

**STUDY & EVALUATION SCHEME FOR  
B.TECH. FOURTH YEAR  
(TEXTILE CHEMISTRY)**

**ON**

**CHOICE BASED CREDIT SYSTEM (CBCS)**  
(Effective from session 2019-20)

**DR. APJ ABDUL KALAM TECHNICAL UNIVERSITY, LUCKNOW**

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**STUDY AND EVALUATION SCHEME**  
**B. TECH TEXTILECHEMISTRY**

**4<sup>th</sup> Year VII-SEMESTER**

**Effective from SESSION-2019-20**

S. No.	Subject Code	Subject Name	L-T-P	Th./Lab Marks	Sessional		Total	Credit
				ESE	CT	TA		
<b>Theory</b>								
1	ROE-071 ROE-072	<b>OPEN ELECTIVE COURSE -1</b> Quality Management Operation Research	3-0-0	70	20	10	100	3
2	RTT031 RTT033	<b>DEPARTMENTAL ELECTIVES-3</b> Nonwoven Technology/ Waste Management & Pollution Control	3-0-0	70	20	10	100	3
3	RTT041 RTT043	<b>DEPARTMENTAL ELECTIVES-4</b> Theory of Textile Structure / Coating of Textiles	3-1-0	70	20	10	100	4
4	RTT705	Technology of Finishing-II	3-1-0	70	20	10	100	4
5	RTT706	Textile Chemicals and Quality Testing	3-0-0	70	20	10	100	3
<b>Practical</b>								
6	RTT755	Technology of Finishing-II Lab	0-0-2	50		50	100	1
7	RTT756	Textile Chemicals and Quality Testing Lab	0-0-2	50		50	100	1
8	RTT753	Industrial Training	0-0-2			100	100	2
9	RTT754	PROJECT-1	0-0-2			200	200	3
	<b>TOTAL</b>			450	100	450	<b>1000</b>	<b>24</b>

**OPEN ELECTIVE COURSE -1**

1. Quality Management
2. Operation Research

**DEPARTMENTAL ELECTIVES-3**

1. RTT-031 Nonwoven Technology
2. RTT-033 Waste Management & Pollution Control

**DEPARTMENTAL ELECTIVES-4**

1. RTT-041 Theory of Textile Structure
2. RTT-043 Coating of Textiles

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**STUDY AND EVALUATION SCHEME**  
**B. TECH TEXTILECHEMISTRY**

**4<sup>th</sup> Year VIII-SEMESTER**

**Effective from SESSION-2019-20**

S. No.	Subject Code	Subject Name	L-T-P	Th./Lab Marks	Sessional		Total	Credit
				ESE	CT	Ta		
1	ROE- O81 ROE- 082	<b>OPEN ELECTIVE COURSE -2</b> Non- Conventional Energy Resources(MOOCs) Product Development	3-0-0	70	20	10	100	3
2	RTT051/ RTT053/ RTT055	<b>DEPARTMENTAL ELECTIVES-5</b> Technical Textiles /Advances in Chemical Processing / Textured Yarn Technology (NPTL/MOOCs)	3-1-0	70	20	10	100	4
3	RTT063/ RTT064/ RTT 065	<b>DEPARTMENTAL ELECTIVES-6</b> Process House Planning &Management Garment Processing/ Evaluation of textile materials (NPTL/MOOCs)	3-0-0	70	20	10	100	3
<b>Practical</b>								
4	RTT851	SEMINAR	0-0-3			100	100	2
5	RTT852	PROJECT	0-0-12	350		250	600	12
	<b>TOTAL</b>			560	60	380	<b>1000</b>	<b>24</b>

**OPEN ELECTIVE COURSE -2**

1. ROE- O81 Non- Conventional Energy Resources
2. ROE- 082 Product Development

**DEPARTMENTAL ELECTIVES-5**

1. RTT-051 Technical Textiles Advances in Chemical Processing
2. RTT-053 Advances in Chemical Processing
3. RTT055 Textured Yarn Technology (NPTL/MOOCs)

## DEPARTMENTAL ELECTIVES-6

1. RTT-063 Process House Planning & Management
2. RTT-064 Garment Processing
3. RTT 065 Evaluation of textile materials (NPTL/MOOCs)

## 7<sup>th</sup> SEMESTER, B. TECH TEXTILE CHEMISTRY

### OPEN ELECTIVE COURSE- 1

#### 1.1 Quality Management (ROE-071)

**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.

## **1.2 OPERATION RESEARCH (ROE-072)**

**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. Panneerseevam, "Operations Research" PHI Learning, 2008.
4. V.K.Khanna, "Total Quality Management" New Age International, 2008.

#### **DEPARTMENTAL ELECTIVE-3**

##### **2.1 RTT-031:-Non-woven Technology**

**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

**3.2 RTT-033:-Waste Management & Pollution Control (L T P 3-0-0)**

**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.

**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.

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 Carter L.W.- Mc Graw Hill Publications

## **DEPARTMENT ELECTIVE**

### **2.1 RTT-041:-Theory of Textile Structure (L T P 3-1-0)**

**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:**

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

### **3.2 RTT-043:-Coating of Textiles(L T P 3-1-0)**

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

**Total lecture required=7**



**Unit-2:** Coating Methods: Knife coating , Roller coating transfer coating , 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 (2).

**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 areawt/area , Degree of fusion/curing- (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:**

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

**4.1 RTT-705:-Technology of Finishing-II (L T P 3-1-0)**

**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 woollen fabrics- Moth proofing, permanent set & testing. Anti felting

**Total lecture required=-7**

**Unit – 4:** Finishing of Synthetic fibres/fabric – Heat setting, Delusturing, antistatic, soil resistance finishes Finishing of synthetics 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& Vaidya
3. Chemical finishing of textiles by W D Schindler and P J Hauser- Woodhead Publishing Ltd
4. Textile Finishing by V.A. Shenai
4. Chemical Finishing, GaPS, Published by NITRA

#### **5.1 RTT-706:-Textile Chemicals and Quality Testing (L T P 3-1-0=4)**

**Unit 1:**Introduction to textile chemical testing – aim and scope, Quantitative chemical analysis of textile fibres and their blends, Quantitative estimation of bleaching agents and dyes.

**Total lecture required -8**

**Unit 2:**Colour fastness of dyes on textiles (wash, light, rubbing, hot press, perspiration) using National and International standards (BIS, AATCC, ISO). Evaluation of Wet treatments

**Total lecture required -7**

**Unit 3:**Estimation of mechanical and chemical degradation of cotton, wool, silk and polyester (aldehyde and carboxyl group estimation in cellulose, amino group estimation of protein fibres, fluidity/viscosity measurement, critical dissolution time, etc).

**Total lecture required -9**

**Unit 4:**Evaluation of various chemicals, auxiliaries used in wet processing plants, Analysis of fresh water and effluent, Measurement of viscosity of chemical ingredients, printing paste, instruments used in chemical analysis.

**Total lecture required -8**

**Unit 5:**Process and quality control in wet processing, Industrial practices for their maintenance, Check points and evaluation of all wet pretreatments, dyeing, printing and finishing.

**Total lecture required -10**

## **Grand total of lectures required : 42**

<u>Title</u>	<u>Author</u>
1. Analytical Methods for a Textile laboratory	JW Weaver
2. Technology of Textile Processing	VA Shenai
3. Pretreatment of textile materials for dyeing and printing Published by NITRA	Prof. (Dr.) M.S. Parmar,
4. AATCC Technical Manual Vol.-76	

## **Lab syllabus**

### **7.1 RTT-756:- Textile Chemicals and Quality Testing Lab**

Quantitative analysis of textile fibres and their blends. Strength analysis of hydrogen peroxide, Strength analysis of sodium carbonate and Strength analysis of sodium hydroxide, Identification of dyes, Colourfastness properties

### **6.1 RTT-755 Technology of Finishing-II**

Water repellency treatment on fabric and analysis of water repellency of treated fabric, Application of Flame retardant agents on textiles and their analysis using vertical, horizontal and inclined (45°) methods, Application of softeners on textiles, Application anti crease finishes on textiles and evaluation, application soil release finishes on textiles and evaluation, moth proofing.

### **8.1 RTT-753 Industrial Training**

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

### **9.1 RTT 754 Project**

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

## **8<sup>TH</sup> SEMESTER B. TECH TEXTILE CHEMISTRY**

### **OPEN ELECTIVE COURSE- 2**

#### **1.1 ROE-081: NON-CONVENTIONAL ENERGY RESOURCES(NPTEL/MOOCs)**

[https://onlinecourses.nptel.ac.in/noc18\\_ge09/preview](https://onlinecourses.nptel.ac.in/noc18_ge09/preview)

**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)

**1.2 ROE 082- 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” Business Books.
4. C.D. Cain, “Engg. Product Design” Business Books

**DEPARTMENTAL ELECTIVES-5**

**2.1 RTT051:-Technical Textiles**

**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 TextilesI

## **2.2 RTT053:-Advances in Chemical Processing (L T P 3-1-0)**

**Unit 1-** Developments in pretreatment: Quick response pretreatment, continuous open width processing, use of environment friendly chemicals, application of enzymes. Other developments like solvent scouring, combined preparatory processes

**Total Lectures required =9**

**Unit 2-** Developments in dyeing and dyes: New forms of dyes, i.e. encapsulated, polymeric, pearl and granular forms. New direct, reactive and disperse dyes. Dyeing of microfibre fabrics. Continuous dyeing, right-first-time approach, Super critical CO<sub>2</sub> dyeing.

**Total Lectures required =10**

**Unit 3-**Developments in printing: Automated colour kitchens, Kerosene substitutes, Novel printing techniques like Ink Jet printing, Xerox printing.Ink, machinery and process for Digital printing.

**Total Lectures required =7**

**Unit 4-** Developments in finishing: Zero formaldehyde easy-care finishes and use of Polycarboxylic acids, polysiloxanes based softeners, restriction on use of some Fire retardants . Breathable water-proof fabrics. Finishing of microfibre fabrics.

**Total Lectures required =8**

**Unit 5-** Plasma technology; Effect and application on textiles, E-Control processing; Eco-friendly processing of textiles. Eco conformance certifications – OekoTex (Confidence in Textiles), GOTS, REACH, etc.

**Total Lectures required =8**

**Grand total of lectures required: 42**

**Text Books and Reference material:**

- 1- Plasma technologies for textiles – R Shishoo, Woodhead Publishing Ltd
- 2- Coloration Technology
- 3- Review of Progress in Coloration
- 4- AATCC Review
- 5- Pretreatment of textile materials for dyeing and printing - Prof. (Dr.) M.S. Parmar, Published by NITRA

### **2.3 Textured Yarn Technology:**

**Unit 1-** Introduction to texturing, General principles involved in the manufacture of textured yarns, Bulked yarns

**Total Lectures required =9**

**Unit 2-** Mechanisms of setting and texturing, Thermo-mechanical texturing, Characterization and optimization, Influence of material and process parameters, Influence of process parameters

**Total Lectures required =10**

**Unit 3-**Influence of process parameters, Draw Texturing, Simultaneous draw texturing with POY, Draw Texturing Machines & Process Parameters, Draw Texturing : Effect of Process Parameters

**Total Lectures required =7**

**Unit 4-** Draw Texturing : Positorque System, Friction Draw Texturing, Air-Jet Texturing

**Total Lectures required =8**

**Unit 5-**Air-Jet Texturing : Effect of Process parameters, Air-Texturing Jets, Interlacement: need and jet design, Bulked continuous filament yarns, Hi-bulk yarns, Texturing of spun yarns, Solvent texturing.

**Total Lectures required =8**

**Grand total of lectures required: 42**

**DEPARTMENTAL ELECTIVES-6**



### **3.1 RTT063:- Process House Planning & Management (L T P3-0-0)**

**Unit-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

**Total Lectures required= 8**

**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 Lectures required=9**

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

**Total 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

**Total Lectures required= 9**

**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 Lectures required= 7**

**Grand total of lectures required: 40**

#### **Reference Books**

- 1- Dye house management, Colour Publication, Bombay
- 2-Health hazards in Textile mills by NITRA
- 3-Energy Conservation in Textile WET Processing by Dr.M.L. Gulrajani, Mahajan publication, Ahemdabad.
- 4-Modern Textile Management-J.BRattan, 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 inn Textile mills by V.A.Shenai,Sevak Publication, Mumbai

8. Pre-treatment of textile materials for dyeing and printing - Prof. (Dr.) M.S. Parmar,  
Published by NITRA

### **3.2 RTT-064:-Garment Processing (L T P 3-0-0)**

**Unit 1:** Introduction to Garment processing - Importance of garment processing- Advantages and limitations of garment processing – Characteristics of various fibers used in garment, manufacturing with respect to garment processing. Major issues in Garment processing

**Total lecture required -7**

**Unit 2 :Garment Dyeing:** Concepts of garment stage and pre garment stage dyeing- General precautions for garment dyeing – flow chart for garment dyeing - Various machinery used for Garment, dyeing like paddle dyeing machine, drum dyeing machine, Drying of garment dyed goods – Various drying machinery like Hydroextractor, Tumble, dryer, RF dryer, Problems in Garment dyeing and its remedies.

**Total lecture required -10**

**Unit 3: Garment Printing:** Special print recipes for garments – Khadi– Metallic – Flock – Plastizol – Reflective – Pearl – Fluorescent – High density printing. Puff Printing – Foil Printing – Plastic, Printing of Garments with Photochromatic and Thermo chromatic dyes, Garment Printing Machinery, Table printing- Multi arm flatbed printing machine for Garments, Transfer printing

**Total lecture required -9**

**Unit 4:Garment Finishing:** Classification – Flow chart, Fragrance finish – UV protection finish - Cool finish - thermo cat finish – water resistant breathable finishes

**Total lecture required -7**

**Unit 5: Garment Washing:**Introduction – Various wash down effect - Stone washing – Various stone washing effects, enzyme wash. Other novel wash down effects like Acid wash, Antique wash, Denim Hand Sand /Scraping- Sand Blasting – Ball Blasting - Whiskering – Ozone Fading – Back Staining- causes and remedies, Laundering, its objective – Laundering procedure for garments made up of various fibers like cotton, linen, wool, silk and manmade textiles – various laundering equipment

**Total lecture required -10**

**Grand total of lectures required =43**

#### **References Books:**

1. Dinkar Mahajan- Know All About Denim- Mahajan Publishers Private Limited, Ahmadabad.
2. Chemical Finishing of textiles by W D Schindler and P J Hauser
3. Textile finishing by Derek Heywood
4. Chemical after treatments of textiles by Mark, Atlas & Wooding
5. Textile Finishing by A J Hall

6. Denim: A Fabric for all by Dr M.S.Parmar, S.S.Satsangi and Dr Jaiprakash, NITRA Publication

### **3.3 Evaluation of textile materials (NPTL/MOOCs)**

**Unit (1):** Evaluation of Textile Materials, Sampling Methods & Sample Size, Sampling Methods & Sample Size: Practical Statistics, Evaluation of Fibre Length.

**Total Lectures required =9**

**Unit (2)** Evaluation of Fibre Fineness, Evaluation of Cotton Fibre Maturity, Evaluation of Yarn Twist

**Total Lectures required =9**

**Unit (3):** Evaluation of Cotton Fibre Properties:(HVI & AFIS), Evaluation of Linear Density of Textile Materials, Evaluation of Moisture in Textiles, Evaluation of Yarn & Fabric Hairiness

**Total Lectures required =9**

**Unit (4):** Evaluation of Tensile Properties of Textile Materials, Evaluation of Tensile Properties of Textile Materials-1, Evaluation of Tensile Properties of Textile Materials-2, Evaluation of Tensile Properties of Textile Materials-3,4,5

**Total Lectures required =9**

**Unit (5):** Evaluation of Yarn Evenness-1-5 Evaluation of Bursting & Tear Strength of Fabrics, Evaluation of Pilling & Abrasion Properties of Fabrics, Evaluation of Low Stress Mechanical Properties of Textile Materials,

#### **4.1 RTT 851 Seminar**

#### **5.1 RTT 852 Project**

Students will carry out major project during eighth semester as a part of curriculum as per AKTU guidelines.

