

**Dr. A. P. J. ABDUL KALAM TECHNICAL UNIVERSITY,
UTTAR PRADESH, LUCKNOW**



Syllabus

For

B. TECH. TEXTILE, Final Year

- 1. Textile Technology**
- 2. Textile Engineering**
- 3. Man Made Fiber Technology**
- 4. Textile Chemistry**

(Effective from the Session: 2016-17)

U.P TECHNICAL UNIVERSITY, LUCKNOW

Study and Evaluation scheme

B. Tech. Man Made Fibre Technology

[Effective from the Session 2016-17]

YEAR 4th , SEMESTER- VII

S. No.	Subject Code	Name of Subject	Periods			Evaluation Scheme			Subject Total	Credits	
			L	T	P	Sessional Assessment		ESE			
						CT	TA				Total
THEORY SUBJECT											
1	NOE-071/ NOE-072 /NOE-073	Entrepreneurship Development/ Quality Management/ Operation Research	3	1	0	30	20	50	100	150	4
2	NTT-701/ NTT-702	Functional Clothing/ Clothing Science	2	0	0	15	10	25	50	75	2
3	NTT-706	Fibre Manufacture & Process Control	3	1	0	30	20	50	100	150	4
4	NTT-704	Knitting Technology	3	1	0	30	20	50	100	150	4
5	NTT-031/ NTT-033	Garment manufacture Technology/ Fibre reinforced Composites	3	1	0	30	20	50	100	150	4
PRACTICAL/ DESIGN/DRAWING											
6	NTT-751	PROJECT	0	0	8	-	50	50	100	150	4
7	NTT-752	Industrial Training	0	0	2	-	75	75		75	2
8	NTT-754	Knitting Technology Lab	0	0	2	10	10	20	30	50	1
	NGP 701	General Proficiency								50	
		Total	14	4	13					1000	25

Open Elective-II from other departments

Open Elective-I from Other Departments

1. NOE 701 Entrepreneurship Development
2. NOE-072 Quality Management
3. NOE-073 Operation Research

Open Elective-1I

1. NTT-701 Functional Clothing
2. NTT-702 Clothing Science

Departmental Elective III

1. NTT-031 Garment manufacture Technology
2. NTT-033 Fibre reinforced Composites

U.P TECHNICAL UNIVERSITY, LUCKNOW

Study and Evaluation scheme

B. Tech. Man Made Fibre Technology

[Effective from the Session 2016-17]

YEAR 4th, SEMESTER- VIII

S. No.	Subject Code	Name of Subject	Periods			Evaluation Scheme				Subject Total	Credits
			L	T	P	Sessional Assessment			ESE		
						CT	TA	Total			
THEORY SUBJECT											
1	NOE 081/ NOE 083	Non Conventional Energy Sources/ Product Development	3	1	0	30	20	50	100	150	4
2	NTT-802	High Performance Fibres	3	1	0	30	20	50	100	150	4
3	NTT-041/ NTT-043	Mill Planning & Organization/ Textile marketing & merchandizing	3	1	0	30	20	50	100	150	4
4	NTT-052/ NTT 053	Technical textiles/ Non Woven	3	1	0	30	20	50	100	150	4
PRACTICAL/ DESIGN/DRAWING											
5	NTT-851	PROJECT	0	0	12		100	100	150	250	7
6	NTT-852	SEMINAR	0	0	3		100	100		100	2
	NGP-801	General proficiency								50	
		Total	12	4	15					1000	25

Open Elective from Other Departments

1. NTT-081: Non Conventional Energy Sources
2. NTT-083 Product Development

Departmental Elective IV

1. NTT-041 Mill Planning & Organization
2. NTT-042 Textile Marketing & Merchandizing

Departmental Elective V

1. NTT-051 Technical textiles
2. NTT-052 Non Woven

1. Open Elective- I from Other Department (L T P 3 1 0) credit =4

1.1 NOE-071: ENTREPRENEURSHIP DEVELOPMENT (L T P 3 1 0)

UNIT –I: Entrepreneurship- definition. growth of small scale industries in developing countries and their positions vis-a-vis large industries; role of small scale industries in the national economy; characteristics and types of small scale industries; demand based and resources based ancillaries and sub-control types. 5 Government policy for small scale industry; stages in starting a small scale industry. 2 (10)

UNIT -II Project identification- assessment of viability, formulation, evaluation, financing, field-study and collection of information, preparation of project report, demand analysis, material balance and output methods, benefit cost analysis, discounted cash flow, internal rate of return and net present value methods. 8

UNIT -III Accountancy- Preparation of balance sheets and assessment of economic viability, decision making, expected costs, planning and production control, quality control, marketing, industrial relations, sales and purchases, advertisement, wages and incentive, inventory control, preparation of financial reports, accounts and stores studies.

UNIT -IV Project Planning and control: The financial functions, cost of capital approach in project planning and control. Economic evaluation, risk analysis, capital expenditures, policies and practices in public enterprises. profit planning and programming, planning cash flow, capital expenditure and operations. control of financial flows, control and communication. 9

UNIT -V Laws concerning entrepreneur viz, partnership laws, business ownership, sales and income taxes and workman compensation act. 5 Role of various national and state agencies which render assistance to small scale industries. 2

Text / Reference Books:

1. Forbat, John, “Entrepreneurship” New Age International.
2. Havinal, Veerbhadrappa, “Management and Entrepreneurship” New Age International
3. Joseph, L. Massod, “Essential of Management”, Prentice Hall of India.

1.2 Quality Management (NOE-072) (L T P 3 1 0) Credits = 4

UNIT-I : Quality Concepts: Evolution of Quality Control, concept change, TQM Modern concept, Quality concept in design, Review of design, Evolution of proto type.

Control on Purchased Product: Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure.

Manufacturing Quality: Methods and techniques for manufacture, inspection and control of product, quality in sales and services, guarantee, analysis of claims.

Total Lectures required =9

UNIT-II: Quality Management: Organization structure and design, quality function, decentralization, designing and fitting, organization for different type products and company, economics of quality value and contribution, quality cost, optimizing quality cost, seduction program.

Human Factor in quality

Attitude of top management, cooperation of groups, operators attitude, responsibility, causes of apparatus error and corrective methods.

Total Lectures required =9

UNIT-III: Control Charts, Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts.

Attributes of Control Chart, Defects, construction and analysis of charts, improvement by control chart, variable sample size, construction and analysis of C charts.

Total Lectures required =9

UNIT -IV : Defects diagnosis and prevention defect study, identification and analysis of defects, correcting measure, factors affecting reliability, MTTF, calculation of reliability, building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle.

Total Lectures required =9

UNIT –V: ISO-9000 and its concept of Quality Management, ISO 9000 series, Taguchi method, JIT in some details.

Total Lectures required =6

Grand total of lectures required = 32

Text / Reference Books:

1. Lt. Gen. H. Lal, "Total Quality Management", Eastern Limited, 1990.
2. Greg Bounds, "Beyond Total Quality Management", McGraw Hill, 1994.
3. Menon, H.G, "TQM in New Product manufacturing", McGraw Hill 1992.

1.3 OPERATION RESEARCH (NOE-073) (L T P 3 1 0) Credits =4

UNIT-I: Introduction:

Definition and scope of operations research (OR), OR model, solving the OR model, art of modeling, phases of OR study.

Linear Programming: Two variable Linear Programming model and Graphical method of solution, Simplex method, Dual Simplex method, special cases of Linear Programming, duality, sensitivity analysis.

Total Lectures required =9

UNIT-II : Transportation Problems:

Types of transportation problems, mathematical models, transportation algorithms,

Assignment: Allocation and assignment problems and models, processing of job through machines.

Total Lectures required =8

UNIT-III : Network Techniques:

Shortest path model, minimum spanning Tree Problem, Max-Flow problem and Min-cost problem. **Project Management:** Phases of project management, guidelines for network construction, CPM and PERT.

Total Lectures required =8

UNIT-IV: Theory of Games: ; Rectangular games, Minima theorem, graphical solution of $2 \times n$ or $m \times 2$ games, game with mixed strategies, reduction to linear programming model.

Quality Systems: Elements of Queuing model, generalized poisson queuing model, single server models.

Total Lectures required =9

UNIT-V: Inventory Control

Models of inventory, operation of inventory system, quantity discount., Replacement, Replacement models: Equipments that deteriorate with time, equipments that fail with time.

Total Lectures required =8

Grand Grand Total Lectures required =42

Text / Reference Books:

1. Wayne L. Winston, "Operations Research" Thomson Learning, 2003.
2. Hamdy H. Taha, "Operations Research-An Introduction" Pearson Education, 2003.
3. R. Panneer Seevam, "Operations Research" PHI Learning, 2008.
4. V.K.Khanna, "Total Quality Management" New Age International, 2008.

2. Open Elective from Other departments

2.1 NTT 701: Functional Clothing (L T P 2 0 0)

Unit 1: Definition of functional clothing, Classification of functional clothing, Functional finishes, ways to apply functional finishes on textile surfaces, Functional clothing market review

Unit 2: Functional Protective clothing: Nuclear biological Chemical protective clothing, extreme cold clothing; design, mechanism and applications, Fire retardant clothing, approaches to achieve fire retardancy in clothing, mechanism of fire retardancy, Soft and hard body armour , super thickening fluids (non-nutonean) for body armour, water proof beathable fabrics, ways to achieve waterproofness and breathability in textiles

Unit 3: Medical functional clothing: therapeutic and rehabilitative clothing, biosensing clothing, wound healing promoting dressings, antimicrobial sutures

Unit 4: Sportswear clothing: moisture management in sportswear, compression textiles, Aerodynamics, Spacesuit design and development, woven and knitted sportswear,

Unit 5: Cosmetotextiles: definition, classification, mechanism to develop various cosmetic effects in textiles, various cosmetoingredients, worldwide scene of cosmetotextiles, Smart Textiles, classification of smart textiles, Intelligent textiles, , mechanism of various types of smart textiles, Wearable electronics

Reference Books

1. Functional Finishes for Textiles: Improving Comfort, Performance and Protection (Woodhead Publishing Series in Textiles), Raushan Paul
2. Functional Textiles and Clothing, [G. Thilagavathi.](#), [M. Parthiban](#), [S. Viju](#)
3. Woodhead Publishing
4. Electronics in Textiles and Clothing: Design, Products and Applications [L. Ashok Kumar](#), [C. Vigneswaran](#), CRC Press
5. Smart Clothes and Wearable Technology, [J. McCann](#) (Editor), [David Bryson](#) Woodhead Publishing Series in Textiles

2.2 NTT 702: Clothing Science (L T P 2 0 0)

Unit 1: Definition of clothing comfort: importance of studying clothing comfort, various components and definition of clothing science, Brief introduction to the various processes related to comfort aspect: psychological, neurophysiological, physiological and physical, Psychology and Comfort: Psychological scaling, scales of measurement, wear trial technique, Aesthetic Comfort: General aspects, measurement of aesthetic properties, changes in aesthetic behavior

Unit 2; Neurophysiological basis of sensory perceptions: Perceptions of skin sensations related to mechanical stimuli: Dynamics of wear sensation, touch and pressure, prickle, itch and inflammation, roughness and scratchiness, Perceptions of sensations related to thermal and moisture stimuli: Fabric mechanical properties and tactile- pressure sensations: Fabric prickliness, fabric itchiness, fabric stiffness, fabric softness, fabric smoothness, roughness and scratchiness, fabric hand

Unit 3: Thermal Conductivity of Fibrous Materials: Various parameters and related factors that affect the thermal conduction through fibrous materials like fibrebatts, nonwoven fabrics, pile fabrics, woven and knitted fabrics, thickness, cover factor, fibre type, yarn structure, fibre morphology and shape, effect of fabric layers etc. Transient heat transfer mechanism (the warm-cool feeling): Kawabata's theoretical proposition of thermal diffusivity as an objective parameter for evaluation of warm-cool feeling, Hess's proposition of thermal absorptivity as a more suitable parameter for the same purpose, Kawabata's instrument, Alambeta

Unit 4: Liquid Moisture Transfer through Fibrous Materials (Wicking and Water absorption): Theory of surface tension, theory of capillary action, wetting and wicking, interaction between liquid and fibrous materials, liquid spreading dynamics on a solid surface, Rayleigh instability, Lucas-Washburn theory, various theories and models on vertical and horizontal wicking through yarns, nonwoven fabrics and woven fabrics, absorption of water by a fibrous mass, objective measurement of wicking and absorption: angle of contact, droplet absorption test, vertical wicking, horizontal or transverse wicking tests

Unit 5: Transfer of moisture vapour through Fibrous Materials: Diffusion of vapour through a porous medium, various modeling approaches, moisture vapour permeability of fabrics, influence of various fabric parameters such as thickness, cover factor, etc. on the moisture vapour permeability, measurement of moisture vapour permeability, International standards

Reference Book

1. Science in Clothing Comfort Apurba Das, R. Alagirusamy, Woodhead Publishing India Pvt Limited, 2010 - Technology & Engineering - 175 pages
2. Improving Comfort in Clothing edited by Guowen Song Woodhead Publications
3. Textiles for Cold Weather Apparel, J. Williams Woodhead Publications

3. NTT-706: Fibre Manufacture & Process Control (L T P 3 1 0) Credits =4

Unit-1: Melt spinning line-extruder, design features of extruder screws (2) mixing of additives, Continuous polymer filter, spin pack and spinneret(2) spinning pack disassembly, cleaning of spinnerets, inspection of spinnerets (2) spinning variables and conditions for continuous spinning, special features of high speed melt spinning(2). **Total of lectures required=9**

Unit-2: Quenching system and quench chamber, Different quenching system (2). High speed winder, automatic winder, metering pump (1), chips drying. (1) Effects of variable throughout rate. (2) Consequence of crystallization in chips on fibre spinning (2) structure formation during melt spinning (1). **Total of lectures required=8**

Unit-3: Introduction to solution spinning classification of solution spinning (2) wet spinning, coagulation in wet spinning, effect of coagulation conditions on fibre properties(2) dry spinning, spinning cell for dry spinning (2), Cross-section formation in dry-spinning, spin finish during dry-spinning, coagulation of viscose fibre in coagulation bath(4). Wet spinning in special context of viscose fibre manufacturing (1) **Total of lectures required=11**

Unit-4: Dry-jet-wet spinning, coagulation process (2) development of structure & morphology during dry-jet-wet spinning (2) importance of dry-jet-wet spinning (2) process control in dry-jet-wet spinning (2). Dry-jet wet spinning of high tenacity acrylic fibre (1) **Total of lectures required=9**

Unit-5: Role of spin-finish (2) introduction to spin finishes components (2) spin finish application. Different techniques of spin finish application, dipping roller method, metered finish system, quench duct lubricating system, spray technique(3). Electro spinning (1) **Total of lectures required=8**

Total of lectures required=45

Text Books & Reference Material:

- 1-Manufactured fibre technology-V.B.Gupta&V.K.Kothari,Chapmann&Hall
- 2-Textile Fibre- V.K.Kothari(vol.2) IAFL Publication
- 3-High speed fibre spinning-A.Ziabickey-john willey
- 4-Essential fibre chemistry-ME CarterMarcel Dekker mc.N.york
- 5-Handbook of Fibre Science: M Leoineli and M Pearce

4. Knitting Technology: (L T P 3 1 0) credits =4

Unit 1: Difference between knits and wovens, knitting terms and definitions (Course,, wale, stitch density) different type of knitting needles: bearded needle, latch needle, sinker, jack, cam arrangement, overlap, under lap, closed lap, open lap.

Total Lectures required =8

Unit 2: Comparison of warp and weft knitting, Classification of weft knitting machine, elements of knitting machine like type of needles, sinkers, etc Needle numbering system, technology of loop formation, geometry of loop structure, Elements of loop structure: needle loop, sinker loop, relation between yarn count, machine gauge and stitch density.

Total Lectures required =9

Unit 3: Classification of knit-structures, loop formation on: single jersey, Rib machines and inters look machines, socks knitting technology, Loop formation on flat bed machine

Total Lectures required =9

Unit 4: Four primary base knitting structures: Plain knitted fabric, Rib fabric, Interlock and Purl fabric, Special knitting machines: Fabric machine, garment length machine, flat machine, circular machine fabrics and Spacer fabrics.

Total Lectures required =7

Unit 5: Basic warp knitting machines, classification of warp knitting, Modern developments in weft knitting technique, calculations regarding production, gsm, stitch density etc, Causes and remedies of faults of knitted fabrics.

Total Lectures required =9

Grand total of lectures required = 42

Reference and Text Book-

1. Knitting Technology – Chamberlin
2. Knitting Technology – W.J. Spencer
3. International Textile Journal – Knitting
4. Knitting Calculation – Chamberlin
5. Wet Knitting Vol. 1&2 –Published by IIT New Delhi.
6. Knitting – NCUTE

Laboratory work: S per Lab Syllabus

5. Departmental Elective (L T P 3 1 0)

5.1 NTT 031 Garment Manufacture Technology (L T P 3 1 0)

Unit (1): Introduction to garment manufacturing technology, Sample cutting, ZFusing, Sewing, Pressing, Finishing and inspection, Line balancing concept.

Total Lectures required =8

Unit (2): Introduction to measurement of fabric dimensional properties, fabric comfort, thermal comfort, objective evaluation of fabric, low stress fabric properties, Kawabata system, fabric assurance by sample testing, fabric defects, Fabric inspection and feedback to back process.

Total Lectures required =9

Unit (3) Introduction to garment cutting, Marker planning, Efficiency of Marker planning, methods of marker planning and marker use, spreading of the fabric, to form a lay, spreading requirements, methods of spreading, fabric packages, objective of cuttings, methods of cuttings

Total Lectures required =9

Unit (4): Introduction to seam, stitch, stitch classification, stitch structure, seam formation, joining material, surface characteristics, seam appearance, damages (thermal and mechanical), seam performance, seam degradation, seam failure, seam puckering and seam testing. Sewing needle and sewing thread, thread consumption

Total Lectures required = 9

Unit 5: Introduction of spreading machines and cutting machines- types and functions, History of sewing machines. Sewing machinery- classification according to bed types, stitch types (hook or looper) material wise (extra light to heavy weight). Major parts of sewing machinery and functions. Parts, functions and adjustments of Over Lock: Collar turning machines, folding machinery fusing and pressing machinery, Computer controlled cutting, sewing, folding machinery. **Total Lectures required =8**

Grand total of lectures required = 42

Grand total of lectures required = 42

Text Books and Reference material:

1. Introduction to Garment Manufacturing Technology By T Ramchandran
 2. Garment Manufacturing Technology by By T Ramchandran
 3. Practical Clothing Construction Part I & II by Mary Methews
- Laboratory work: NA

5.2 NTT 033: Fibre Reinforced Composites (L T P 3 1 0) Credits = 4

Unit 1: Definition of composites, Types of composites - fibre particulate and laminar composites, Fibre composites: Constituents - functions of fibre and matrix

Total Lectures Required =9

Unit 2: Types of high performance fibres - properties - types of matrix materials – Thermoset and Thermo plastics properties: short fibre composites, fibre matrix interface, coupling agents, coupling of interfaces and interfacial reaction in fibre composites, fracture mode in fibre composites.

Total Lectures Required =9

Unit 3: Introduction to fibre reinforced composite material manufacturing techniques, Textile performs for composites: weaving, knitting, braiding.

Total Lectures Required =8

Unit 4: Vacuum bagging, compression molding, injection molding, pultrusion, thermoforming, filament winding, resin transfer molding.

Total Lectures Required =8

Unit 5: Testing of composites- Fibre volume fraction -Laminar tensile - shear – compression and flexural properties, applications of fibre reinforced composites

Total Lectures Required =8

Grand Total of Lectures Required =42

Reference Books:

1. D hull An Introduction to composite materials, Cambridge university press, 1998
 2. L Gupta “Advanced Composite Materials”, Himalayan Book, New Delhi, 1998
 3. Mathews F.L and Rawlings R.D “Composite Materials Engineering science” Chapman and Hall London, 1994
 4. Hearle. J.W.S “High performance fibres composites and engineering textile structures” JTI (special issue) 1990
 5. Textile Progress monogram on “Hybrid yarns and textile performing for thermoplastic composites” by R. Alagirusamy, R Fanguero, V. Ogale and N. Padaki Textile Progress 2006 Vol 38 No. 4 (Wood Head Publishing Limited)
- De.S.K. and White J.R. Short fibre polymer composites, Wood head, 2001

7th SEMESTER MMFT LAB SYLLABUS

NTT-754: Knitting Technology Lab (L T P 0 0 2) Credits =1

To study the path of yarn through circular and flat knitting machine, different knitting elements including the cam system, driving mechanism of plain knitting machine, cloth take-up mechanism of plain knitting m/c, rib knitting m/c including arrangement of dial and cylinder needles, cam, system and driving mechanism, Interlock knitting m/c including arrangement of dial and cylinder needle, cam system and driving mechanism, Warp knitting machine constructional details and mechanism of operation.

NTT-751: Project (L T P 0 0 8) Credits = 4:

Students will carry out minor project during seventh semester as a part of curriculum as per UPTU guidelines.

NTT-752: Industrial training Viva Voice (L T P 0 0 2) Credits = 2

Students shall carryout industrial training as a part of their curriculum after the completion of their 3rd year for one month. After this their performance shall be evaluated during 7th semester by taking viva of each and every student.

8th SEMESTER MAN MADE FIBRE TECHNOLOGY

1. OPEN ELECTIVE-II

1.1 NOE-081: NON-CONVENTIONAL ENERGY RESOURCES (L T P 3 1 0)

UNIT-I: Introduction to various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits. 3 Solar Cells: Theory of solar cells. Solar cell materials, solar cell array, solar cell power plant, limitations. 4

UNIT-II: Solar Thermal Energy: Solar radiation, flat plate collectors and their materials, applications and performance, focussing of collectors and their materials, applications and performance; solar thermal power plants, thermal energy storage for solar heating and cooling, limitations. 9

UNIT-III: Geothermal Energy: Resources of geothermal energy, thermodynamics of geo-thermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations. 4 Magneto-hydrodynamics (MHD): Principle of working of MHD Power plant, performance and limitations. 2 Fuel Cells: Principle of working of various types of fuel cells and their working, performance and limitations. 3

UNIT-IV: Thermo-electrical and thermionic Conversions: Principle of working, performance and limitations. 2 Wind Energy: Wind power and its sources, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics. Performance and limitations of energy conversion systems. 6

UNIT-V: Bio-mass: Availability of bio-mass and its conversion theory. 2 Ocean Thermal Energy Conversion (OTEC): Availability, theory and working principle, performance and limitations. Wave and Tidal Wave: Principle of working, performance and limitations. Waste Recycling Plants. 3

Text/References Books:

1. Raja etal, "Introduction to Non-Conventional Energy Resources" Scitech Publications.
2. John Twideu and Tony Weir, "Renewal Energy Resources" BSP Publications, 2006.
3. M.V.R. Koteswara Rao, " Energy Resources: Conventional & Non-Conventional " BSP Publications,2006.
4. D.S. Chauhan,"Non-conventional Energy Resources" New Age International.
5. C.S. Solanki, "Renewal Energy Technologies: A Practical Guide for Beginners" PHI Learning. (14)

1.2 NOE 083- PRODUCT DEVELOPMENT (L T P 3 1 0)

UNIT-1: Concept of Product, definition and scope. Design definitions, old and new design methods, design by evolution, examples such as evolution of sewing M/C, bicycle, safety razor etc., need based developments, technology based developments physical reliability & economic feasibility of design concepts.

UNIT –II: Morphology of design, divergent, transformation and convergent phases of product design, identification of need, Analysis of need. Design criteria; functional, aesthetics, ergonomics, form, shape, size, colour. Mental blocks, Removal blocs, Ideation techniques, Creativity, Check list.

UNIT –III: Transformations, Brainstorming& Synetics, Morphological techniques. Utility Concept, Utility Value, Utility Index, Decision making under Multiple Criteria. Economic aspects, Fixed and variable costs, Break-even analysis.

UNIT-IV: Reliability considerations, Bath tub curve, Reliability of systems in series and parallel, Failure rate, MTTF and MTBF, Optimum spares from Reliability considerations. Design of display and controls, Man-machine interface, Compatibility of displays and controls. Ergonomic aspects, Anthropometric data and its importance in design. Application of Computers in Product development & design.

UNIT-V: Existing techniques, such as work-study, SQC etc. for improving method & quality of product. Innovation versus Invention. Technological Forecasting. Use of Standards for Design.

Text/Reference Books:

1. A.K. Chitab& R.C. Gupta “Product design & Manufacturing” – Prentice Hall (EE)
2. R.P. Crewford, “The Technology of creation Thinking” Prentice Hall.
3. C.D. Cain, “Product Design & Decision” Business Books.
5. C.D. Cain, “Engg. Product Design” Business Books.

2. NTT-802:-High Performance Fibres (L T P 3 1 0) Credits =4

Unit – I; Introduction- Definition, molecular dimensionality mechanical properties, Fibre markets, Hi -Performance Gelspun Polyethylene fibres- Manufacture, fibres characteristics, properties & applications. **Total lectures required=9**

Unit- II: Aramids- Introduction, polymer preparation, Spinning, Structure & properties, applications, Fibres based on liquid crystalline polymer (PPTA fibre). **Total lectures required=8**

Unit- III: Carbon Fibres- Physical properties, PAN bases Carbon fibres, Pitch based Carbon fibres, Vapour grown Carbon fibres, Applications. **Total lectures required= 8**

Unit-4:Glass Fibres- Glass for Fibres, Fibre manufacture, fibre finish, fibre properties& application, optical fibres. **Total lectures required=8**

Unit –5: Vectran (Melt spun wholly aromatic polyester fibre), Fibre production, properties & application, PBO (Polyphenylene benzobisoxazole) fibres- Fibre production, properties & application. PEEK Fibres -Fibre production, properties & application. **Total lectures required=9**

Grand total of lectures required= 42

Reference Books

1. High Performance Fibree by J.W.S. Hearle

3.1 NTT 041:- Mill Planning & Organization (L T P 3 1 0) Credits =4

Unit-I: Preparation of project—Spinning/Weaving/Processing/Composite

- A- Selection of product
- B- Site Selection (site, location, land and cost)
- C- Building (single, double and multiple)
- D- Plant and Machinery

Total lecture required 09

Unit-II

1. Industrial hazards: i. Fire hazards, ii. Mechanical hazards, iii. Electrical etc
2. Safety rules for prevention of accidents
3. Humidification of textile mill- humidifier and humidification
4. Ventilation, floor cleaning in textile mills, lightening
5. Air conditioning and Refrigeration system

Total lecture required 08

UNIT III:

Balancing of machine (plant layout for machines-- balancing of machines, layout of different machines, calculation for balancing of machines for different processes—spinning, weaving)

Total lecture required 07

UNIT IV

Production Costing—various terms used in costing (cost volume, profit analysis, cost allocation on waste, effect on cost direct , indirect

Various elements of costing- concept of estimation for costing, break-even analysis

Total lecture required 10

UNIT V

Economic Viability

Staff organization in textile mills – daily wages, various systems

Recruitment, allocation and skill development

Management and information system MIS

Total lecture required 08

Text Books & Reference Material

1. Industrial Engineering, Organization & management by Tarachand
2. Industrial Economics & Principle of Management by T.M. Chabra
3. Industrial Economics & Principle of Management by S. K Sharma

3.2 NTT 043:-TEXTILE MARKETING AND MERCHANDISING (L T P 3 1 0) =4

Unit 1: Introduction to Textile Marketing function; genesis, the marketing concept. Marketing Management System: objectives, its interfaces with other functions in the organisation. Environment of Textile Marketing, Political and Economic Environment, Market segmentation Consumer buying behaviour. Socio- cultural environment

Unit 2: Textile Marketing Strategy:- Marketing planning and Marketing programming. The concept of marketing mix, Product policy; the concept of textile product life cycle. New product decisions. Textile marketing and Pricing, Management of distribution: channels of distribution. Advertising and promotions. The concept of Unique Selling Proposition.

Unit 3: Implementation and Control. The marketing organization alternative organization structures; the concept of product management. Administration of the textile marketing programme: sales forecasting; marketing and sales budgeting; sales management; management of sales force. Evaluation of marketing performance; sales analysis; control of marketing effort; marketing audit

Unit 4: Jute textile sector, Silk textile sector, Man-made textile sector, Wool Textile sector, Statistics of Indian textile business (Domestic & Export) and World textile trade, Textile policy, World trade practices, norms, barriers, etc., Various pertinent prevailing issue impacting textile industry and trade, corporate social responsibility, ISO accreditation, etc., Retailing in textiles vis-a-vis consumer trends and behaviour and the challenges,

Unit 5: Textile Merchandising: Process of Planning, Purchasing, Motivating and Controlling of Materials in a optimum manner, vendor development, manufacturing, pricing, product design and development, exporting etc.

Reference Books:

1. Marketing Research A S Rao, Neha Publishers and distributors.
2. Marketing: Connecting with Customers, Gilbert D. Harrell, Michigan State University ISBN-10: 0-9798304-7-1, Chicago Education Press, LLC.2012
3. **Pocket Textile Merchandising & Marketing Expert Hardcover – 2008** by Textile Industries Media Group
4. **Apparel Merchandising: The Line Starts Here, 2nd Edition** by Jeremy A. Rosenau , David L. Wilson, ISBN-13: 978-1563674488
5. Retail Merchandising Sapna Pradhan Tata McGraw Hill Education Private Limited 2009

1. Departmental Elective 5

4.1 NTT 052: Technical Textiles (L T P 3 1 0) Credits =4

Unit (1): Introduction to technical textile, types of technical textiles, textiles used in industry such as filtration, filter fabric construction- woven, needle felt & knitted filter fabric, finishing treatment of filter fabric, thermal and chemical properties of filter fabric, essential requirements of good filter fabric. Application of nano technology and nano materials for the improved filtration.

Total Lectures required =8

Unit (2): Manufacture and properties of protective textiles- water proof/coated and water repellent, antimicrobial, flame retardant, chemical resistance, Nuclear and biological resistance, mechanical resistance such as bullet proof, cut proof, stab proof

Total Lectures required =9

Unit (3): Medical textiles, fibres used, classification of medical textiles- non-implantable material wound dressings, bandages, plasters, etc, Extra-corporal devices – Artificial kidney, liver lung, implantable material- suture, soft tissue implant, Orthopedic implants, Cardiovascular implants, Healthcare/ hygiene products, medical cost, surgical gown, face mast etc.

Total Lectures required =8

Unit (4): Smart textiles, brief introduction of smart textiles, classification of smart textiles, passive smart textiles, active smart textiles, brief discussion of smart shirt, smart suit, musical jacket, space suit etc. automotive textiles: type cord, seat belt, air bag, seat upholstery, carpets, headliners, helmets etc, Agro textile: Shade net, green house film, Mulch net, crop cover, anti hail and bird protection net, finishing net etc.

Total Lectures required =9

Unit (5): Introduction of geo textile, classification of geo textiles, functions of geo textile-soil reinforcement, drainage (fluid transmission), filtration, separation, erosion control/ absorption, objective of geo textiles, manufacturing of geo textile, essential properties of geo textiles- Mechanical determinants, Hydraulic determinants, durability determinants

Total Lectures required =8

Grand total of lectures required = 42

Text Books and Reference material:

1. Hand book of technical textiles- A.R. Horrocks & S.C. Anand
2. Smart fibre, fabrics and clothing Tao X
3. Shears handbook of industrial Textiles.

4.2 NTT 053:- Non-Woven (L T P 3 1 0) Credits =4

Unit 1: National and international scenario on non-woven fabric production, Concept about felts and non woven, Classification of non-woven fabrics, fibres for non-woven fabrics, Felt Manufacturing process

Total Lectures Required =9

Unit 2: Various method of web formation, web characteristics and their influence on properties of non-woven fabrics, (3) Non woven fabric by Needle punch, Description of needle punching machine, effect of process variables on properties of needle punch fabric

Total Lectures Required =9

Unit 3: Non-woven fabric by hydro entanglement, Description of hydro entanglement machine, effect of process variables on properties of hydro entanglement non woven fabric, Non-woven fabric by adhesive bonding, mechanical bonding, Melt blown process of non-woven fabric manufacturing

Total Lectures Required =8

Unit 4: Non-woven fabric by Stitch bonding, Non-woven fabric by chemical bonding, Non-woven fabric by bonding with thermoplastic adhesives, Non-woven fabric by Spun laced, Effect of process variables on properties of stitch bonding, chemical bonding spun laced non-woven fabrics.

Total Lectures Required =8

Unit 5: Flocked fabric, Laminates, latest development in non-woven industry: ultrasonic bonding, Infra-red bonding, bonding by bi-component fibres. Application of various non woven fabrics

Total Lectures Required =8

Grand total of Lectures required= 42

Reference & Text Books

1. Non Woven – N.N. Banarjee
2. Non woven – NCUTE
3. Knitting technology : Spencer

U.P TECHNICAL UNIVERSITY, LUCKNOW

Study and Evaluation scheme

B. Tech. Textile Chemistry

[Effective from the Session 2016-17]

YEAR 4th, SEMESTER- VII

S. No.	Subject Code	Name of Subject	Periods			Evaluation Scheme			Subject Total	Credits	
			L	T	P	Sessional Assessment		ESE			
						CT	TA				Total
THEORY SUBJECT											
1	NOE-071/ NOE-072 /NOE-073	Entrepreneurship Development/ Quality Management/ Operation Research	3	1	0	30	20	50	100	150	4
2	NTT-709/ NTT-702	Physical Chemistry of Dyeing/ Clothing Science	2	0	0	15	10	25	50	75	2
3	NTT-707	Technology of Finishing-II	3	1	0	30	20	50	100	150	4
4	NTT-708	Waste Management & pollution Control	3	1	0	30	20	50	100	150	4
5	NTT-031/ NTT-033	Garment manufacture Technology/ Fibre Reinforced Composites	3	1	0	30	20	50	100	150	4
PRACTICAL/ DESIGN/DRAWING											
6	NTT-751	PROJECT	0	0	8	-	50	50	100	150	4
7	NTT-752	Industrial Training	0	0	2	-	75	75		75	2
8	NTT-757	Technology of Finishing-II Lab	0	0	2	10	10	20	30	50	1
	NGP 701	General Proficiency								50	
		Total	14	4	13					1000	25

Open Elective-II from other departments

Open Elective-I from Other Departments

1. NOE 701 Entrepreneurship Development
2. NOE-072 Quality Management
3. NOE-073 Operation Research

Open Elective-II

1. NTT-709 Physical Chemistry of Dyeing
2. NTT-702 Clothing Science

Departmental Elective III

1. NTT-031 Garment manufacture Technology
2. NTT-033 Fibre Reinforced Composites

U.P TECHNICAL UNIVERSITY, LUCKNOW

Study and Evaluation scheme

B. Tech. Textile Chemistry

[Effective from the Session 2016-17]

YEAR 4th, SEMESTER- VIII

S. No.	Subject Code	Name of Subject	Periods			Evaluation Scheme			Subject Total	Credits	
			L	T	P	Sessional Assessment					
						CT	TA	Total			
THEORY SUBJECT											
1	NOE 081/ NOE 083	Non Conventional Energy Sources/ Product Development	3	1	0	30	20	50	100	150	4
2	NTT-803	Coating of Textiles	3	1	0	30	20	50	100	150	4
3	NTT-042/ NTT-043	Process House Planning/ Textile Marketing & Merchandizing	3	1	0	30	20	50	100	150	4
4	NTT-052/ NTT 053	Technical Textiles/ Non Woven	3	1	0	30	20	50	100	150	4
PRACTICAL/ DESIGN/DRAWING											
5	NTT-851	PROJECT	0	0	12		100	100	150	250	7
6	NTT-852	SEMINAR	0	0	3		100	100		100	2
	NGP-801	General proficiency								50	
		Total	12	4	15					1000	25

Open Elective from Other Departments

1. NTT-081: Non Conventional Energy Sources
2. NTT-083 Product Development

Departmental Elective IV

1. NTT-041 Mill Planning & Organization
2. NTT-042 Textile Marketing & Merchandizing

Departmental Elective V

1. NTT-051 Technical textiles
2. NTT-052 Non Woven

7th SEMESTER, B. TECH. TEXTILE CHEMISTRY

3. Open Elective- I from Other Department (L T P 3 1 0) credit =4

1.1 NOE-071: ENTREPRENEURSHIP DEVELOPMENT (L T P 3 1 0)

UNIT -I :Entrepreneurship- definition. growth of small scale industries in developing countries and their positions vis-a-vis large industries; role of small scale industries in the national economy; characteristics and types of small scale industries; demand based and resources based ancillaries and sub-control types. 5 Government policy for small scale industry; stages in starting a small scale industry. 2 (10)

UNIT –II: Project identification- assessment of viability, formulation, evaluation, financing, field-study and collection of information, preparation of project report, demand analysis, material balance and output methods, benefit cost analysis, discounted cash flow, internal rate of return and net present value methods. 8

UNIT –III: Accountancy- Preparation of balance sheets and assessment of economic viability, decision making, expected costs, planning and production control, quality control, marketing, industrial relations, sales and purchases, advertisement, wages and incentive, inventory control, preparation of financial reports, accounts and stores studies. 9

UNIT –IV: Project Planning and control: The financial functions, cost of capital approach in project planning and control. Economic evaluation, risk analysis, capital expenditures, policies and practices in public enterprises. profit planning and programming, planning cash flow, capital expenditure and operations. control of financial flows, control and communication. 9

UNIT –V: Laws concerning entrepreneur viz, partnership laws, business ownership, sales and income taxes and workman compensation act. 5 Role of various national and state agencies which render assistance to small scale industries. 2

Text / Reference Books:

1. Forbat, John, “” New Age International.
2. Havinal, Veerbhadrapa, “Entrepreneurship Management and Entrepreneurship” New Age International
3. Joseph, L. Massod, “Essential of Management", Prentice Hall of India.

1.2 NOE 072-Quality Management (L T P 3 1 0) Credits = 4

UNIT-I : Quality Concepts: Evolution of Quality Control, concept change, TQM Modern concept, Quality concept in design, Review of design, Evolution of proto type.

Control on Purchased Product: Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure.

Manufacturing Quality: Methods and techniques for manufacture, inspection and control of product, quality in sales and services, guarantee, analysis of claims.

Total Lectures required =9

UNIT-II: Quality Management

Organization structure and design, quality function, decentralization, designing and fitting, organization for different type products and company, economics of quality value and contribution, quality cost, optimizing quality cost, seduction program.

Human Factor in quality

Attitude of top management, cooperation of groups, operators attitude, responsibility, causes of apparatus error and corrective methods.

Total Lectures required =9

UNIT-III: Control Charts, Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts.

Attributes of Control Chart, Defects, construction and analysis of charts, improvement by control chart, variable sample size, construction and analysis of C charts.

Total Lectures required =9

UNIT -IV : Defects diagnosis and prevention defect study, identification and analysis of defects, correcting measure, factors affecting reliability, MTTF, calculation of reliability, building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle.

Total Lectures required =9

UNIT –V: ISO-9000 and its concept of Quality Management, ISO 9000 series, Taguchi method, JIT in some details.

Total Lectures required =6

Grand total of lectures required = 32

Text / Reference Books:

1. Lt. Gen. H. Lal, "Total Quality Management", Eastern Limited, 1990.
2. Greg Bounds, "Beyond Total Quality Management", McGraw Hill, 1994.
3. Menon, H.G, "TQM in New Product manufacturing", McGraw Hill 1992.

1.3 NOE 073: OPERATION RESEARCH (L T P 3 1 0) Credits =4

UNIT-I: Introduction:

Definition and scope of operations research (OR), OR model, solving the OR model, art of modeling, phases of OR study.

Linear Programming: Two variable Linear Programming model and Graphical method of solution, Simplex method, Dual Simplex method, special cases of Linear Programming, duality, sensitivity analysis. **Total Lectures required =9**

UNIT-II : Transportation Problems:

Types of transportation problems, mathematical models, transportation algorithms,

Assignment: Allocation and assignment problems and models, processing of job through machines. **Total Lectures required =8**

UNIT-III : Network Techniques:

Shortest path model, minimum spanning Tree Problem, Max-Flow problem and Min-cost problem.

Project Management: Phases of project management, guidelines for network construction, CPM and PERT. **Total Lectures required =8**

UNIT-IV: Theory of Games:

Rectangular games, Minima theorem, graphical solution of $2 \times n$ or $m \times 2$ games, game with mixed strategies, reduction to linear programming model.

Quality Systems: Elements of Queuing model, generalized poisson queuing model, single server models. **Total Lectures required =9**

UNIT-V:

Inventory Control, Models of inventory, operation of inventory system, quantity discount., Replacement, Replacement models: Equipments that deteriorate with time, equipments that fail with time. **Total Lectures required =8**

Grand Total Lectures required =42

Text / Reference Books:

1. Wayne L. Winston, "Operations Research" Thomson Learning, 2003.
2. Hamdy H. Taha, "Operations Research-An Introduction" Pearson Education, 2003.
3. R. Panneer Seevam, "Operations Research" PHI Learning, 2008.
4. V.K.Khanna, "Total Quality Management" New Age International, 2008.

4. Open Elective from Other departments

2.1 NTT 709: Physical Chemistry of Dyeing (L T P 2 0 0)

Unit 1: Introduction to the theory of dyeing absorption- law of light absorption, role of fibre structure in dyeing, Adsorption- Isotherms. **Total lectures required -9**

Unit 2: Chemical potential of dyes, activity of dye in solution and in fibre, physio- chemical factors in dyeing. Simple relation for calculation of affinity, diffusion coefficient of dyes into fibres. **Total lectures required -9**

Unit 3: Kinetic – diffusion of dyes inside the fibre rate of dyeing, thermodynamics – entropy of dyeing, temperature effects, heat of dyeing. **Total lectures required -9**

Unit 4: Colour measurement & C/E System, Numerical expression of colour difference- Adaims chromaticity value, Spectro photo meter. **Total lectures required -9**

Total no. of lectures= 36

Text Book: -

1. Synthetic dye stuff – Cain & Thrope
2. Chemistry of dyes & principle of dyeing -V.A. Shenai

Reference Book:

1. Process of dye chemistry: Fierz, David & Ballengray
2. Dyeing and chemical technology of fibre: E.K. Frotran
3. Processing of textile fibres: Sadov
4. Chemistry of synthetic dyes: Venkataraman
5. Chemistry of dyestuff: L.L. Liod, M. f

4.2 NTT 702: Clothing Science (L T P 2 0 0)

Unit 1: Definition of clothing comfort: importance of studying clothing comfort, various components and definition of clothing science, Brief introduction to the various processes related to comfort aspect: psychological, neurophysiological, physiological and physical, Psychology and Comfort: Psychological scaling, scales of measurement, wear trial technique, Aesthetic Comfort: General aspects, measurement of aesthetic properties, changes in aesthetic behavior

Unit 2; Neurophysiological basis of sensory perceptions: Perceptions of skin sensations related to mechanical stimuli: Dynamics of wear sensation, touch and pressure, prickle, itch and inflammation, roughness and scratchiness, Perceptions of sensations related to thermal and moisture stimuli: Fabric mechanical properties and tactile- pressure sensations: Fabric prickliness, fabric itchiness, fabric stiffness, fabric softness, fabric smoothness, roughness and scratchiness, fabric hand

Unit 3: Thermal Conductivity of Fibrous Materials: Various parameters and related factors that affect the thermal conduction through fibrous materials like fibrebatts, nonwoven fabrics, pile fabrics, woven and knitted fabrics, thickness, cover factor, fibre type, yarn structure, fibre morphology and shape, effect of fabric layers etc. Transient heat transfer mechanism (the warm-cool feeling): Kawabata's theoretical proposition of thermal diffusivity as an objective parameter for evaluation of warm-cool feeling, Hess's proposition of thermal absorbtivity as a more suitable parameter for the same purpose, Kawabata's instrument, Alambeta

Unit 4: Liquid Moisture Transfer through Fibrous Materials (Wicking and Water absorption): Theory of surface tension, theory of capillary action, wetting and wicking, interaction between liquid and fibrous materials, liquid spreading dynamics on a solid surface, Rayleigh instability, Lucas-Washburn theory, various theories and models on vertical and horizontal wicking through yarns, nonwoven fabrics and woven fabrics, absorption of water by a fibrous mass, objective measurement of wicking and absorption: angle of contact, droplet absorption test, vertical wicking, horizontal or transverse wicking tests

Unit 5: Transfer of moisture vapour through Fibrous Materials: Diffusion of vapour through a porous medium, various modeling approaches, moisture vapour permeability of fabrics, influence of various fabric parameters such as thickness, cover factor, etc. on the moisture vapour permeability, measurement of moisture vapour permeability, International standards

Reference Book

4. Science in Clothing Comfort Apurba Das, R. Alagirusamy, Woodhead Publishing India Pvt Limited, 2010 - Technology & Engineering - 175 pages
5. Improving Comfort in Clothing edited by Guowen Song Woodhead Publications
6. Textiles for Cold Weather Apparel, J. Williams Woodhead Publications

3. NTT-707: Technology of Finishing-II (L T P 3 1 0=4)

Unit – 1: Water proofing and water repelling, testing of water repellency, mechanism of water repelling, area of use. **Total lecture required – 8**

Unit – 2: Principle & mechanism of flame Retardancy, Flame Retardancy of cotton, polyester and P/C blends. Testing methods for evaluation of flame Retardancy..

Total lecture required 8

Unit – 3: Finishing of woolen fabrics- Moth proofing, permanent set & testing. Anti felt, s

Total lecture required -7

Unit – 4: Finishing of Synthetic fibres/fabric – Heat setting (2), Delusturing (2), antistatic (2), soil resistance finishes Finishing of synthetics and Lenin fabrics e.g. 100% Polyester, Nylons, acrylics and their blends with cotton, viscose, wool.

Total lecture required -10

Unit 5” Nano Finishes;- Various types of nano finishes, Characterization and their application in textiles: e.g. soil release, water repellent, fire retardant, stain repellent, anti microbial, UV protection nano finishes.

Total lecture required -9

Grand total of lectures required: 42

Reference Books:

1. Introduction to textile finishing by J.T. marsh
2. Chemical Processing of Synthetic Fibres & Blends by Datye & Vaidhya
3. Textile Finishing by V.A. Shenai

4. NTT 708:-Waste Management & Pollution Control (L T P 3 1 0)

Unit 1: Toxicity of intermediates, dyes, processing aids- bleaching, dyeing, printing and finishing auxiliaries etc, Analytical methods for various pollutants, Formaldehydes, Pentachlorophenol, Biological Oxygen Demand (BOD), Chemical Oxygen demand (COD)

Total number of lectures required = 8

Unit 2: Environmental impact assessment, Definition & need, Introduction to environmental impact assessment methodology, Unit process, waste minimization and recycling

Total number of lectures required = 8

Unit 3: textile effluent and their characterization, Methods of effluent treatment, Disposal of effluents, reuse of water in a process house, Fibre and polymer waste, recovery and recycling of monomer, Modification of polymer waste & its utilization.

Total number of lectures required = 8

Unit 4: Source of water: factors contributing water pollution and their effect, water pollution parameters, physical, biological, chemical standards for quality of treated water, Effluent treatment methods and control, basic principles, Unit Operations (Sedimentation, precipitation, filtration and incineration), specific pollutants.

Total number of lectures required = 8

Unit 5: Pollution of air, causes, effect, monitoring and control, Source of noise pollution, its effect and control, Legislation- salient provisions of water act, Air act, Environment pollution act, Environment Impact Assessment, basic principles, purpose, components, methodology and constraints.

Total number of lectures required = 8

Grand total of lectures required = 40

Reference Books:

1. Basic course in environmental studies- S. Deswal & Anupama Deswal
2. Environment Impact Assessment by Mc. Graw Hill by Carter L.W.

6. Departmental Elective (L T P 3 1 0)

5.1 NTT 031 Garment Manufacture Technology (L T P 3 1 0)

Unit (1): Introduction to garment manufacturing technology, Sample cutting, ZFusing, Sewing, Pressing, Finishing and inspection, Line balancing concept.

Total Lectures required =8

Unit (2): Introduction to measurement of fabric dimensional properties, fabric comfort, thermal comfort, objective evaluation of fabric, low stress fabric properties, Kawabata system, fabric assurance by sample testing, fabric defects, Fabric inspection and feedback to back process.

Total Lectures required =9

Unit (3) Introduction to garment cutting, Marker planning, Efficiency of Marker planning, methods of marker planning and marker use, spreading of the fabric, to form a lay, spreading requirements, methods of spreading, fabric packages, objective of cuttings, methods of cuttings

Total Lectures required =9

Unit (4): Introduction to seam, stitch, stitch classification, stitch structure, seam formation, joining material, surface characteristics, seam appearance, damages (thermal and mechanical), seam performance, seam degradation, seam failure, seam puckering and seam testing.

Total Lectures required =9

Unit (5): Importance of garment processing and finishes, types of garment, processing of garments and special garment finishes.

Total Lectures required =7

Grand total of lectures required = 42

Text Books and Reference material:

4. Introduction to Garment Manufacturing Technology By T Ramchandran
 5. Garment Manufacturing Technology by By T Ramchandran
 6. Practical Clothing Construction Part I & II by Mary Methews
- Laboratory work: NA

5.2 NTT 033:- Fibre Reinforced Composites (L T P 3 1 0) Credits = 4

Unit 1: Definition of composites, Types of composites - fibre particulate and laminar composites, Fibre composites: Constituents - functions of fibre and matrix

Total Lectures Required =9

Unit 2: Types of high performance fibres - properties - types of matrix materials – Thermoset and Thermo plastics properties: short fibre composites, fibre matrix interface, coupling agents, coupling of interfaces and interfacial reaction in fibre composites, fracture mode in fibre composites. **Total Lectures Required =9**

Unit 3: Introduction to fibre reinforced composite material manufacturing techniques, Textile performs for composites: weaving, knitting, braiding.

Total Lectures Required =8

Unit 4: Vacuum bagging, compression molding, injection molding, pultrusion, thermoforming, filament winding, resin transfer molding. **Total Lectures Required =8**

Unit 5: Testing of composites- Fibre volume fraction -Laminar tensile - shear – compression and flexural properties, applications of fibre reinforced composites

Total Lectures Required =8

Grand Total of Lectures Required =42

Reference Books:

6. D hull An Introduction to composite materials, Cambridge university press, 1998
7. L Gupta “Advanced Composite Materials”, Himalayan Book, New Delhi, 1998
8. Mathews F.L and Rawlings R.D “Composite Materials Engineering science” Chapman and Hall London, 1994
9. Hearle. J.W.S “High performance fibres composites and engineering textile structures” JTI (special issue) 1990
10. Textile Progress monogram on “Hybrid yarns and textile performing for thermoplastic composites” by R. Alagirusamy, R Fangueiro, V. Ogale and N. Padaki Textile Progress 2006 Vol 38 No. 4 (Wood Head Publishing Limited)
11. De.S.K. and White J.R. Short fibre polymer composites, Wood head, 2001

7th SEMESTER LAB SYLLABUS

NTT-758Technology of Finishing-II (L T P 0 0 3)

Water proofing and water repelling, testing of water repellency, Flame retardency of cotton, polyester and P/C blends, Finishing of woolen fabrics, antistatic, soil resistance finishes.

NTT-751: Project (L T P 0 0 8) Credits = 4:

Students will carry out minor project during seventh semester as a part of curriculum as per UPTU guidelines.

NTT-752: Industrial training Viva Voice (L T P 0 0 2) Credits = 2

Students shall carryout industrial training as a part of their curriculum after the completion of their 3rd year for one month. After this their performance shall be evaluated during 7th semester by taking viva of each and every student.

8th SEMESTER, B. TECH. TEXTILE CHEMISTRY

3. OPEN ELECTIVE-II

1.1 NOE-081: NON-CONVENTIONAL ENERGY RESOURCES (L T P 3 1 0)

UNIT-I: Introduction to various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits. 3 Solar Cells: Theory of solar cells. solar cell materials, solar cell array, solar cell power plant, limitations. 4

UNIT-II: Solar Thermal Energy: Solar radiation, flat plate collectors and their materials, applications and performance, focussing of collectors and their materials, applications and performance; solar thermal power plants, thermal energy storage for solar heating and cooling, limitations. 9

UNIT-III:: Geothermal Energy: Resources of geothermal energy, thermodynamics of geothermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations. 4 Magneto-hydrodynamics (MHD): Principle of working of MHD Power plant, performance and limitations. 2 Fuel Cells: Principle of working of various types of fuel cells and their working, performance and limitations. 3

UNIT-IV: Thermo-electrical and thermionic Conversions: Principle of working, performance and limitations. 2 Wind Energy: Wind power and its sources, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics. Performance and limitations of energy conversion systems. 6

UNIT-V: Bio-mass: Availability of bio-mass and its conversion theory. 2 Ocean Thermal Energy Conversion (OTEC): Availability, theory and working principle, performance and limitations. Wave and Tidal Wave: Principle of working, performance and limitations. Waste Recycling Plants. 3

Text/References Books:

1. Raja etal, "Introduction to Non-Conventional Energy Resources" Scitech Publications.
2. John Twideu and Tony Weir, "Renewal Energy Resources" BSP Publications, 2006.
3. M.V.R. Koteswara Rao, " Energy Resources: Conventional & Non-Conventional " BSP Publications,2006.
4. D.S. Chauhan,"Non-conventional Energy Resources" New Age International.
5. C.S. Solanki, "Renewal Energy Technologies: A Practical Guide for Beginners" PHI Learning. (14)

3.2 NOE 083- Product Development

UNIT-1: Concept of Product, definition and scope. Design definitions, old and new design methods, design by evolution, examples such as evolution of sewing M/C, bicycle, safety razor etc., need based developments, technology based developments physical reliability & economic feasibility of design concepts.

UNIT –II: Morphology of design, divergent, transformation and convergent phases of product design, identification of need, Analysis of need. Design criteria; functional, aesthetics, ergonomics, form, shape, size, colour. Mental blocks, Removal blocks, Ideation techniques, Creativity, Check list.

UNIT –III: Transformations, Brainstorming & Synetics, Morphological techniques. Utility Concept, Utility Value, Utility Index, Decision making under Multiple Criteria. Economic aspects, Fixed and variable costs, Break-even analysis.

UNIT-IV: Reliability considerations, Bath tub curve, Reliability of systems in series and parallel, Failure rate, MTTF and MTBF, Optimum spares from Reliability considerations. Design of display and controls, Man-machine interface, Compatibility of displays and controls. Ergonomic aspects, Anthropometric data and its importance in design. Application of Computers in Product development & design.

UNIT-V: Existing techniques, such as work-study, SQC etc. for improving method & quality of product. Innovation versus Invention. Technological Forecasting. Use of Standards for Design.

Text/Reference Books:

1. A.K. Chitambar & R.C. Gupta “Product design & Manufacturing” – Prentice Hall (EE)
2. R.P. Crawford, “The Technology of Creative Thinking” Prentice Hall.
3. C.D. Cain, “Product Design & Decision” Business Books.
5. C.D. Cain, “Engg. Product Design” Business Books.

4. Coating of Textiles (NTT-803) (L T P 3 1 0=4)

Unit-1: Polymeric materials for coating- (Rubbers: natural and synthetic, (3)(Polyvinyl chloride, Polyurethane, Acrylic polymers and its dough preparation for coating, Adhesive treatment (4)

Total lecture required=7

Unit-2: Coating Methods: Knife coating (1), Roller coating (1) transfer coating (1), Rotary screen printing (2) calendaring , lamination , melt coating (2)

Total lecture required=7

Unit-3: Physical properties of coated fabric (2) Rheology of coating pastes (1), Rheological Behaviors of fluids, pastes (1) hydrodynamic analysis of coating (2) factors effecting for degradation of coated fabric.

Total lecture required=8

Unit-4: Coating for foul weather protection, (1) Impermeable cloth (1) breathable cloth (1) Non Apparel cloth (1), Coating for Chemical protection (1) Thermo chromic coating (1) Temperature Adaptable coating (1) Camouflage nets (1) Metal and conducting polymer-coated fabrics (2) Radiation cured coating (1)

Total lecture required=8

Unit-5: Test methods for coated fabrics, Coating per unit area wt/area , Degree of fusion/curing of coating- (1) blocking, Abrasion resistance (1) Test for colour- Fastness to dry and wet rubbing, Resistance to water penetration (3) Air permeability (1) water vapour permeability (1) low temperature bend test (1) low temperature impact test (1) Adhesion test

Total lecture required=9

Grand Total lecture required=39

Reference Books:

References:

1. Coating & Laminated Textiles by Water Fung
2. Coated Textile by A.K. Sen
3. Coated Fabric technology Vol 1-3 Technomic publication
4. Coated & laminated Fabric by AATCC symposium

5. DEPARTMENTAL ELECTIVE 4

3.1 NTT 042:- PROCESS HOUSE PLANNING (L T P 3 1 0) = 4

Unit-1: 1 Elements of project report for setting up of process house.

- a.) Land (site and location of its development)
- b.) Construction of building—types
- c.) Plant machinery (preparatory, dyeing, printing, finishing)
- d.) Miscellaneous and allied aspects.

Unit-2: Importance of effluent management: their effect in environment, -Tolerance limit enforced by state pollution Boards & its purpose, Characteristics of process waste streams-process, process, possible pollutants & nature of waste water, methods of disposal of industrial waste (from dye house & print house specially), Water energy (steam) Source & its conservation, -Steam and water consumption, Reutilization of water,

Total of lectures required=7

Unit-3: Balancing of machines for a complete process house, Layout of different machines of a process house, Factors affecting plan layout (3). Handling of dyes & chemicals –methods & precautions, Maintenance, Objective and various types of maintenance in process house. **Total of lectures required=7**

Unit-4: Costing (1), introduction to cost terms and purposes , elements of costing (1). Cost volume, profit analysis, Master budget, flexible budget, cost allocation, process costing, waste cost in process house, labour and material cost, wage system in process house, Predetermining dyeing, finishing and printing cost, economic and technical feasibility Viability evaluation of a project

Unit (5) Calculation regarding payback period and Breakeven point (1) Types of staff organization (2).Staff organization system in textile mills, Management Information system (MIS)

Total of lectures required

Reference Books

- 1- Art of Dyeing by B.S. Chauhan
- 2-Health hazards in Textile mills by NITRA
- 3-Dye house management, Colour Publication, Bombay
- 4-Modern Textile Management J.B.Rattan, Abhishek Publication, Chandigarh.
- 5-Water and effluents in textile by ATIRA.
- 6-Economy, energy and environment in textile wet processing by S.S. Trivedi.
- 7-Occupational Health and Safety in Textile mills by Dr. V.A.Shenai,Sevak Publication, Mumbai
- 8-Energy Conservation in Textile WET Processing by Dr.M.L. Gulrajani, Mahajan publication, Ahemdabad.

5.2 NTT 043:-TEXTILE MARKETING AND MERCHANDISING

Unit 1: Introduction to Textile Marketing function; genesis, the marketing concept. Marketing Management System: objectives, its interfaces with other functions in the organisation.

Environment of Textile Marketing, Political and Economic Environment, Market segmentation Consumer buying behaviour. Socio- cultural environment

Unit 2: Textile Marketing Strategy:- Marketing planning and Marketing programming. The concept of marketing mix, Product policy; the concept of textile product life cycle. New product decisions. Textile marketing and Pricing, Management of distribution: channels of distribution. Advertising and promotions. The concept of Unique Selling Proposition.

Unit 3: Implementation and Control. The marketing organization alternative organization structures; the concept of product management. Administration of the textile marketing programme: sales forecasting; marketing and sales budgeting; sales management; management of sales force.

Evaluation of marketing performance; sales analysis; control of marketing effort; marketing audit

Unit 4: Jute textile sector, Silk textile sector, Man-made textile sector, Wool Textile sector, Statistics of Indian textile business (Domestic & Export) and World textile trade, Textile policy, World trade practices, norms, barriers, etc., Various pertinent prevailing issue impacting textile industry and trade, corporate social responsibility, ISO accreditation, etc., Retailing in textiles vis-a-vis consumer trends and behaviour and the challenges,

Unit 5: Textile Merchandising: Process of Planning, Purchasing, Motivating and Controlling of Materials in a optimum manner, vendor development, manufacturing, pricing, product design and development, exporting etc.

Reference Books:

6. Marketing Research A S Rao, Neha Publishers and distributors
7. Marketing: Connecting with Customers, Gilbert D. Harrell, Michigan State University ISBN-10: 0-9798304-7-1, Chicago Education Press, LLC.2012
8. Pocket Textile Merchandising & Marketing Expert Hardcover – 2008 by Textile Industries Media Group
9. Apparel Merchandising: The Line Starts Here, *2nd Edition* by Jeremy A. Rosenau , David L. Wilson, ISBN-13: 978-1563674488
10. Retail Merchandising Sapna Pradhan Tata McGraw Hill Education Private Limited 2009

6. DEPARTMENTAL ELECTIVE 5

4.1 NTT 052: Technical Textiles (L T P 3 1 0) Credits =4

Unit (1): Introduction to technical textile, types of technical textiles, textiles used in industry such as filtration, filter fabric construction- woven, needle felt & knitted filter fabric, finishing treatment of filter fabric, thermal and chemical properties of filter fabric, essential requirements of good filter fabric. Application of nano technology and nano materials for the improved filtration.

Total Lectures required =8

Unit (2): Manufacture and properties of protective textiles- water proof/coated and water repellent, antimicrobial, flame retardant, chemical resistance, Nuclear and biological resistance, mechanical resistance such as bullet proof, cut proof, stab proof

Total Lectures required =9

Unit (3): Medical textiles, fibres used, classification of medical textiles- non-implantable material wound dressings, bandages, plasters, etc, Extra-corporal devices – Artificial kidney, liver lung, implantable material- suture, soft tissue implant, Orthopedic implants, Cardiovascular implants, Healthcare/ hygiene products, medical cost, surgical gown, face mast etc.

Total Lectures required =8

Unit (4): Smart textiles, brief introduction of smart textiles, classification of smart textiles, passive smart textiles, active smart textiles, brief discussion of smart shirt, smart suit, musical jacket, space suit etc. automotive textiles: type cord, seat belt, air bag, seat upholstery, carpets, headliners, helmets etc, Agro textile: Shade net, green house film, Mulch net, crop cover, anti hail and bird protection net, finishing net etc.

Total Lectures required =9

Unit (5): Introduction of geo textile, classification of geo textiles, functions of geo textile-soil reinforcement, drainage (fluid transmission), filtration, separation, erosion control/ absorption, objective of geo textiles, manufacturing of geo textile, essential properties of geo textiles- Mechanical determinants, Hydraulic determinants, durability determinants

Total Lectures required =8

Grand total of lectures required = 42

Text Books and Reference material:

4. Hand book of technical textiles- A.R. Horrocks & S.C. Anand
5. Smart fibre, fabrics and clothing Tao X
6. Shears handbook of industrial Textiles.

4.2 NTT 053:- Non-Woven (L T P 3 1 0) Credits =4

Unit 1: National and international scenario on non-woven fabric production, Concept about felts and non woven, Classification of non-woven fabrics, fibres for non-woven fabrics, Felt Manufacturing process

Total Lectures Required =9

Unit 2: Various method of web formation, web characteristics and their influence on properties of non-woven fabrics, (3) Non woven fabric by Needle punch, Description of needle punching machine, effect of process variables on properties of needle punch fabric

Total Lectures Required =9

Unit 3: Non-woven fabric by hydro entanglement, Description of hydro entanglement machine, effect of process variables on properties of hydro entanglement non woven fabric, Non-woven fabric by adhesive bonding, mechanical bonding, Melt blown process of non-woven fabric manufacturing

Total Lectures Required =8

Unit 4: Non-woven fabric by Stitch bonding, Non-woven fabric by chemical bonding, Non-woven fabric by bonding with thermoplastic adhesives, Non-woven fabric by Spun laced, Effect of process variables on properties of stitch bonding, chemical bonding spun laced non-woven fabrics.

Total Lectures Required =8

Unit 5: Flocked fabric, Laminates, latest development in non-woven industry: ultrasonic bonding, Infra-red bonding, bonding by bi-component fibres. Application of various non woven fabrics

Total Lectures Required =8

Grand total of Lectures required= 42

Reference & Text Books

1. Non Woven – N.N. Banarjee
2. Non woven – NCUTE
3. Knitting technology : Spencer

U.P TECHNICAL UNIVERSITY, LUCKNOW

Study and Evaluation scheme

B. Tech. Textile Engineering

[Effective from the Session 2016-17]

YEAR 4th , SEMESTER- VII

S. No.	Subject Code	Name of Subject	Periods			Evaluation Scheme			Subject Total	Credits	
			L	T	P	Sessional Assessment		ESE			
						CT	TA				Total
THEORY SUBJECT											
1	NOE-071/ NOE-072 /NOE-073	Entrepreneurship Development/ Quality Management/ Operation Research	3	1	0	30	20	50	100	150	4
2	NTT-701/ NTT-702	Functional Clothing/ Clothing Science	2	0	0	15	10	25	50	75	2
3	NTT-705	Principles & Design of Spinning & Weaving machines	3	1	0	30	20	50	100	150	4
4	NTT-704	Knitting Technology	3	1	0	30	20	50	100	150	4
5	NTT-031/ NTT-032	Garment manufacture Technology/ Process Control in Spinning & Weaving	3	1	0	30	20	50	100	150	4
PRACTICAL/ DESIGN/DRAWING											
6	NTT-751	PROJECT	0	0	8	-	50	50	100	150	4
7	NTT-752	Industrial Training	0	0	2	-	75	75		75	2
8	NTT-754	Knitting Technology Lab	0	0	2	10	10	20	30	50	1
	NGP 701	General Proficiency								50	
		Total	14	4	13					1000	25

Open Elective-I from Other Departments

1. NOE 701 Entrepreneurship Development
2. NOE-072 Quality Management
3. NOE-073 Operation Research

Open Elective-II

1. NTT-701 Functional Clothing
2. NTT-702 Clothing Science

Departmental Elective III

1. NTT-031 Garment manufacture Technology
2. NTT-032 Process Control in Spinning & Weaving

U.P TECHNICAL UNIVERSITY, LUCKNOW

Study and Evaluation scheme

B. Tech. Textile Engineering

[Effective from the Session 2016-17]

YEAR 4th, SEMESTER- VIII

S. No.	Subject Code	Name of Subject	Periods			Evaluation Scheme			Subject Total	Credits	
			L	T	P	Sessional Assessment					
						CT	TA	Total			
THEORY SUBJECT											
1	NOE 081/ NOE 083	Non Conventional Energy Sources/ Product Development	3	1	0	30	20	50	100	150	4
2	NTT-801	Theory of Textile Structure	3	1	0	30	20	50	100	150	4
3	NTT-041/ NTT-043	Mill Planning & Organization/ Textile marketing & merchandizing	3	1	0	30	20	50	100	150	4
4	NTT-051/ NTT-052/ NTT 053	Advance Weaving Technology/ Technical textiles/ Non Woven	3	1	0	30	20	50	100	150	4
PRACTICAL/ DESIGN/DRAWING											
5	NTT-851	PROJECT	0	0	12		100	100	150	250	7
6	NTT-852	SEMINAR	0	0	3		100	100		100	2
	NGP-801	General proficiency								50	
		Total	12	4	15					1000	25

Open Elective from Other Departments

1. NTT-081: Non Conventional Energy Sources
2. NTT-083 Product Development

Departmental Elective IV

1. NTT-041 Mill Planning & Organization
2. NTT-042 Textile Marketing & Merchandizing

Departmental Elective V

1. NTT-051 Technical textiles
2. NTT-052 Non Woven

7th Semester **B. Tech. Textile Technology**

5. Open Elective- I from Other Department (L T P 3 1 0) credit =4

1.1 NOE-071: ENTREPRENEURSHIP DEVELOPMENT (L T P 3 1 0)

UNIT –I: Entrepreneurship- definition. growth of small scale industries in developing countries and their positions vis-a-vis large industries; role of small scale industries in the national economy; characteristics and types of small scale industries; demand based and resources based ancillaries and sub-control types. 5 Government policy for small scale industry; stages in starting a small scale industry. 2 (10)

UNIT -II Project identification- assessment of viability, formulation, evaluation, financing, field-study and collection of information, preparation of project report, demand analysis, material balance and output methods, benefit cost analysis, discounted cash flow, internal rate of return and net present value methods. 8

UNIT -III Accountancy- Preparation of balance sheets and assessment of economic viability, decision making, expected costs, planning and production control, quality control, marketing, industrial relations, sales and purchases, advertisement, wages and incentive, inventory control, preparation of financial reports, accounts and stores studies. 9

UNIT -IV Project Planning and control: The financial functions, cost of capital approach in project planning and control. Economic evaluation, risk analysis, capital expenditures, policies and practices in public enterprises. profit planning and programming, planning cash flow, capital expenditure and operations. control of financial flows, control and communication. 9

UNIT -V Laws concerning entrepreneur viz, partnership laws, business ownership, sales and income taxes and workman compensation act. 5 Role of various national and state agencies which render assistance to small scale industries. 2

Text / Reference Books:

1. Forbat, John, “Entrepreneurship” New Age International.
2. Havinal, Veerbhadrapa, “Management and Entrepreneurship” New Age International
3. Joseph, L. Massod, “Essential of Management”, Prentice Hall of India.

1.2 Quality Management (NOE-072) (L T P 3 1 0) Credits = 4

UNIT-I : Quality Concepts: Evolution of Quality Control, concept change, TQM Modern concept, Quality concept in design, Review of design, Evolution of proto type.

Control on Purchased Product: Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure.

Manufacturing Quality: Methods and techniques for manufacture, inspection and control of product, quality in sales and services, guarantee, analysis of claims.

Total Lectures required =9

UNIT-II: Quality Management

Organization structure and design, quality function, decentralization, designing and fitting, organization for different type products and company, economics of quality value and contribution, quality cost, optimizing quality cost, seduction program.

Human Factor in quality

Attitude of top management, cooperation of groups, operators attitude, responsibility, causes of apparatus error and corrective methods. **Total Lectures required =9**

UNIT-III: Control Charts, Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts.

Attributes of Control Chart, Defects, construction and analysis of charts, improvement by control chart, variable sample size, construction and analysis of C charts.

Total Lectures required =9

UNIT -IV : Defects diagnosis and prevention defect study, identification and analysis of defects, correcting measure, factors affecting reliability, MTTF, calculation of reliability, building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle. **Total Lectures required =9**

UNIT -V: ISO-9000 and its concept of Quality Management, ISO 9000 series, Taguchi method, JIT in some details. **Total Lectures required =6**

Grand total of lectures required = 32

Text / Reference Books:

1. Lt. Gen. H. Lal, "Total Quality Management", Eastern Limited, 1990.
2. Greg Bounds, "Beyond Total Quality Management", McGraw Hill, 1994.
3. Menon, H.G, "TQM in New Product manufacturing", McGraw Hill 1992.

1.3 OPERATION RESEARCH (NOE-073) (L T P 3 1 0) Credits =4

UNIT-I: Introduction:

Definition and scope of operations research (OR), OR model, solving the OR model, art of modeling, phases of OR study.

Linear Programming: Two variable Linear Programming model and Graphical method of solution, Simplex method, Dual Simplex method, special cases of Linear Programming, duality, sensitivity analysis. **Total Lectures required =9**

UNIT-II: Transportation Problems:

Types of transportation problems, mathematical models, transportation algorithms,

Assignment: Allocation and assignment problems and models, processing of job through machines. **Total Lectures required =8**

UNIT-III : Network Techniques:

Shortest path model, minimum spanning Tree Problem, Max-Flow problem and Min-cost problem.

Project Management: Phases of project management, guidelines for network construction, CPM and PERT. **Total Lectures required =8**

UNIT-IV: Theory of Games:

Rectangular games, Minima theorem, graphical solution of $2 \times n$ or $m \times 2$ games, game with mixed strategies, reduction to linear programming model.

Quality Systems: Elements of Queuing model, generalized poisson queuing model, single server models. **Total Lectures required =9**

UNIT-V:

Inventory Control, Models of inventory, operation of inventory system, quantity discount., Replacement, Replacement models: Equipments that deteriorate with time, equipments that fail with time. **Total Lectures required =8**

Grand Total Lectures required =42

Text / Reference Books:

1. Wayne L. Winston, "Operations Research" Thomson Learning, 2003.
2. Hamdy H. Taha, "Operations Research-An Introduction" Pearson Education, 2003.
3. R. Panneer Seevam, "Operations Research" PHI Learning, 2008.
4. V.K.Khanna, "Total Quality Management" New Age International, 2008.

6. Open Elective from Other departments

2.1 NTT 701: Functional Clothing (L T P 2 0 0)

Unit 1: Definition of functional clothing, Classification of functional clothing, Functional finishes, ways to apply functional finishes on textile surfaces, Functional clothing market review

Unit 2: Functional Protective clothing: Nuclear biological Chemical protective clothing, extreme cold clothing; design, mechanism and applications, Fire retardant clothing, approaches to achieve fire retardancy in clothing, mechanism of fire retardancy, Soft and hard body armour , super thickening fluids (non-nutonean) for body armour, water proof beathable fabrics, ways to achieve waterproofness and breathability in textiles

Unit 3: Medical functional clothing: therapeutic and rehabilitative clothing, biosensing clothing, wound healing promoting dressings, antimicrobial sutures

Unit 4: Sportswear clothing: moisture management in sportswear, compression textiles, Aerodynamics, Spacesuit design and development, woven and knitted sportswear,

Unit 5; Cosmetotextiles: definition, classification, mechanism to develop various cosmetic effects in textiles, various cosmetoingredients, worldwide scene of cosmetotextiles, Smart Textiles, classification of smart textiles, Intelligent textiles, , mechanism of various types of smart textiles, Wearable electronics

Reference Books

6. Functional Finishes for Textiles: Improving Comfort, Performance and Protection (Woodhead Publishing Series in Textiles), Raushan Paul
7. Functional Textiles and Clothing, [G. Thilagavathi.](#), [M. Parthiban](#), [S. Viju](#)
8. Woodhead Publishing
9. Electronics in Textiles and Clothing: Design, Products and Applications [L. Ashok Kumar](#), [C. Vigneswaran](#), CRC Press
10. Smart Clothes and Wearable Technology, [J. McCann](#) (Editor), [David Bryson](#) Woodhead Publishing Series in Textiles

6.2 NTT 702: Clothing Science (L T P 2 0 0)

Unit 1: Definition of clothing comfort: importance of studying clothing comfort, various components and definition of clothing science, Brief introduction to the various processes related to comfort aspect: psychological, neurophysiological, physiological and physical, Psychology and Comfort: Psychological scaling, scales of measurement, wear trial technique, Aesthetic Comfort: General aspects, measurement of aesthetic properties, changes in aesthetic behavior

Unit 2; Neurophysiological basis of sensory perceptions: Perceptions of skin sensations related to mechanical stimuli: Dynamics of wear sensation, touch and pressure, prickle, itch and inflammation, roughness and scratchiness, Perceptions of sensations related to thermal and moisture stimuli: Fabric mechanical properties and tactile- pressure sensations: Fabric prickliness, fabric itchiness, fabric stiffness, fabric softness, fabric smoothness, roughness and scratchiness, fabric hand

Unit 3: Thermal Conductivity of Fibrous Materials: Various parameters and related factors that affect the thermal conduction through fibrous materials like fibrebatts, nonwoven fabrics, pile fabrics, woven and knitted fabrics, thickness, cover factor, fibre type, yarn structure, fibre morphology and shape, effect of fabric layers etc. Transient heat transfer mechanism (the warm-cool feeling): Kawabata's theoretical proposition of thermal diffusivity as an objective parameter for evaluation of warm-cool feeling, Hess's proposition of thermal absorbtivity as a more suitable parameter for the same purpose, Kawabata's instrument, Alambeta

Unit 4: Liquid Moisture Transfer through Fibrous Materials (Wicking and Water absorption): Theory of surface tension, theory of capillary action, wetting and wicking, interaction between liquid and fibrous materials, liquid spreading dynamics on a solid surface, Rayleigh instability, Lucas-Washburn theory, various theories and models on vertical and horizontal wicking through yarns, nonwoven fabrics and woven fabrics, absorption of water by a fibrous mass, objective measurement of wicking and absorption: angle of contact, droplet absorption test, vertical wicking, horizontal or transverse wicking tests

Unit 5: Transfer of moisture vapour through Fibrous Materials: Diffusion of vapour through a porous medium, various modeling approaches, moisture vapour permeability of fabrics, influence of various fabric parameters such as thickness, cover factor, etc. on the moisture vapour permeability, measurement of moisture vapour permeability, International standards.

Reference Book

7. Science in Clothing Comfort Apurba Das, R. Alagirusamy, Woodhead Publishing India Pvt Limited, 2010 - Technology & Engineering - 175 pages
8. Improving Comfort in Clothing edited by Guowen Song Woodhead Publications
9. Textiles for Cold Weather Apparel, J. Williams Woodhead Publications

4. NTT 705: Principle & design of spinning & weaving machines: (L T P 3 1 0) = 4

Unit 1: Design of cone drums for Scutcher, principles of mixing, opening, cleaning in Blow Room line, difference in aerodynamics of lint and trash and its utilization in blow room machinery design, redesigning of openers by using different principles for better performance. Transmission of motion to various parts of carding machine, different systems of carding web collection, sliver coiling system, Inertia of carding engine, latest carding machine developments.

Total Lectures Required = 9

Unit 2: Concept of lap formation for comber, designing concept of comber cylinder, top comb, detaching system, latest machinery developments in comber frame.

Different drafting systems in draw frame, roller weighing system, roller setting, and different stop motion, Differential motions used in speed frame, design of cone drums for speed frame, Design of flyer, building motion of speed frame.

Total Lectures Required = 9

Unit 3: Design and analysis of ring frame cams, designing concept of building motion of ring frame, design of ring spindle and bolster, designing concept of various rings and travelers.

Designing concepts of drum winding, designing of winding drum, traverse in different winding machines, Concepts of latest tensioners for winding, designing concept of slub catchers

Total Lectures Required = 9

Unit 4: Designing concepts of warping drums, sectional warping, designing concepts of high efficiency creels, Transmission of motion in warping machines, concept of designing of stop motions in warping, Designing concept of saw box for sizing machine, designing of drying cylinder, heating system for drying cylinder, latest machinery developments in sizing machines

Total Lectures Required = 9

Unit 5: Principles governing the design of looms. Mechanics of basic weaving operations, Kinetics of slay, slay eccentricity, designing concepts of tappet for different twill weaves, warp tension measurement and its control, Different picking system, weft insertion system of sulzer, rapier, airjet and waterjet systems. Brief introduction of electronic Dobby and Jacquard, Designing concept of multiphase weaving, mechanism of different stop motions on shuttleless looms. Designing concept of loom for 2.5 D, 3 D fabric, and multi-axial weaving.

Total Lectures Required = 9

Grand Total of Lectures Required = 45

Text Books & Reference Books

1. Spun Yarn Technology by Eric Oxtoby
2. The technology of Short Staple Spinning- W. Klien
3. Mechanics of Spinning by R.S. Rengasamy
4. Modern development in weaving machine, by Duxburg
5. Weaving mechanism, machine and management, by Talukdar.
6. Weaving mechanism, by Robinson
7. Modern weaving preparation and machinery, by A. Ormerod

5. Knitting Technology: (L T P 3 1 0) credits =4

Unit 1: Difference between knits and wovens, knitting terms and definitions (Course,, wale, stitch density) different type of knitting needles: bearded needle, latch needle, sinker, jack, cam arrangement, overlap, under lap, closed lap, open lap.

Total Lectures required =8

Unit 2: Comparison of warp and weft knitting, Classification of weft knitting machine, elements of knitting machine like type of needles, sinkers, etc Needle numbering system, technology of loop formation, geometry of loop structure, Elements of loop structure: needle loop, sinker loop, relation between yarn count, machine gauge and stitch density.

Total Lectures required =9

Unit 3: Classification of knit-structures, loop formation on: single jersey, Rib machines and inters look machines, socks knitting technology, Loop formation on flat bed machine

Total Lectures required =9

Unit 4: Four primary base knitting structures: Plain knitted fabric, Rib fabric, Interlock and Purl fabric, Special knitting machines: Fabric machine, garment length machine, flat machine, circular machine fabrics and Spacer fabrics.

Total Lectures required =7

Unit 5: Basic warp knitting machines, classification of warp knitting, Modern developments in weft knitting technique, calculations regarding production, gsm, stitch density etc, Causes and remedies of faults of knitted fabrics.

Total Lectures required =9

Grand total of lectures required = 42

Reference and Text Book-

1. Knitting Technology – Chamberlin
2. Knitting Technology – W.J. Spencer
3. International Textile Journal – Knitting
4. Knitting Calculation – Chamberlin
5. Wet Knitting Vol. 1&2 –Published by IIT New Delhi.
6. Knitting – NCUTE

Laboratory work: S per Lab Syllabus

7. Departmental Elective (L T P 3 1 0)

10.1 NTT 031 Garment Manufacture Technology (L T P 3 1 0)

Unit (1): Introduction to garment manufacturing technology, Sample cutting, ZFusing, Sewing, Pressing, Finishing and inspection, Line balancing concept. **Total Lectures required =8**

Unit (2): Introduction to measurement of fabric dimensional properties, fabric comfort, thermal comfort, objective evaluation of fabric, low stress fabric properties, Kawabata system, fabric assurance by sample testing, fabric defects, Fabric inspection and feedback to back process.

Total Lectures required =9

Unit (3) Introduction to garment cutting, Marker planning, Efficiency of Marker planning, methods of marker planning and marker use, spreading of the fabric, to form a lay, spreading requirements, methods of spreading, fabric packages, objective of cuttings, methods of cuttings

Total Lectures required =9

Unit (4): Introduction to seam, stitch, stitch classification, stitch structure, seam formation, joining material, surface characteristics, seam appearance, damages (thermal and mechanical), seam performance, seam degradation, seam failure, seam puckering and seam testing. Sewing needle and sewing thread, thread consumption

Total Lectures required =9

Unit 5: Introduction of spreading machines and cutting machines- types and functions, History of sewing machines. Sewing machinery- classification according to bed types, stitch types (hook or looper) material wise (extra light to heavy weight). Major parts of sewing machinery and functions. Parts, functions and adjustments of Over Lock: Collar turning machines, folding machinery fusing and pressing machinery, Computer controlled cutting, sewing, folding machinery. **Total Lectures required =8**

Grand total of lectures required = 42

Text Books and Reference material:

7. Introduction to Garment Manufacturing Technology By T Ramchandran
8. Garment Manufacturing Technology by By T Ramchandran
9. Practical Clothing Construction Part I & II by Mary Methews
Laboratory work: NA

10.2 NTT 032: Process Control in Spinning & Weaving (L T P 3 1 0)

Unit (1): Importance of evolving a system for process control, control of mixing quality through fibre characteristics, simultaneous control of mixing cost and quality, concept of bale management. Control of waste in blow room and carding, norms for waste and cleaning efficiency in blow room & card, control of neps, assessment of performance of blow room & card, control of comber waste, concept of yarn realization, calculation pertaining to waste & yarn realization. **Total Lectures required =9**

Unit (2) Measurement and analysis of productivity, means to improve productivity, maximizing machine efficiency in ring spinning, controlling end breakage rate in ring spinning, control of soft waste and hard waste, control of yarn faults and package defects- slubs, crackers, spinner's doubles, bad piecing & slough off.

Control of yarn quality- count, strength and their variability, study of CV% (within bobbin and between bobbin), control of variability of lea strength, single yarn strength and elongation %, Control of yarn unevenness, imperfections and hairiness. **Total Lectures required =9**

Unit (3): Scope of process control in weaving, systems of process control in weaving, setting norms and schedule of checks, machinery audit, optimizing quality of winding, control of quality of knot, producing good package, dressing of the beams for reducing incidence of cross ends.

Total Lectures required =9

Unit (4): Process control in warping, minimizing end breakage in warping, quality of warping beam, control of productivity, factors responsible for loss in efficiency, control of productivity, Process control in sizing, choice recipe and size pick-up, control of size pick-up, control of yarn stretch, quality of sized beams, **Total Lectures required =9**

Unit (5): Process control in loom shed, snap study and time and motion study, control of warp and weft breakage, causes and remedies of fabric defects, factors responsible for loss in efficiency, control of productivity, process control in grey inspection, and folding sections.

Total Lectures required =9

Grand total of lectures required = 45

Reference Books

1. Machine catalogues of various machines manufacture
2. Process Control in Spinning by ATIRA
3. Process control in weaving by ATIRA
4. Process Control in Spinning by K.R. Salhotra
5. Weaving tablets by ATIRA

7th SEMESTER LAB SYLLABUS

NTT-754: Knitting Technology Lab (L T P 0 0 2) Credits =1

To study the path of yarn through circular and flat knitting machine, different knitting elements including the cam system, driving mechanism of plain knitting machine, cloth take-up mechanism of plain knitting m/c, rib knitting m/c including arrangement of dial and cylinder needles, cam, system and driving mechanism, Interlock knitting m/c including arrangement of dial and cylinder needle, cam system and driving mechanism, Warp knitting machine constructional details and mechanism of operation.

NTT-751: Project (L T P 0 0 8) Credits = 4:

Students will carry out minor project during seventh semester as a part of curriculum as per UPTU guidelines.

NTT-752: Industrial training Viva Voice (L T P 0 0 2) Credits = 2

Students shall carryout industrial training as a part of their curriculum after the completion of their 3rd year for one month. After this their performance shall be evaluated during 7th semester by taking viva of each and every student.

8th SEMESTER TEXTILE ENGINEERING

7. OPEN ELECTIVE-II

1.1 NOE-081: NON-CONVENTIONAL ENERGY RESOURCES (L T P 3 1 0)

UNIT-I: Introduction to various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits. 3 Solar Cells: Theory of solar cells. solar cell materials, solar cell array, solar cell power plant, limitations. 4

UNIT-II: Solar Thermal Energy: Solar radiation, flat plate collectors and their materials, applications and performance, focussing of collectors and their materials, applications and performance; solar thermal power plants, thermal energy storage for solar heating and cooling, limitations. 9

UNIT-III: Geothermal Energy: Resources of geothermal energy, thermodynamics of geothermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations. 4 Magneto-hydrodynamics (MHD): Principle of working of MHD Power plant, performance and limitations. 2 Fuel Cells: Principle of working of various types of fuel cells and their working, performance and limitations. 3

UNIT-IV: Thermo-electrical and thermionic Conversions: Principle of working, performance and limitations. 2 Wind Energy: Wind power and its sources, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics. Performance and limitations of energy conversion systems. 6

UNIT-V: Bio-mass: Availability of bio-mass and its conversion theory. 2 Ocean Thermal Energy Conversion (OTEC): Availability, theory and working principle, performance and limitations. Wave and Tidal Wave: Principle of working, performance and limitations. Waste Recycling Plants. 3

Text/References Books:

1. Raja et al, "Introduction to Non-Conventional Energy Resources" Scitech Publications.
2. John Twideu and Tony Weir, "Renewal Energy Resources" BSP Publications, 2006.
3. M.V.R. Koteswara Rao, " Energy Resources: Conventional & Non-Conventional " BSP Publications,2006.
4. D.S. Chauhan,"Non-conventional Energy Resources" New Age International.
5. C.S. Solanki, "Renewal Energy Technologies: A Practical Guide for Beginners" PHI Learning. (14)

7.2 NOE 083- PRODUCT DEVELOPMENT (L T P 3 1 0)

UNIT-1: Concept of Product, definition and scope. Design definitions, old and new design methods, design by evolution, examples such as evolution of sewing M/C, bicycle, safety razor etc., need based developments, technology based developments physical reliability & economic feasibility of design concepts.

UNIT –II: Morphology of design, divergent, transformation and convergent phases of product design, identification of need, Analysis of need. Design criteria; functional, aesthetics, ergonomics, form, shape, size, colour. Mental blocks, Removal blocs, Ideation techniques, Creativity, Check list.

UNIT –III: Transformations, Brainstorming& Synetics, Morphological techniques. Utility Concept, Utility Value, Utility Index, Decision making under Multiple Criteria. Economic aspects, Fixed and variable costs, Break-even analysis.

UNIT-IV: Reliability considerations, Bath tub curve, Reliability of systems in series and parallel, Failure rate, MTTF and MTBF, Optimum spares from Reliability considerations. Design of display and controls, Man-machine interface, Compatibility of displays and controls. Ergonomic aspects, Anthropometric data and its importance in design. Application of Computers in Product development & design.

UNIT-V: Existing techniques, such as work-study, SQC etc. for improving method & quality of product. Innovation versus Invention. Technological Forecasting. Use of Standards for Design.

Text/Reference Books:

1. A.K. Chitab& R.C. Gupta “Product design & Manufacturing” – Prentice Hall (EE)
2. R.P. Crewford, “The Technology of creation Thinking” Prentice Hall.
3. C.D. Cain, “Product Design & Decision” Bussiness Books.
5. C.D. Cain, “Engg. Product Design” Bussiness Books

8. Theory of Textile Structure (NTT-801) (L T P 3 1 0) Credits =4

Unit (1): Classification of yarns, Yarn geometry- idealized yarn geometry, relationship of yarn number and twist factor, packing of fibres in a yarn, ideal packing, hexagonal close packing and radial packing, packing factor and its measurement, yarn diameter, method of measurement of twist contraction. **Total Lectures required =10**

Unit (2): Fibre migration: mean fibre position, amplitude of migration and frequency of migration, mechanism of migration, spinning-in coefficient and fibre extent. estimation of strength of blended yarn. **Total Lectures required =6**

Unit 3: Mechanism of staple fibre yarns, translation of fibre properties into yarn properties, twist and strength relationship, limit of twist, spinability of textile fibres, relation with end-breakage rate. **Total Lectures required =9**

Unit (4): Elements of fabric geometry, cloth setting theories, flexible and rigid thread model, Pierce's equation and later modifications. **Total Lectures required =7**

Unit (5): Relation of fabric properties to simple geometry, crimp interchange in woven fabric, crimp balance equation, Fabric cover, cover factor and their significance, relation between cover and weight per unit area of fabric, Theoretical treatment of fabric deformation in tension
Total Lectures required =10

Grand total of lectures required = 42

Text Books and Reference material:

2. Textile Yarn- B.C. Goswami, J.G. Martindale, F.L. Scardine
3. Textile structure- J.W.S. Hearle, S. Backer, Grossberg.
4. Pierce's geometry- Textile institute

3.1 NTT 041:- Mill Planning & Organization (L T P 3 1 0) Credits =4

Unit-I: Preparation of project—Spinning/Weaving/Processing/Composite

E- Selection of product

F- Site Selection (site, location, land and cost)

G- Building (single, double and multiple)

H- Plant and Machinery

Total lecture required 09

Unit-II

6. Industrial hazards: i. Fire hazards, ii. Mechanical hazards, iii. Electrical etc

7. Safety rules for prevention of accidents

8. Humidification of textile mill- humidifier and humidification

9. Ventilation, floor cleaning in textile mills, lightening

10. Air conditioning and Refrigeration system

Total lecture required 08

UNIT III:

Balancing of machine (plant layout for machines-- balancing of machines, layout of different machines, calculation for balancing of machines for different processes—spinning, weaving)

Total lecture required 07

UNIT IV

Production Costing—various terms used in costing (cost volume, profit analysis, cost allocation on waste, effect on cost direct , indirect

Various elements of costing- concept of estimation for costing, break-even analysis

Total lecture required 10

UNIT V

Economic Viability

Staff organization in textile mills – daily wages, various systems

Recruitment, allocation and skill development

Management and information system MIS

Total lecture required 08

Text Books & Reference Material

1. Industrial Engineering, Organization & management by Tarachand

2. Industrial Economics & Principle of Management by T.M. Chabra

3. Industrial Economics & Principle of Management by S. K Sharma

a. NTT 043:-TEXTILE MARKETING AND MERCHANDISING (L T P 3 1 0) =4

Unit 1: Introduction to Textile Marketing function; genesis, the marketing concept. Marketing Management System: objectives, its interfaces with other functions in the organisation. Environment of Textile Marketing, Political and Economic Environment, Market segmentation Consumer buying behaviour. Socio- cultural environment

Unit 2: Textile Marketing Strategy:- Marketing planning and Marketing programming. The concept of marketing mix, Product policy; the concept of textile product life cycle. New product decisions. Textile marketing and Pricing, Management of distribution: channels of distribution. Advertising and promotions. The concept of Unique Selling Proposition.

Unit 3: Implementation and Control. The marketing organization alternative organization structures; the concept of product management. Administration of the textile marketing programme: sales forecasting; marketing and sales budgeting; sales management; management of sales force. Evaluation of marketing performance; sales analysis; control of marketing effort; marketing audit

Unit 4: Jute textile sector, Silk textile sector, Man-made textile sector, Wool Textile sector, Statistics of Indian textile business (Domestic & Export) and World textile trade, Textile policy, World trade practices, norms, barriers, etc., Various pertinent prevailing issue impacting textile industry and trade, corporate social responsibility, ISO accreditation, etc., Retailing in textiles vis-a-vis consumer trends and behaviour and the challenges,

Unit 5: Textile Merchandising: Process of Planning, Purchasing, Motivating and Controlling of Materials in a optimum manner, vendor development, manufacturing, pricing, product design and development, exporting etc.

Reference Books:

11. Marketing Research A S Rao, Neha Publishers and distributors
12. Marketing: Connecting with Customers, Gilbert D. Harrell, Michigan State University ISBN-10: 0-9798304-7-1, Chicago Education Press, LLC.2012
13. **Pocket Textile Merchandising & Marketing Expert Hardcover – 2008** by Textile Industries Media Group
14. **Apparel Merchandising: The Line Starts Here, 2nd Edition** by Jeremy A. Rosenau , David L. Wilson, ISBN-13: 978-1563674488
15. Retail Merchandising Sapna Pradhan Tata McGraw Hill Education Private Limited 2009

5. Departmental Elective 5

4.1 NTT 051:- Advance Weaving Technology (L T P 3 1 0) Credits = 4

Unit (1): Principle of operation of shuttle-less loom, classification of shuttle-less looms, various systems of weft insertion, advantage of shuttle less looms over shuttle looms

Total Lectures required =8

Unit (2): Basic principle of sulzer projectile weaving, sequence of weft insertion i.e. weft supply system, feeding of yarn to projectile, Toggle-torsion bar picking mechanism, Cam driven shedding (dobby, card cutting, card reading, card wielding and card pasting), double cam beat-up, weaving machine timing advantages and limitations of sulzer looms, shuttle less weaving with more than one weft.

Total Lectures required =9

Unit 3: The rapier system of weft insertion, classification of rapier looms and its description, flexible and rigid rapier, tip transfer and loop transfer, weft control mechanism, loom timing

Total Lectures required =8

Unit (4): Working principle of air-jet weaving, essential requirements of shedding, sequence of weft insertion, weft measuring, weft tensioning, beating-up, weft gripping, weft cutting, weft stop motion and selvedge formation ,Problems in air-jet weaving machine, its remedies, design of nozzle, nozzle parameters affecting characteristics of air-jet, quality of air required, weaving machine timings, air drag force & factors affecting air drag force, blowing sequence of relay nozzles and timing control.

Total Lectures required =9

Unit (5): Water-jet weaving machine: principle of weft insertion, path of yarn on weaving machine, sequence of weft insertion i.e. weft supply system, feeding of yarn to main nozzle, picking mechanism, nozzle pump design, problems encountered, drying of fabric on weaving machine, quality of water required. **Total Lectures required =9**

Grand total of lectures required = 42

Text Books & Reference Material

1. Text Books and Reference material:
1. Modern development in weaving machine, by Duxburg
2. Weaving mechanism, machine and management, by Talukdar.
3. Weaving mechanism, by Robinson
4. Modern weaving preparation and machinery, by A. Ormerod

4.2 NTT 052: Technical Textiles (L T P 3 1 0) Credits =4

Unit (1): Introduction to technical textile, types of technical textiles, textiles used in industry such as filtration, filter fabric construction- woven, needle felt & knitted filter fabric, finishing treatment of filter fabric, thermal and chemical properties of filter fabric, essential requirements of good filter fabric. Application of nano technology and nano materials for the improved filtration.

Total Lectures required =8

Unit (2): Manufacture and properties of protective textiles- water proof/coated and water repellent, antimicrobial, flame retardant, chemical resistance, Nuclear and biological resistance, mechanical resistance such as bullet proof, cut prof, stab proof

Total Lectures required =9

Unit (3): Medical textiles, fibres used, classification of medical textiles- non-implantable material wound dressings, bandages, plasters, etc, Extra-corporal devices – Artificial kidney, liver lung, implantable material- suture, soft tissue implant, Orthopedic implants, Cardiovascular implants, Healthcare/ hygiene products, medical cost, surgical gown, face mast etc.

Total Lectures required =8

Unit (4): Smart textiles, brief introduction of smart textiles, classification of smart textiles, passive smart textiles, active smart textiles, brief discussion of smart shirt, smart suit, musical jacket, space suit etc. automotive textiles: type cord, seat belt, air bag, seat upholstery, carpets, headliners, helmets etc, Agro textile: Shade net, green house film, Mulch net, crop cover, anti hail and bird protection net, finishing net etc.

Total Lectures required =9

Unit (5): Introduction of geo textile, classification of geo textiles, functions of geo textile-soil reinforcement, drainage (fluid transmission), filtration, separation, erosion control/ absorption, objective of geo textiles, manufacturing of geo textile, essential properties of geo textiles- Mechanical determinants, Hydraulic determinants, durability determinants

Total Lectures required =8

Grand total of lectures required = 42

Text Books and Reference material:

7. Hand book of technical textiles- A.R. Horrocks & S.C. Anand
8. Smart fibre, fabrics and clothing Tao X
9. Shears handbook of industrial Textiles.

4.3 NTT 053:- Non-Woven (L T P 3 1 0) Credits =4

Unit 1: National and international scenario on non-woven fabric production, Concept about felts and non woven, Classification of non-woven fabrics, fibres for non-woven fabrics, Felt Manufacturing process

Total Lectures Required =9

Unit 2: Various method of web formation, web characteristics and their influence on properties of non-woven fabrics, (3) Non woven fabric by Needle punch, Description of needle punching machine, effect of process variables on properties of needle punch fabric

Total Lectures Required =9

Unit 3: Non-woven fabric by hydro entanglement, Description of hydro entanglement machine, effect of process variables on properties of hydro entanglement non woven fabric, Non-woven fabric by adhesive bonding, mechanical bonding, Melt blown process of non-woven fabric manufacturing

Total Lectures Required =8

Unit 4: Non-woven fabric by Stitch bonding, Non-woven fabric by chemical bonding, Non-woven fabric by bonding with thermoplastic adhesives, Non-woven fabric by Spun laced, Effect of process variables on properties of stitch bonding, chemical bonding spun laced non-woven fabrics.

Total Lectures Required =8

Unit 5: Flocked fabric, Laminates, latest development in non-woven industry: ultrasonic bonding, Infra-red bonding, bonding by bi-component fibres. Application of various non woven fabrics

Total Lectures Required =8

Grand total of Lectures required= 42

Reference & Text Books

1. Non Woven – N.N. Banarjee
2. Non woven – NCUTE
3. Knitting technology : Spencer

U.P TECHNICAL UNIVERSITY, LUCKNOW

Study and Evaluation scheme

B. Tech. Textile Technology

[Effective from the Session 2016-17]

YEAR 4th , SEMESTER- VII

S. No.	Subject Code	Name of Subject	Periods			Evaluation Scheme			Subject Total	Credits	
			L	T	P	Sessional Assessment					ESE
						CT	TA	Total			
THEORY SUBJECT											
1	NOE-071 NOE-072 /NOE-073	Entrepreneurship Development/ Quality Management/ Operation Research	3	1	0	30	20	50	100	150	4
2	NTT-701/ NTT-702	Functional Clothing/ Clothing Science	2	0	0	15	10	25	50	75	2
3	NTT-703	Advance Spinning Technology	3	1	0	30	20	50	100	150	4
4	NTT-704	Knitting Technology	3	1	0	30	20	50	100	150	4
5	NTT-031/ NTT-032	Garment manufacture Technology/ Process Control in Spinning & Weaving	3	1	0	30	20	50	100	150	4
PRACTICAL/ DESIGN/DRAWING											
6	NTT-751	PROJECT	0	0	8	-	50	50	100	150	4
7	NTT-752	Industrial Training	0	0	2	-	75	75		75	2
8	NTT-754	Knitting Technology Lab	0	0	2	10	10	20	30	50	1
	NGP 701	General Proficiency								50	
		Total	14	4	13					1000	25

Open Elective-II from other departments

Open Elective-1

1. NOE 701 Entrepreneurship Development
2. NOE-072 Quality Management
3. NOE-073 Operation Research

Open Elective-II from Other Departments

1. NTT-701 Functional Clothing
2. NTT-702 Clothing Science

Departmental Elective III

1. NTT-031 Garment manufacture Technology
2. NTT-032 Process Control in Spinning & Weaving

U.P TECHNICAL UNIVERSITY, LUCKNOW

Study and Evaluation scheme

B. Tech. Textile Technology

[Effective from the Session 2016-17]

YEAR 4th, SEMESTER- VIII

S. No.	Subject Code	Name of Subject	Periods			Evaluation Scheme			Subject Total	Credits	
			L	T	P	Sessional Assessment					
						CT	TA	Total			
THEORY SUBJECT											
1	NOE 081/ NOE 083	Non Conventional Energy Sources/ Product Development	3	1	0	30	20	50	100	150	4
2	NTT-801	Theory of Textile Structure	3	1	0	30	20	50	100	150	4
3	NTT-041/ NTT-043	Mill Planning & Organization/ Textile marketing & merchandizing	3	1	0	30	20	50	100	150	4
4	NTT-051/ NTT-052/	Advance Weaving Technology/ Technical Textiles	3	1	0	30	20	50	100	150	4
PRACTICAL/ DESIGN/DRAWING											
5	NTT-851	PROJECT	0	0	12		100	100	150	250	7
6	NTT-852	SEMINAR	0	0	3		100	100		100	2
	NGP-801	General proficiency								50	
		Total	12	4	15					1000	25

Open Elective from Other Departments

1. NOE-081: Non Conventional Energy Sources
2. NOE-083: Product Development

Departmental Elective IV

1. NTT-041 Mill Planning & Organization
2. NTT-042 Textile Marketing & Merchandizing

Departmental Elective V

1. NTT-051 Advance Weaving Technology
2. NTT-052 Technical Textiles

7th Semester **B. Tech. Textile Technology**

7. Open Elective- I from Other Department (L T P 3 1 0) credit =4

1.1 NOE-071: ENTREPRENEURSHIP DEVELOPMENT (L T P 3 1 0)

UNIT -I : Entrepreneurship- definition. growth of small scale industries in developing countries and their positions vis-a-vis large industries; role of small scale industries in the national economy; characteristics and types of small scale industries; demand based and resources based ancillaries and sub-control types. 5 Government policy for small scale industry; stages in starting a small scale industry. 2 (10)

UNIT –II: Project identification- assessment of viability, formulation, evaluation, financing, field-study and collection of information, preparation of project report, demand analysis, material balance and output methods, benefit cost analysis, discounted cash flow, internal rate of return and net present value methods. 8

UNIT –III: Accountancy- Preparation of balance sheets and assessment of economic viability, decision making, expected costs, planning and production control, quality control, marketing, industrial relations, sales and purchases, advertisement, wages and incentive, inventory control, preparation of financial reports, accounts and stores studies. 9

UNIT -IV: Project Planning and control: The financial functions, cost of capital approach in project planning and control. Economic evaluation, risk analysis, capital expenditures, policies and practices in public enterprises. profit planning and programming, planning cash flow, capital expenditure and operations. control of financial flows, control and communication. 9

UNIT –V: Laws concerning entrepreneur viz, partnership laws, business ownership, sales and income taxes and workman compensation act. 5 Role of various national and state agencies which render assistance to small scale industries. 2

Text / Reference Books:

1. Forbat, John, “Entrepreneurship” New Age International.
2. Havinal, Veerbhadrappa, “Management and Entrepreneurship” New Age International
3. Joseph, L. Massod, “Essential of Management", Prentice Hall of India.

1.2 Quality Management (NOE-072) (L T P 3 1 0) Credits = 4

UNIT-I : Quality Concepts: Evolution of Quality Control, concept change, TQM Modern concept, Quality concept in design, Review of design, Evolution of proto type.

Control on Purchased Product: Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure.

Manufacturing Quality: Methods and techniques for manufacture, inspection and control of product, quality in sales and services, guarantee, analysis of claims.

Total Lectures required =9

UNIT-II: Quality Management

Organization structure and design, quality function, decentralization, designing and fitting, organization for different type products and company, economics of quality value and contribution, quality cost, optimizing quality cost, seduction program.

Human Factor in quality: Attitude of top management, cooperation of groups, operators attitude, responsibility, causes of apparatus error and corrective methods.

Total Lectures required =9

UNIT-III: Control Charts, Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts.

Attributes of Control Chart, Defects, construction and analysis of charts, improvement by control chart, variable sample size, construction and analysis of C charts.

Total Lectures required =9

UNIT -IV : Defects diagnosis and prevention defect study, identification and analysis of defects, correcting measure, factors affecting reliability, MTTF, calculation of reliability, building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle.

Total Lectures required =9

UNIT –V: ISO-9000 and its concept of Quality Management, ISO 9000 series, Taguchi method, JIT in some details. **Total Lectures required =6**

Grand total of lectures required = 42

Text / Reference Books:

1. Lt. Gen. H. Lal, "Total Quality Management", Eastern Limited, 1990.
2. Greg Bounds, "Beyond Total Quality Management", McGraw Hill, 1994.
3. Menon, H.G, "TQM in New Product manufacturing", McGraw Hill 1992.

1.3 OPERATION RESEARCH (NOE-073) (L T P 3 1 0) Credits =4

UNIT-I: Introduction:

Definition and scope of operations research (OR), OR model, solving the OR model, art of modeling, phases of OR study.

Linear Programming: Two variable Linear Programming model and Graphical method of solution, Simplex method, Dual Simplex method, special cases of Linear Programming, duality, sensitivity analysis. **Total Lectures required =9**

UNIT-II : Transportation Problems:

Types of transportation problems, mathematical models, transportation algorithms,

Assignment: Allocation and assignment problems and models, processing of job through machines. **Total Lectures required =8**

UNIT-III : Network Techniques:

Shortest path model, minimum spanning Tree Problem, Max-Flow problem and Min-cost problem.

Project Management: Phases of project management, guidelines for network construction, CPM and PERT. **Total Lectures required =8**

UNIT-IV: Theory of Games:

Rectangular games, Minima theorem, graphical solution of $2 \times n$ or $m \times 2$ games, game with mixed strategies, reduction to linear programming model.

Quality Systems: Elements of Queuing model, generalized poisson queuing model, single server models. **Total Lectures required =9**

UNIT-V:

Inventory Control, Models of inventory, operation of inventory system, quantity discount., Replacement, Replacement models: Equipments that deteriorate with time, equipments that fail with time. **Total Lectures required =8**

Grand Total Lectures required =42

Text / Reference Books:

1. Wayne L. Winston, "Operations Research" Thomson Learning, 2003.
2. Hamdy H. Taha, "Operations Research-An Introduction" Pearson Education, 2003.
3. R. Panneer Seevam, "Operations Research" PHI Learning, 2008.
4. V.K.Khanna, "Total Quality Management" New Age International, 2008.

8. Open Elective from Other departments

2.1 NTT 701: Functional Clothing (L T P 2 0 0)

Unit 1: Definition of functional clothing, Classification of functional clothing, Functional finishes, ways to apply functional finishes on textile surfaces, Functional clothing market review

Unit 2: Functional Protective clothing: Nuclear biological Chemical protective clothing, extreme cold clothing; design, mechanism and applications, Fire retardant clothing, approaches to achieve fire retardancy in clothing, mechanism of fire retardancy, Soft and hard body armour , super thickening fluids (non-nutonean) for body armour, water proof beathable fabrics, ways to achieve waterproofness and breathability in textiles

Unit 3: Medical functional clothing: therapeutic and rehabilitative clothing, biosensing clothing, wound healing promoting dressings, antimicrobial sutures

Unit 4: Sportswear clothing: moisture management in sportswear, compression textiles, Aerodynamics, Spacesuit design and development, woven and knitted sportswear,

Unit 5: Cosmetotextiles: definition, classification, mechanism to develop various cosmetic effects in textiles, various cosmetoingredients, worldwide scene of cosmetotextiles, Smart Textiles, classification of smart textiles, Intelligent textiles, , mechanism of various types of smart textiles, Wearable electronics

Reference Books

11. Functional Finishes for Textiles: Improving Comfort, Performance and Protection (Woodhead Publishing Series in Textiles), Raushan Paul
12. Functional Textiles and Clothing, [G. Thilagavathi.](#), [M. Parthiban](#), [S. Viju](#)
13. Woodhead Publishing
14. Electronics in Textiles and Clothing: Design, Products and Applications [L. Ashok Kumar](#), [C. Vigneswaran](#), CRC Press
15. Smart Clothes and Wearable Technology, [J. McCann](#) (Editor), [David Bryson](#) Woodhead Publishing Series in Textiles

8.2 NTT 702: Clothing Science (L T P 2 0 0)

Unit 1: Definition of clothing comfort: importance of studying clothing comfort, various components and definition of clothing science, Brief introduction to the various processes related to comfort aspect: psychological, neurophysiological, physiological and physical, Psychology and Comfort: Psychological scaling, scales of measurement, wear trial technique, Aesthetic Comfort: General aspects, measurement of aesthetic properties, changes in aesthetic behavior

Unit 2; Neurophysiological basis of sensory perceptions: Perceptions of skin sensations related to mechanical stimuli: Dynamics of wear sensation, touch and pressure, prickle, itch and inflammation, roughness and scratchiness, Perceptions of sensations related to thermal and moisture stimuli: Fabric mechanical properties and tactile- pressure sensations: Fabric prickliness, fabric itchiness, fabric stiffness, fabric softness, fabric smoothness, roughness and scratchiness, fabric hand

Unit 3: Thermal Conductivity of Fibrous Materials: Various parameters and related factors that affect the thermal conduction through fibrous materials like fibrebatts, nonwoven fabrics, pile fabrics, woven and knitted fabrics, thickness, cover factor, fibre type, yarn structure, fibre morphology and shape, effect of fabric layers etc. Transient heat transfer mechanism (the warm-cool feeling): Kawabata's theoretical proposition of thermal diffusivity as an objective parameter for evaluation of warm-cool feeling, Hess's proposition of thermal absorbtivity as a more suitable parameter for the same purpose, Kawabata's instrument, Alambeta

Unit 4: Liquid Moisture Transfer through Fibrous Materials (Wicking and Water absorption): Theory of surface tension, theory of capillary action, wetting and wicking, interaction between liquid and fibrous materials, liquid spreading dynamics on a solid surface, Rayleigh instability, Lucas-Washburn theory, various theories and models on vertical and horizontal wicking through yarns, nonwoven fabrics and woven fabrics, absorption of water by a fibrous mass, objective measurement of wicking and absorption: angle of contact, droplet absorption test, vertical wicking, horizontal or transverse wicking tests

Unit 5: Transfer of moisture vapour through Fibrous Materials: Diffusion of vapour through a porous medium, various modeling approaches, moisture vapour permeability of fabrics, influence of various fabric parameters such as thickness, cover factor, etc. on the moisture vapour permeability, measurement of moisture vapour permeability, International standards.

Reference Book

10. Science in Clothing Comfort Apurba Das, R. Alagirusamy, Woodhead Publishing India Pvt Limited, 2010 - Technology & Engineering - 175 pages
11. Improving Comfort in Clothing edited by Guowen Song Woodhead Publications
12. Textiles for Cold Weather Apparel, J. Williams Woodhead Publications

5. NTT-703: Advance Spinning Technology (L T P 3 1 0) Credits =4

Unit-1: Open-end spinning processes, advantages and limitations of open-end spinning process. Rotor spinning- Objectives of rotor spinning, Mechanism of yarn formation on rotor spinning, Opening unit and yarn formation, Design of rotor, navel and yarn withdrawal tube.

Total Lectures Required = 8

Unit-2: Yarn characteristics and comparison of yarn properties with ring yarn, wrapper fibres, Rotor and ring yarn structure Effect of rotor variables and fibre properties on rotor spun yarns, Limitations of rotor spinning. **Total Lectures Required = 8**

Unit-3: Friction spinning- Principle, DREF-2 and DREF-3, yarn formation , yarn quality, yarn structure, fibre specifications for optimum results, merits & limitations, end use of friction spun yarn. **Total Lectures Required = 9**

Unit-4: Air jet Spinning-Principle, concept of false twist, Murata jet spinning, operation principle, Raw material requirement, Effect of process variables on yarn twist & tenacity, yarn quality, structure, properties and end uses of air jet spun yarns, limitation of air jet yarns.

Total Lectures Required = 9

Unit-5: Production of sewing thread, fancy yarns, core spun yarns, Tyre cord yarns, SIRO spinning, Electrostatic spinning, end uses of these yarns, merits & limitations.

Total Lectures Required = 8

Grant Total of Lectures Required =42

Reference Book-

1. NCUTE Series
2. The technology of short staple spinning- W. Klein
3. Spun Yarn technology- Eric Oxtoby
4. Spun Yarn technology, A. Venkatsubramani

6. Knitting Technology: (L T P 3 1 0) credits =4

Unit 1: Difference between knits and wovens, knitting terms and definitions (Course,, wale, stitch density) different type of knitting needles: bearded needle, latch needle, sinker, jack, cam arrangement, overlap, under lap, closed lap, open lap. **Total Lectures required =8**

Unit 2: Comparison of warp and weft knitting, Classification of weft knitting machine, elements of knitting machine like type of needles, sinkers, etc Needle numbering system, technology of loop formation, geometry of loop structure, Elements of loop structure: needle loop, sinker loop, relation between yarn count, machine gauge and stitch density. **Total Lectures required =9**

Unit 3: Classification of knit-structures, loop formation on: single jersey, Rib machines and inters look machines, socks knitting technology, Loop formation on flat bed machine
Total Lectures required =9

Unit 4: Four primary base knitting structures: Plain knitted fabric, Rib fabric, Interlock and Purl fabric, Special knitting machines: Fabric machine, garment length machine, flat machine, circular machine fabrics and Spacer fabrics. **Total Lectures required =7**

Unit 5: Basic warp knitting machines, classification of warp knitting, Modern developments in weft knitting technique, calculations regarding production, gsm, stitch density etc, Causes and remedies of faults of knitted fabrics. **Total Lectures required =9**

Grand total of lectures required = 42

Reference and Text Book-

1. Knitting Technology – Chamberlin
 2. Knitting Technology – W.J. Spencer
 3. International Textile Journal – Knitting
 4. Knitting Calculation – Chamberlin
 5. Wet Knitting Vol. 1&2 –Published by IIT New Delhi.
 6. Knitting – NCUTE
- Laboratory work: As per Lab Syllabus

8. Departmental Elective (L T P 3 1 0)

15.1 NTT 031 Garment Manufacture Technology (L T P 3 1 0)

Unit (1): Introduction to garment manufacturing technology, Sample cutting, Fusing, Sewing, Pressing, Finishing and inspection, Line balancing concept. **Total Lectures required =8**

Unit (2): Introduction to measurement of fabric dimensional properties, fabric comfort, thermal comfort, objective evaluation of fabric, low stress fabric properties, Kawabata system, fabric assurance by sample testing, fabric defects, Fabric inspection and feedback to back process.

Total Lectures required =9

Unit (3) Introduction to garment cutting, Marker planning, Efficiency of Marker planning, methods of marker planning and marker use, spreading of the fabric, to form a lay, spreading requirements, methods of spreading, fabric packages, objective of cuttings, methods of cuttings

Total Lectures required =9

Unit (4): Introduction to seam, stitch, stitch classification, stitch structure, seam formation, joining material, surface characteristics, seam appearance, damages (thermal and mechanical), seam performance, seam degradation, seam failure, seam puckering and seam testing. Sewing needle and sewing thread, thread consumption

Total Lectures required = 9

Unit 5: Introduction of spreading machines and cutting machines- types and functions, History of sewing machines. Sewing machinery- classification according to bed types, stitch types (hook or looper) material wise (extra light to heavy weight). Major parts of sewing machinery and functions. Parts, functions and adjustments of Over Lock: Collar turning machines, folding machinery fusing and pressing machinery, Computer controlled cutting, sewing, folding machinery.

Total Lecture Required: 8

Grand total of lectures required = 42

Text Books and Reference material:

10. Introduction to Garment Manufacturing Technology By T Ramchandran
 11. Garment Manufacturing Technology by By T Ramchandran
 12. Practical Clothing Construction Part I & II by Mary Methews
- Laboratory work: NA

15.2 NTT 032: Process Control in Spinning & Weaving (L T P 3 1 0)

Unit (1): Importance of evolving a system for process control, control of mixing quality through fibre characteristics, simultaneous control of mixing cost and quality, concept of bale management. Control of waste in blow room and carding, norms for waste and cleaning efficiency in blow room & card, control of neps, assessment of performance of blow room & card, control of comber waste, concept of yarn realization, calculation pertaining to waste & yarn realization **Total Lectures required =9**

Unit (2) Measurement and analysis of productivity, means to improve productivity, maximizing machine efficiency in ring spinning, controlling end breakage rate in ring spinning, control of soft waste and hard waste, control of yarn faults and package defects- slubs, crackers, spinner's doubles, bad piecing & slough off.

Control of yarn quality- count, strength and their variability, study of CV% (within bobbin and between bobbin), control of variability of lea strength, single yarn strength and elongation %, Control of yarn unevenness, imperfections and hairiness.

Total Lectures required =9

Unit (3): Scope of process control in weaving, systems of process control in weaving, setting norms and schedule of checks, machinery audit, optimizing quality of winding, control of quality of knot, producing good package, dressing of the beams for reducing incidence of cross ends.

Total Lectures required =9

Unit (4): Process control in warping, minimizing end breakage in warping, quality of warping beam, control of productivity, factors responsible for loss in efficiency, control of productivity, Process control in sizing, choice recipe and size pick-up, control of size pick-up, control of yarn stretch, quality of sized beams. **Total Lectures required =9**

Unit (5): Process control in loom shed, snap study and time and motion study, control of warp and weft breakage, causes and remedies of fabric defects, factors responsible for loss in efficiency, control of productivity, process control in grey inspection, and folding sections.

Total Lectures required =9

Grand total of lectures required = 45

Reference Books

6. Machine catalogues of various machines manufacture
7. Process Control in Spinning by ATIRA
8. Process control in weaving by ATIRA
9. Process Control in Spinning by K.R. Salhotra
10. Weaving tablets by ATIRA

Lab Syllabus

NTT-754: Knitting Technology Lab (L T P 0 0 2) Credits =1

To study the path of yarn through circular and flat knitting machine, different knitting elements including the cam system, driving mechanism of plain knitting machine, cloth take-up mechanism of plain knitting m/c, rib knitting m/c including arrangement of dial and cylinder needles, cam, system and driving mechanism, Interlock knitting m/c including arrangement of dial and cylinder needle, cam system and driving mechanism, Warp knitting machine constructional details and mechanism of operation.

NTT-751: Project (L T P 0 0 8) Credits = 4:

Students will carry out minor project during seventh semester as a part of curriculum as per UPTU guidelines.

NTT-752: Industrial training Viva Voice (L T P 0 0 2) Credits = 2

Students shall carryout industrial training as a part of their curriculum after the completion of their 3rd year for one month. After this their performance shall be evaluated during 7th semester by taking viva of each and every student.

8th Semester **B. Tech. Textile Technology**

9. OPEN ELECTIVE-II

1.1 NOE-081: NON-CONVENTIONAL ENERGY RESOURCES (L T P 3 1 0)

UNIT-I: Introduction to various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits. 3 Solar Cells: Theory of solar cells. solar cell materials, solar cell array, solar cell power plant, limitations. 4

UNIT-II: Solar Thermal Energy: Solar radiation, flat plate collectors and their materials, applications and performance, focussing of collectors and their materials, applications and performance; solar thermal power plants, thermal energy storage for solar heating and cooling, limitations. 9

UNIT-III: Geothermal Energy: Resources of geothermal energy, thermodynamics of geothermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations. 4 Magneto-hydrodynamics (MHD): Principle of working of MHD Power plant, performance and limitations. 2 Fuel Cells: Principle of working of various types of fuel cells and their working, performance and limitations. 3

UNIT-IV: Thermo-electrical and thermionic Conversions: Principle of working, performance and limitations. 2 Wind Energy: Wind power and its sources, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics. Performance and limitations of energy conversion systems. 6

UNIT-V: Bio-mass: Availability of bio-mass and its conversion theory. 2 Ocean Thermal Energy Conversion (OTEC): Availability, theory and working principle, performance and limitations. Wave and Tidal Wave: Principle of working, performance and limitations. Waste Recycling Plants. 3

Text/References Books:

1. Raja etal, "Introduction to Non-Conventional Energy Resources" Scitech Publications.
2. John Twideu and Tony Weir, "Renewal Energy Resources" BSP Publications, 2006.
3. M.V.R. Koteswara Rao, " Energy Resources: Conventional & Non-Conventional " BSP Publications,2006.
4. D.S. Chauhan,"Non-conventional Energy Resources" New Age International.
5. C.S. Solanki, "Renewal Energy Technologies: A Practical Guide for Beginners" PHI Learning. (14)

9.2 NOE 083- PRODUCT DEVELOPMENT

UNIT-1: Concept of Product, definition and scope. Design definitions, old and new design methods, design by evolution, examples such as evolution of sewing M/C, bicycle, safety razor etc., need based developments, technology based developments physical reliability & economic feasibility of design concepts.

UNIT –II: Morphology of design, divergent, transformation and convergent phases of product design, identification of need, Analysis of need. Design criteria; functional, aesthetics, ergonomics, form, shape, size, colour. Mental blocks, Removal blocs, Ideation techniques, Creativity, Check list.

UNIT –III: Transformations, Brainstorming& Synetics, Morphological techniques. Utility Concept, Utility Value, Utility Index, Decision making under Multiple Criteria. Economic aspects, Fixed and variable costs, Break-even analysis.

UNIT-IV: Reliability considerations, Bath tub curve, Reliability of systems in series and parallel, Failure rate, MTTF and MTBF, Optimum spares from Reliability considerations. Design of display and controls, Man-machine interface, Compatibility of displays and controls. Ergonomic aspects, Anthropometric data and its importance in design. Application of Computers in Product development & design.

UNIT-V: Existing techniques, such as work-study, SQC etc. for improving method & quality of product. Innovation versus Invention. Technological Forecasting. Use of Standards for Design.

Text/Reference Books:

1. A.K. Chitab& R.C. Gupta “Product design & Manufacturing” – Prentice Hall (EE)
2. R.P. Crewford, “The Technology of creation Thinking” Prentice Hall.
3. C.D. Cain, “Product Design & Decision” Bussiness Books.
5. C.D. Cain, “Engg. Product Design” Bussiness Books.

10. Theory of Textile Structure (NTT-801) (L T P 3 1 0) Credits =4

Unit (1): Classification of yarns, Yarn geometry- idealized yarn geometry, relationship of yarn number and twist factor, packing of fibres in a yarn, ideal packing, hexagonal close packing and radial packing, packing factor and its measurement, yarn diameter, method of measurement of twist contraction. **Total Lectures required =10**

Unit (2): Fibre migration: mean fibre position, amplitude of migration and frequency of migration, mechanism of migration, spinning-in coefficient and fibre extent. estimation of strength of blended yarn **Total Lectures required =6**

Unit 3: Mechanism of staple fibre yarns, translation of fibre properties into yarn properties, twist and strength relationship, limit of twist, spinability of textile fibres, relation with end-breakage rate. **Total Lectures required =9**

Unit (4): Elements of fabric geometry, cloth setting theories, flexible and rigid thread model, Pierce's equation and later modifications.
Total Lectures required =7

Unit (5): Relation of fabric properties to simple geometry, crimp interchange in woven fabric, crimp balance equation, Fabric cover, cover factor and their significance, relation between cover and weight per unit area of fabric, Theoretical treatment of fabric deformation in tension
Total Lectures required =10

Grand total of lectures required = 42

Text Books and Reference material:

6. Textile Yarn- B.C. Goswami, J.G. Martindale, F.L. Scardine
7. Textile structure- J.W.S. Hearle, S. Backer, Grossberg.
8. Pierce's geometry- Textile institute

3. Departmental Elective 4

3.1 NTT 041:- Mill Planning & Organization (L T P 3 1 0) Credits =4

Unit-I: Preparation of project—Spinning/Weaving/Processing/Composite

I- Selection of product

J- Site Selection (site, location, land and cost)

K- Building (single, double and multiple)

L- Plant and Machinery

Total lecture required 09

Unit-II

11. Industrial hazards: i. Fire hazards, ii. Mechanical hazards, iii. Electrical etc

12. Safety rules for prevention of accidents

13. Humidification of textile mill- humidifier and humidification

14. Ventilation, floor cleaning in textile mills, lightening

15. Air conditioning and Refrigeration system

Total lecture required 08

UNIT III:

Balancing of machine (plant layout for machines-- balancing of machines, layout of different machines, calculation for balancing of machines for different processes—spinning, weaving)

Total lecture required 07

UNIT IV

Production Costing—various terms used in costing (cost volume, profit analysis, cost allocation on waste, effect on cost direct , indirect

Various elements of costing- concept of estimation for costing, break-even analysis

Total lecture required 10

UNIT V

Economic Viability

Staff organization in textile mills – daily wages, various systems

Recruitment, allocation and skill development

Management and information system MIS

Total lecture required 08

Text Books & Reference Material

1. Industrial Engineering, Organization & management by Tarachand

2. Industrial Economics & Principle of Management by T.M. Chabra

3. Industrial Economics & Principle of Management by S. K Sharma

a. NTT 043:-TEXTILE MARKETING AND MERCHANDISING (L T P 3 1 0) =4

Unit 1: Introduction to Textile Marketing function; genesis, the marketing concept. Marketing Management System: objectives, its interfaces with other functions in the organisation. Environment of Textile Marketing, Political and Economic Environment, Market segmentation Consumer buying behaviour. Socio- cultural environment

Unit 2: Textile Marketing Strategy:- Marketing planning and Marketing programming. The concept of marketing mix, Product policy; the concept of textile product life cycle. New product decisions. Textile marketing and Pricing, Management of distribution: channels of distribution. Advertising and promotions. The concept of Unique Selling Proposition.

Unit 3: Implementation and Control. The marketing organization alternative organization structures; the concept of product management. Administration of the textile marketing programme: sales forecasting; marketing and sales budgeting; sales management; management of sales force. Evaluation of marketing performance; sales analysis; control of marketing effort; marketing audit

Unit 4: Jute textile sector, Silk textile sector, Man-made textile sector, Wool Textile sector, Statistics of Indian textile business (Domestic & Export) and World textile trade, Textile policy, World trade practices, norms, barriers, etc., Various pertinent prevailing issue impacting textile industry and trade, corporate social responsibility, ISO accreditation, etc., Retailing in textiles vis-a-vis consumer trends and behaviour and the challenges,

Unit 5: Textile Merchandising: Process of Planning, Purchasing, Motivating and Controlling of Materials in a optimum manner, vendor development, manufacturing, pricing, product design and development, exporting etc.

Reference Books:

16. Marketing Research A S Rao, Neha Publishers and distributors
17. Marketing: Connecting with Customers, Gilbert D. Harrell, Michigan State University ISBN-10: 0-9798304-7-1, Chicago Education Press, LLC.2012
18. **Pocket Textile Merchandising & Marketing Expert Hardcover – 2008** by Textile Industries Media Group
19. **Apparel Merchandising: The Line Starts Here, 2nd Edition** by Jeremy A. Rosenau , David L. Wilson, ISBN-13: 978-1563674488
20. Retail Merchandising Sapna Pradhan Tata McGraw Hill Education Private Limited 2009

9. Departmental Elective 5

4.1 NTT 051:- Advance Weaving Technology (L T P 3 1 0) Credits = 4

Unit (1): Principle of operation of shuttle-less loom, classification of shuttle-less looms, various systems of weft insertion, advantage of shuttle less looms over shuttle looms

Total Lectures required =8

Unit (2): Basic principle of sulzer projectile weaving, sequence of weft insertion i.e. weft supply system, feeding of yarn to projectile, Toggle-torsion bar picking mechanism, Cam driven shedding (dobby, card cutting, card reading, card wielding and card pasting), double cam beat-up, weaving machine timing advantages and limitations of sulzer looms, shuttle less weaving with more than one weft.

Total Lectures required =9

Unit 3: The rapier system of weft insertion, classification of rapier looms and its description, flexible and rigid rapier, tip transfer and loop transfer, weft control mechanism, loom timing

Total Lectures required =8

Unit (4): Working principle of air-jet weaving, essential requirements of shedding, sequence of weft insertion, weft measuring, weft tensioning, beating-up, weft gripping, weft cutting, weft stop motion and selvedge formation ,Problems in air-jet weaving machine, its remedies, design of nozzle, nozzle parameters affecting characteristics of air-jet, quality of air required, weaving machine timings, air drag force & factors affecting air drag force, blowing sequence of relay nozzles and timing control.

Total Lectures required =9

Unit (5): Water-jet weaving machine: principle of weft insertion, path of yarn on weaving machine, sequence of weft insertion i.e. weft supply system, feeding of yarn to main nozzle, picking mechanism, nozzle pump design, problems encountered, drying of fabric on weaving machine, quality of water required. **Total Lectures required =9**

Grand total of lectures required = 42

Text Books & Reference Material

2. Text Books and Reference material:
5. Modern development in weaving machine, by Duxburg
6. Weaving mechanism, machine and management, by Talukdar.
7. Weaving mechanism, by Robinson
8. Modern weaving preparation and machinery, by A. Ormerod
9. Woven terry fabric-manufacturing and quality management- Woodhead, JP Singh

4.2 NTT 052: Technical Textiles (L T P 3 1 0) Credits =4

Unit (1): Introduction to technical textile, types of technical textiles, textiles used in industry such as filtration, filter fabric construction- woven, needle felt & knitted filter fabric, finishing treatment of filter fabric, thermal and chemical properties of filter fabric, essential requirements of good filter fabric. Application of nano technology and nano materials for the improved filtration.

Total Lectures required =8

Unit (2): Manufacture and properties of protective textiles- water proof/coated and water repellent, antimicrobial, flame retardant, chemical resistance, Nuclear and biological resistance, mechanical resistance such as bullet proof, cut proof, stab proof

Total Lectures required =9

Unit (3): Medical textiles, fibres used, classification of medical textiles- non-implantable material wound dressings, bandages, plasters, etc, Extra-corporal devices – Artificial kidney, liver lung, implantable material- suture, soft tissue implant, Orthopedic implants, Cardiovascular implants, Healthcare/ hygiene products, medical cost, surgical gown, face mast etc.

Total Lectures required =8

Unit (4): Smart textiles, brief introduction of smart textiles, classification of smart textiles, passive smart textiles, active smart textiles, brief discussion of smart shirt, smart suit, musical jacket, space suit etc. automotive textiles: type cord, seat belt, air bag, seat upholstery, carpets, headliners, helmets etc, Agro textile: Shade net, green house film, Mulch net, crop cover, anti hail and bird protection net, finishing net etc.

Total Lectures required =9

Unit (5): Introduction of geo textile, classification of geo textiles, functions of geo textile-soil reinforcement, drainage (fluid transmission), filtration, separation, erosion control/ absorption, objective of geo textiles, manufacturing of geo textile, essential properties of geo textiles- Mechanical determinants, Hydraulic determinants, durability determinants

Total Lectures required =8

Grand total of lectures required = 42

Text Books and Reference material:

10. Hand book of technical textiles- A.R. Horrocks & S.C. Anand
11. Smart fibre, fabrics and clothing Tao X
12. Shears handbook of industrial Textiles.

