S. Hamby, Wiley Eastern. Ltd.,
3. **"The measurement of Appearance" -** Richard S. Hunter and Richard W. Harold, Wiley Interscience.
4. **"An introduction to quality control for the apparel industry" -** Pradip. V. Mehta.
5. **International Apparel Quality Manuals" -** KES- F and FAST manuals.
6. **Progress in Textile Science and Technology" -** Vol-1, Ed. V.K. Kothari, IAFL, India, 2000.

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As per 2017 Regulation

04	16JTT41	Group-3	ADVANCED APPAREL PRODUCTION TECHNOLOGY

Exam Hours:03	Exam Marks:100

Module1.

The nature and scope of apparel manufacturing: Types of apparel manufacture-fundaments of apparel production. Basic types of apparelproduction process - major function of apparel manufacturing – engineering functions, management functions- apparel trade association**.** Computerized pattern making in garment production. Principle of pattern making, garment balance, Size charts, pattern grading, computerized made to measure system, Technological advances in pattern making, Gerber technology, Lectra systems, material utilizations, application/developments in computer aided apparel systems, Future trends. Computerized cutting, marker quality and geometric principle for calculating optimum marking design, principles of stitch, seam and their analysis, seam quality, computerized sewing, pressing and moulding.

Module2.

Advances in apparel product development; Industrial change process model for clothing product development, models of new productdevelopment, product development tools and application area product life time management (PLM) Demand Led new product development future trends.

Module3.

Technological advances in sewing garment: History of sewing development of the industrial saving, machine advances in sewing needledesign, advances in sewing thread technology, Advances in sewing machine automation, semi automatic sewing equipment, machine using computer numerical control. Future trends in cloth technology.

Module4.

Development in pressing technology for garment finishing: The pressing process, pressing with pressure pressing without pressure, creaseresistant finishes and permanent creasing future trends. Packaging and ware housing: Type of packing and packing materials, quality specification, merchandise packing and shipping packing. Intra transport, ware housing, computerized storage systems.

Module5.

Indian apparel industry: Overview of technology in apparel manufacturing technology, usage, regional features and structures of the industry,Indian apparel export and important product category, domestic market and domestic brands, technology status and outlook**.** Apparel productivity- Apparel productivity in India and Western world, global comparison characteristics of low, medium and high productivity manufacturers and factors associated with productivity actions towards higher productivity**.**

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. **Apparel Manufacturing Hand book: Analysis, Princip les and Practice"** – Jacob Solinger, Van Nostrand Reinhold Company 1981
2. **Managing Productivity in the Apparel Industry" -** Rajesh Bheda, CBP Publisher and Distributors.
3. **The Technology of Clothing Manufacture**", Harold Carrand Barbara Latham, John Wiley & Sons
4. **Seams Productions and Analysis -** Radh D Clock
5. **Advances in Apparel Production -** Ed. by Catherine Fairhurst, Textile Institute, Woodhead Publications Limited, Cambridge.

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As per 2017 Regulation

01	16JTT151	Group-4	ADVANCED TEXTILE MATHEMATI CS

Exam Hours:03	Exam Marks:100

Module1.

Confidence limits- Estimation of confidence intervals, confidence limits for large and small samples, confidence limits for standard deviation and difference in mean and SD.

Significance tests-interpretation of significance tests, single tail and double tail tests, chi-square distributions

Module2.

Analysis of variance- the design of experiments, randomised variation in experiments, randomisation, completely randomised design (CRD) and randomised block design (one way & two way ANOVA)

Module3.

Linear regression and time series-relation between variables, variation about regression line, regression equation, correlation coefficient, interpretation of "R", equation for regression partial and multiple correlation. Components of time series, measurement of trend using method of least squares.

Module4.

Spinning calculations- forces acting on ring and traveller, calculations related to various drives viz, belt, rope, chain, gear etc. Details of average count and resultant count of yarn. Calculation related spin plan-preparation of spin plan for known count and known quantity of yarn produced with given spinning machinery details. Calculation s related OE spinning, Air jet spinning, and friction spinning. Calculation of no. of fibres in the yarn, calculation related to evenness of sliver, riving, single & double yarns.

Module5.

Weaving and knitting calculation - estimation of production of different types of preparatory machines, sizing machines and looms. Calculation of fabric weight, cloth cover, stitch density of knitted fabric, air porosity, fabric thickness. Preparation of plan for weaving industry from known machine and material parameters.

Calculations in garment manufacturing - standard time, importance of GSD & its benefits in garment industry. SAM calculations using synthetic data and time study techniques. Garments CM cost estimation using SAM. Calculation of product capacity of a factory, seam efficiency, seam strength, thread consumption factor etc.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

References

1. Textile Testing – J E Booth., CBS Publishers, New Delhi, 1996
2. Handbook of textile testing and quality control-Hamby and Grover, Wiley Eastern Pvt. Ltd., Delhi 1969
3. Practical statistics for textile Industry – Part-1 & 2, Gave Leaf, Textile Institute 1984
4. Textile Mathematics-Vol. 1,2,3" J E Booth. Futterworths Pub London,1980
5. Textile Mechanics-Vol 1&2, K Slater, Textile Institute Pub ,1979
6. Weaving calculation- Sen Gupta, D. B Tarparwala& sons., 1956
7. Mechanics of Textile Machinery-W A Hanton, Langmans, Green and Co., London 1950
8. "An introduction to quality control for the apparel industry", Pradip V. Mehata
9. "Progress in textile science and technology " Vol-1 Ed., V K Kotari, AIFI., India 2000

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As per 2017 Regulation

02	16JTT423	Group-4	MARKETING MANAGEMENT
Exam Hours:03		**Exam Marks:100**	

Module1.

Core concepts of marketing. Need, Want & Demand, Product, Value and satisfaction. Production concept, product concept, selling concept and Marketing concept. A model for consumer buying behaviour, factors influencing consumer behavior, buying decision process- Buying roles & stages in buying. New product development-Idea generation, Idea screening, Concept development and using, Product development. Marketing strategies in the various stages 'Product Life Cycle'. Pricing - Objectives, Influencing factors, methods, strategies for new products and existing products.

Module2.

Channel Decisions Nature and characteristics of Marketing Channel Functions, channel dynamics, Channel Design and Management decisions. Communication process - Steps in the development of effective communication, Designing message, selection communication channels, deciding promotion mix, measuring results. Promotional Mix tools**.** Advertising, Sales promotion, personal selling, public relations, and direct marketing. Marketing organization & implementation: Evolution, ways of organizing the marketing departments, marketing relations with other departments**.**

Module3.

E-Business frameworks - media convergence - Anatomy of E-Biz applications - Internal and External applications and integration - organizational business – ED - Implementation -Managing technology – IT bills of various governments. Introduction to web applications - technologies for Web services –Internet tools relevant for E-Business Internet applications for E-business. Types of electronic payments -Digital token based payments - Smart cards credit cards based - other emerging payments technologies - E-governance and implications - Technical specification of digital currencies**.**

Module4.

Brand, Brand identity, Brand Image, Brand Personality, Brand Loyalty and the connected issues. Brand Positioning, Repositioning, Brand Equity: Conceptualization and measurement Trends in Brand Management: Brand cult, Brand alliances, Co-branding, Destination, Branding. Introduction to industrial marketing, Difference between consumer marketing and industrial marketing, classification of industrial products, Nature of demand, Industrial marketing system. Industrial buying behaviour.

Module5.

The concept and the need for international marketing - the nature, scope and variety of international markets. International market Vs Local Markets, differences & Similarities. Trade groups, international regulations, trade bodies & Organization like IMF, World Bank & Conference e.g. GATT, UNCTAD, their impact on world trade Euro-dollar & Petro Dollar Market. Exchange rate fluctuations on Imports and Exports.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. "**Retail Management-A Strategic Approach**" - Barry Bermans and Joel Evans, 8th edition, PHI private limited, New Delhi, 2002.
2. "**The Art of Retailing**" - A.J. Lamba, 1st edition, Tata McGraw Hill, New Delhi, 2003.
3. **Marketing Management"** - Kotler Philip, 1st Ed., Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2004
4. " **Marketing Management**" - S. Jayachandra, 1st edition, Excel Publications , New Delhi, 2004
5. "The **Economics of Electronic Commerce"** - Soon-Young choi, Whiston, A.B., Macmillan Publishing Company, USA.
6. "Electronic **commerce-A manager's guide"** - Kalakota R & Whinston, A. B., Addition Wesley, USA.
7. **"Advertising and Promotion" -** Belch E. George & Belch A. Michael, 5th edition, Tata Megraw Hill, New Delhi, 2001.
8. "Brand **building advertising: concepts and cases**" - Parameswaran, Tata Mcgraw Hill, New Delhi, 2002 .
9. " **Strategic Brand Management**" - Jean Noel Kapferer, Global business press, Abhinav Publishing industry, 1st ed., New Delhi, 1994.
10. "Industrial **Marketing, AITBS"** - Hill, M Richard, Alexander S. Ralph, Cross James S, 4Ed. New Delhi 1991.
11. "Direct **Marketing: An Integrated Approach"** - William J. McDonald, McGraw Hill, Singapore, 1st edition, 1998.

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PhD Coursework Courses – 2018 (Textile and Silk Technology)
As per 2017 Regulation

03	16JTT424	Group-4	FINANCIAL MANAGEMENT
Exam Hours:03		**Exam Marks:100**	

Module1.
Financial Management: An overview, function and goals of financial management, financial planning and major financial decision areas**.**

Module2.
Capital structure: Theories of capital structure, NI and NOI approaches, capital structure decision, EBIT – EPS analysis. RO – ROE analysis,cash flow analysis**.**

Module3.
Capital Budgeting: Methods of capital budgeting, investment criteria, NPV, IRR, Pay Back Period, Risk analysis in capital budgeting.

Module4.
Working Capital Management: Current assets, Cash and Inventory management, EQQ, ABC analysis.

Module5.
Financial Analysis and Planning: Financial ratios, Break – even analysis and Leverages, application of financial analysis.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. **"Financial Management – Theory and Practice, 8 th Edition"** – Prasanna Chandra, Tata McGraw Hill, New Delhi
2. **"Fundamentals of Financial Management" –** James C. Van Horne, John Martin Wachowicz, Financial Times/Prentice Hall, 2008
3. **"Financial Management"** – Keown Scott
4. **"Financial Management"** – M.Y.Khan and Jain.

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PhD Coursework Courses – 2018 (Textile and Silk Technology)

As per 2017 Regulation

04	16JTT252	Group-4	HUMAN RESOURCE MANAGEMENT

Exam Hours:03	Exam Marks:100

Module1.

Introduction to human resource management with reference to objectives and policies. Functions of HRM, Scope, importance and impact on Textile Industry.

Module2.

Importance of job analysis and job specifications. Different types of job evaluation programmes. Basis of promotion, demotion, transfers, Methods of training personnel for higher performance and productivity. Grievance Handling – procedure for grievance handling.

Module3.

Modern methods of recruitment and selection. Industrial disputes, procedure for settlement of disputes.

Module4.

Welfare measures, bonus facilities, Wage and salary administration and incentive schemes.

Module5.

Motivation and Morale. Labour Management relations. Objectives and functions of trade unions. Factories act and their importance.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. **"Human Resource Management –** P Subba Rao, Himalaya Publishing, New Delhi
2. **"Human Resource Management" –** Gary Dessler and Biju Varkkey, Prentice Hall
3. " **Personnel Management"** - Edwin B. Flippo, McGraw-Hill, 1986
4. " **Personnel Management"** - Subratha Ghosh
5. " **Management of Personnel in Indian Enterprises"** - N.N. Chatterjee, Allied Book Agency, 1978
6. " **Personnel Management**" - Derek Torrington, Laura Hall, Prentice-Hall, 19 87

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PhD Coursework Courses – 2018 (Textile and Silk Technology)

As per 2017 Regulation

01	16JTT421	Group-5	FRICTION IN TEXTILES
Exam Hours:03		**Exam Marks:100**	

Module1.

General mechanism of friction Laws of friction, theories of friction, friction in various textile processes like spinning, weaving and chemical processing etc. Detailed study of various methods of measurement of fibre friction in textiles. Role of friction in the mechanical behaviour of fabrics.

Module2.

Study of surface geometry of synthetic fibres. Spin finish application to synthetic fibres, Theory of spin finish application, various methods of spin finish application, spin finish composition for synthetic filaments, staple fibres and textured yarns.

Module3.

Abrasion of textile surfaces measurement of abrasion resistance, factors affecting the abrasion resistance.

Module4.

Resistivity and static behaviour of textile surfaces, effect of photochemical and environmental degradation on the surface properties of textile fibres. Soil release from the textile surface, stain and water repellency of textile surfaces.

Module5.

Generation of static charges in textile process and their remedies. Role of fiber friction in garment making, Effect of friction on comfort property of textiles.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCES:

1. **"Surface Characteristics of Fibres and Textiles" -** Ed.by M.J.Schick, New York: M. Dekker, c1975-1977
2. **"Friction in Textiles" –** H G Howell, Literary Licensing, LLC, 2013

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PhD Coursework Courses – 2018 (Textile and Silk Technology)

As per 2017 Regulation

02	16JTT154	Group-5	APPLICATION OF IT IN TEXTILES
Exam Hours:03		**Exam Marks:100**	

Module1.

Introduction to IT in Textiles: information technology and the web paradigm, E-business application for textile industry**.**

Module2.

Enterprise resource planning: Structure of ERP, General Principles involved in the application of ERP, ERP models, ERP selections for thetextile industry**.**

Module3.

Internet and internet concepts: Internet based manufacturing EDI for textile businesses, logistics management, management information systems in spinning, weaving and wet processing sections.

Module4.

Applications: CAD \ CAM in Textiles**.** Information technology in fashion and garment industry.

Module5.

Management: Total quality management and information technology**.**

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. **"Texinfotech - 99, Resume of papers"** - IT in Textiles in the New Millennium, July 1999, IIT, Delhi.
2. **"Texinfotech - 2000, International Conference", Resume of papers, New Delhi, 2000**
3. **"E-Commerce" -** Kamlesh K. Bajaj & Debjani Nag -TATA, McGraw HILL Co. Ltd, New Delhi.
4. **"Electronic Commerce" -** Gary P. Schneider

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PhD Coursework Courses – 2018 (Textile and Silk Technology)

As per 2017 Regulation

03	16JTT254	Group-5	VARIABILITY AND ITS CONTROL

Exam Hours:03	Exam Marks:100

Module1.
Lap formation and control of lap uniformity. Irregularities of carded, drawn and combed Silver and their control. Irregularities in roving, yarns and their control.

Module2.
Influence of different materials and their blends on irregularity. Index of blend irregularity and its influence on the quality of end product.

Module3.
Influence of ambient conditions on the irregularity of material at various stages of processing restricted to spinning of cotton and its blends**.**

Module4.
Influence of ambient conditions on the irregularity of material at various stages of processing restricted to spinning of cotton and its blends**.**

Module5.
Instruments used for measurement of irregularity – analysis and interpretation of data and graphs remedial measures.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. **"Textile yarns",** B.C. Goswamy, J.C. Martindale-Willey Interscience.
2. **"Manual of cotton spinning",** Vol IV. Part -1-Foster Textile Inst.
3. **"An Introduction to the Study of Spinning"-** W E Morton, Lightning Source Incorporated, 2008.
4. **Roller Drafting"** - Nogeera

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PhD Coursework Courses – 2018 (Textile and Silk Technology)

As per 2017 Regulation

01	16JTT153	Group-6	STRATEGIC MANAGEMENT AND TECHNOLOGY
Exam Hours:03		**Exam Marks:100**	

Module 1.

Management information system: Introduction and background frame work-information needed economics System view - role of MIS on various levels - structure of MIS – Information network - system life cycle - data flow - decision trees.

Module 2.

Corporate strategy and planning: Concept of frame work, corporate management, role, Function skill.

Module 3.

Strategic analysis: cost dynamics - portfolio analysis – financial analysis, Strategic choices. Alternating - iversification-mergers and acquisition implementation and evaluation of strategy.

Module 4.

Strategic management and leadership: Role of leadership - process of leadership – line structure, styles.

Module 5.

Technology management: Technology life cycle – transformation – alternatives – appropriate technology - technology change – technology transfer – models. Technology Absorption Assessment – evaluation, diffusion.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Management Information Systems: conceptual foundation, structure and development" - David G.B, McGraw hill New York
2. Effective Leadership", "The Skills of Leadership- Effective Leadership", "The Skills of Leadership
3. Strategic Management – An Integrated Approach - Charles WL Hill and Gareth R Jones.

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PhD Coursework Courses – 2018 (Textile and Silk Technology)

As per 2017 Regulation

02	16JTT422	Group-6	THEORY OF YARN SPINNING
Exam Hours:03		**Exam Marks:100**	

Module 1.

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

Module 2.

FIBRE PROCESSING: Methods adopted to clean the fibre from trash, short fibres and neps; role of blow-room, card and comber in fibre cleaning. Definition of fibre-extent; influence of fibre-extent on yarn quality; improvement of fibre-extent by straightening actions in carding, drafting and combing**.**

Module 3.

ATTENUATION: Principle of rollers drafting and its application in yarn production; drafting irregularities-their causes and remedies; the function of aprons in roller drafting; limitation of apron-drafting and the scope for improvement; mechanism of wire-point drafting and its application in yarn production; merits and demerits of wire-point drafting. Comparison of wire-point drafting with roller drafting.

Module 4.

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

Module 5.

LEVELLING and FIBRE BLENDING: Influence of intermediate product uniformity on yarn uniformity; methods of leveling adopted during spinning processes. Important of fibre-mix homogeneity on yarn quality; types of mixing during spinning preparatory process; assessment of blend efficiency.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. " **Spun Yarn Technology" -** Oxtoby E, Butterworth's, London, 1987.
2. **"The Technology of Short-staple Spinning" -** Klein W, The Textile Institute, Manchester, 1998.
3. **"A practical Guide to Opening and Carding" -** Klein W, The Textile Institute, Manchester, 1999.
4. **"A Practical Guide to Combing, Drawing and the Roving Frame" -** Klein W, The Textile Institute, Manchester, 1999.
5. **A practical Guide to Ring Spinning" -** Klein W, The Textile Institute, Manchester, 1999.

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PhD Coursework Courses – 2018 (Textile and Silk Technology)

As per 2017 Regulation

03	16JTT12	Group-6	ADVANCED KNITTING AND NONWOVENS
Exam Hours:03		**Exam Marks:100**	

Module 1.

KNITTING:

Warp knit fabrics; warp knit v/s woven construction, Single needle bar structure and working mechanism, pattern mechanism. Five basic over lap/under lap variations, closed lap and open lap, direction of lapping at successive courses. Classes of warp knitting machinery, knitting cycle, Tricot, Raschel machines. Knitting elements in Raschel machine, knitting cycle in Raschel Knitting action of the single needle bar Raschel and compound needle.

Module 2.

Knitting elements of Tricot machines, knitting cycle in Tricot machine. Plain Tricot structures, knitted with two full set guide bars, two bar Tricot, Shark skin, Queenscord, Velour and Velvet structures, Satin, overfed pile structures, reverse lock knit. Differences between Tricot and Raschel machines and fabrics. Laying-in in warp knitting, rules governing, laying-in, fall-plate patterning, full width weft insertion, cut presser and miss press structures. Modified warp knit machines and fabrics:- Fall plate and chopper bar Raschel, co-we-nit, weft insertion in knitting. Pattern controlling mechanism, pattern wheels, electronic jacquards.

Module 3.

Yarns for warp knitting:- Materials for warp knitting, filament and spun yarns, unconventional yarns, important yarn properties for warp knitting, winding and warping for warp knitting. Faults in warp knits. warp knitting calculations.

Module 4.

NONWOVENS:

Classification of non-wovens, preparatory machines for non-wovens fabric Production. Effects of fiber arrangements in the web. Methods and technique used in non-woven production, needle punched, stitch bonded, and adhesive bonded wet laid spun bonded, spun laced laminated and moulded fabrics. Classification of binders and their properties, effect of fiber properties on non-wovens. Modern developments in non-woven productions.

Module 5.

Structure of non-wovens: web geometry, fiber orientation curl factor, web density. Identification, properties and application of different non-wovens. Methods of tests: porosity, tear strength, air permeability, tensile strength, 3-point bending test, fatigue test, CBR Loading, cone puncture test, absorbency test, peeling test, pilling test, study of DIN standards.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. **"Knitting Technology" -** David J Spencer.
2. **"Warp Knitting" -** Ajgaonkar.
3. **"Non-woven fabrics" –** NN Banerjee.
4. **"Non-woven Bonded Fabrics" -** Joachim Lünenschloss, Wilhelm Albrecht
5. **"Non-woven Fabrics" – production and applications" -** M.L. Gulrajani.
6. " **Non-woven Technology"** – BTRA Conference papers.