PROPOSED STUDY & EVALUATION SCHEME
FOR
B. TECH.
(TEXTILE CHEMISTRY)
ON
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**Department Elective I:**

1. RTC051: Polymer Chemistry
2. RTC052: Industrial Chemistry
## Study and Evaluation Scheme
### B. Tech Textile Chemistry

#### 3rd Year VI-Semester

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**Department Elective I:**

1. **RTC061:** Fabric Structure & Analysis
2. **RTC062:** Chemistry of Dyes & Colour Chemistry/
5th Semester B. Tech. Textile Chemistry

1. Managerial Economies (L T P 3-0-0: As per AKTU syllabus by concerned BoS)
2. Sociology/ Cyber Security (L T P 3-0-0 = 3): As per AKTU Syllabus
3. Textile Testing-I (L T P 3-1-0 = 4)
   - Unit (1): Introduction to fiber, yarn and fabric testing, sampling, random sampling, biased sampling, sampling techniques, square and cut-square technique, selection of sample for testing.
   - **Total Lectures required = 8**
   - Unit (2): Atmospheric conditions for testing, absolute and relative humidity, moisture regain & moisture content and their measurement, dry and wet bulb hygrometer, importance of moisture in textiles, effect of moisture on properties (physical, & mechanical) of textile material, factors affecting the regain, Shirley moisture meter, control of atmospheric conditions during testing.
   - **Total Lectures required = 9**

   - Unit (3): Measurement of physical characteristics of cotton viz. length, fineness, maturity, bundle strength, colour and foreign matter including principle, construction, operation, and calibration of the equipment in common use.
   - **Total Lectures required = 8**

   - Unit (4): Mechanical properties of fibres, relation between structure and mechanical properties of fibres, Measurement of physical properties of man-made fibres i.e. length, denier, strength, elongation, modulus, work of rupture, crimp, spin finish, fibre quality index etc.
   - **Total Lectures required = 8**

   - Unit (5): Determination of yarn count, diameter, resultant count of folded yarn, relation between Ne, D, T, Nm, Instruments used for determination of count, quadrant balance, Knowles balance, Beeslay balance and physical balance, Twist, classification of twist, twist measurement, direct counting method, continuous twist tester, twist-untwist method, Twist tester, R.B. twist tester, level of twist.
   - **Total Lectures required = 9**

Grand total of lectures required = 42

Text Books and Reference material:
1. Quality control and testing management, by V.K. Kothari
2. Principles of textile testing, by J.E. Booth
3. Physical testing of textiles, by B.P. Savile

Laboratory work: As per lab syllabus
4. **Technology of Dyeing-II (L T P 3-0-0 = 3)**

Unit – 1: Mass coloration of Man Made fibres viz, polyester, nylon, acrylics, viscose and various methods- colour additions in polymerization, chips coating, master batch addition systems, Advantages and limitations of the above processes.

**Total lecture required – 9**

Unit – 2: Development in dyeing m/is- jet dyeing m/cs, soft flow m/cs, infra colour dyeing m/cs, closed jiggers and contentious dyeing ranges.

**Total lecture required – 7**

Unit – 3: Natural dyes (1), their sources and extraction, Different mordents used in dyeing, different methods – pre, post, simultaneous mordanting.

**Total lecture required – 9**

Unit – 4: Dyeing of cotton, wool, silk, with natural dyes Fastness properties of dyed goods, Light, washing rubbing, sublimation perspiration etc.

**Total lecture required – 9**

Unit 5: Computer colour matching, colour matching tristimulus values, spectral match, Delta and K/S values, K-M theory, Technique for CCM for textiles, Advantage of CCM. German Ban, its importance and acts, various pollutants caused by dyeing with various dyes.

**Total lecture required – 8**

**Total lecture required – 40**

**Reference & text Books:**
1. Technology of Dyeing Vol 6 by V.A. Shenai
2. Dyeing & Chemical technology of textile Fibres by E.R. Trotman
3. Textile Chemistry Vol III by R.H. Peters
4. Chemical Processing of Synthetic Fibres & Blends by Datye & Vaidhya

5. **Technology of Printing-I (L T P 3-0-0 = 3)**

Unit (1): Introduction to printing, methods and styles of printing, classification of printing thickeners and methods of thickners paste preparation, emulsion thickners, synthetic thickeners, and mechanism of viscosity build up in emulsion and synthetic thickness, Rheological behavior of thickeners **Total Lectures Required = 9**

Unit (2): Preparation of cloth for printing, preparation of paste for printing, General description, preparation of paste, wetting agents, hygroscopic chemicals dispersing agents, oxidation and reducing agents etc., precaution **Total Lectures Required = 9**

Unit (3): Methods of printing - block printing, block preparation, spray printing, transfer printing-fundamental principle of transfer printing, various machines and application techniques, its advantages and disadvantages (2), roller engraving and chroming rollers. **Total Lectures Required = 8**
Unit (4): Screen printing- preparation of screens, Manual and automatic flat bed screen printing, rotary screen printing, rotary screen preparation-manual and photosensitive, its method of application, merits and demerits. Faults and prevention in printing methods, Total Lectures Required = 8

Unit (5): Pigment printing of cotton, Faults in printing & their prevention. Methods of print fixation, and machines used for after treatment of printing goods- steaming, ageing, curing etc. Total Lectures Required = 8

Grand Total of lectures required = 42

Text Books/Reference Books:-
1. Tech. Of printing - V.A. Shenai
2. Printing - D.G. Kale
3. Tech. Of textile printing – R.S. Prayag

6. Departmental Elective 1 (L T P 3-1-0 = 4) Polymer Chemistry/ Industrial Chemistry

a) Polymer Chemistry (3-1-0)

Unit (1) Scope of Polymer Chemistry, (a) definition of monomers, homo-polymers and copolymers (b) Chemistry of important monomers (c) Thermo sets (d) Thermoplastic (e) Elastomers (f) Tg, Tm, and solution properties of polymers. Total Lectures Required = 9

Unit (2) Condensation polymerization (b) Mechanism, kinetic and molecular weight build up, (c) Bulk, Solution, Emulsion and suspension polymerization (d) comparison of condensation and addition polymerization. Total Lectures Required = 8

Unit (3): Addition polymerization , (b) Type of addition polymerization , (c) Radical, cationic and anionic polymerization (d) Mechanism and kinetics of polymerization (e) Copolymerization, Stereo-Regular polymerization, Block and Graft polymerization. Total Lectures Required = 9

Unit (4): Characterization of molecular weight of polymers, End-Group analysis method, Viscosity of measurement method, gel permeable chromatography. Techniques for measurement Polydispersity Total Lectures Required = 8

Unit (5): Application of polymer to textiles, Fiber forming synthetic polymer, Properties of fiber forming synthetic polymer. Total Lectures Required = 8

Grand Total Lectures required = 42

Text Books & Reference Books:
1. Text Book of Polymer science by F.W. Bill Meyer
3. Polymer science by Gawaskar, Vishwanathan, sreedhar and Jaydev
4. Polymer chemistry by B.K.Sharma

b) Industrial Chemistry( 3-1-0)
Unit (1): Clausius-Claparyon equation and its applications, General Phase theory-Phase rule, phase equilibrium and P.T. diagram for one component system, Equilibrium in two and three component system. Total Lectures required = 09

Unit (2): General introduction about Acids- (a) Hydrochloric Acid, Sulphuric Acid, (b) Acetic Acid, Formic Acid; (3) Alcohols, Aldehydes, and Ketones and their application in textiles. Total Lectures required = 08

Unit (3): General methods of preparation and properties of Monohydric alcohols, polyhydric alcohols e.g. Glycol and glycerol, Aldehydes-formaldehyde and Ketones-acetone, Dicarboxylic acids-oxalic acid, DMF and their application in textiles. Total Lectures required = 08

Unit (4): Introduction of Solution- saturated and unsaturated, ideal and non ideal solution. Different type of concentration units, Effect of temperature on concentration. Total Lectures required = 08

Unit (5): Determination of strength of hypochlorite, hydrogen peroxide, hydrosulphite, Estimation of strength of NaOH containing sodium carbonate volumetrically and by Tw meter. Total Lectures required = 09

Grand Total Lectures required = 34

Reference books:
1. Industrial Chemistry by B.K. Sharma
2. Synthetic Organic Chemistry by Chatwal and Gurdeep
3. Chemistry of Dyes and Principles of Dying by V.A. Shenai
4. Physical Chemistry of Surfaces by A.W. Adamson
5. Chemical Principles of Synthetic Fibre Dying by S.M. Burkinshaw
6. Physical Chemistry of Dying by Vickerstaff

Laboratory work: As per the lab Syllabus
6th Semester B. Tech. Textile Chemistry

1. Industrial Management (L T P 3-0-0 = 3): As per concerned BoS AKTU

2. Cyber Security/ Sociology (L T P 3-0-0 = 3) As per BoS AKTU Syllabus

3. Textile Testing-II (L T P 3-1-0= 4)
   
   Unit (1): Tensile properties of yarn and fabric, stress-strain curve, various methods for finding of yield point, methods for finding of various modulus, destination of tenacity, and stiffness of fabric. **Total Lectures Required = 7**
   
   Unit (2): Procedure of determination of strength and elongation in the spun yarns, knowledge about the equipment used, yarn tensile strength testing machines, single yarn strength tester, lea strength tester, fabric strength tester- impact tester, Grab test, fabric B.S. Test, Scott serigraph, Instron tensile tester. **Total Lectures Required = 9**
   
   Unit (3): Measurement of evenness testing of yarns, nature and causes of irregularities, principles and methods of evenness testing, evaluation and interpretation of evenness diagram & spectrogram and their associated equipment, Classimat faults. **Total Lectures required =9**
   
   Unit (4): Measurement of physical properties of fabric and the knowledge of the equipment used, tensile strength, bursting strength, tearing strength, pilling, air permeability, crimp, thickness, EPI, PPI, weight and cover factor. **Total Lectures required =10**
   
   Unit (5): Measurement of water repellency, shrinkage, measurement of fastness to light and rubbing, thermal transmission, Brief introduction to FAST and KAWABATA. **Total Lectures required =7**
   
   **Grand total of lectures required = 42**

Text Books & Reference Books: -

1. Physical testing of textiles by B.P. Saville.
2. Quality control and testing management by Dr. V.K. Kothari.
4. Quality control by V.K. Kothari

4. Technology of Printing-II (L T P 3-0-0 = 3)
   
   Unit-1: Various styles of printing including direct, resist & discharge style of printing, printing of cotton, wool and silk with different dye classes using the above styles. **Total lecture required=9**
**Unit-2:** Printing with different dye classes of polyester, nylon, acrylic and their blends such as p/v, p/e, wool/acrylic, wool/nylon and different types of union fabrics-cotton/wool, cotton/silk etc. With different dye classes. **Total lecture required = 9**

**Unit-3:** Other styles of printing like raised, crepon, damask, metal and flock, Poly chromatic dyeing, foam printing, bubble printing etc. **Total lecture required = 8**

**Unit-4:** Various machines used for drying (1) steaming, washing, ageing and curing ) Transfer printing, methods. Sublimation, transfer printing of polyester Digital or inkjet printing. **Total lecture required = 8**

**Unit-5:** Printing of non woven’s-carpet, hosiery goods and bonded goods, inkjet printing, camaflouge printing, costing of printing. **Total lecture required = 8**

**Grand Total lecture required = 42**

**Text Books/ Reference & text Books:**
1. Technology of Printing by V.A. Shenai
2. Technology of Printing by G.D. Kale
3. Chemical Processing of Synthetic Fibres & Blends by Datye & Vaidhya

5. **Technology of Finishing-I (L T P 3-0-0 = 3)**
   **Unit – 1:** Principle of finishing of cotton, wool, silk, linen & jute, Classification of various finishing – (a) Mechanical, Chemical, , Temporary and durable/ permanent finishes, semi- permanent. **Total lectures = 10**

   **Unit – 2:** Finishing machines – Mangle & their function, drying machines-, Stentering, Calendaring, Sanforising, Decatlising. **Total lecture required – 8**

   **Unit – 3:** Beetling of linen, Crimping of Silk & rayon, Softening, Stiffening. **Total lecture required – 8**

   **Unit – 4:** Easy care finish, minimum application technique including foam technology-blow ratio foam generator, stabilizer, applicator. **Total lecture required= 8**

   **Unit – 5:** Finishing of woolen fabrics Dry Wet decatising, Felting, Milling, Permanent Setting, Shrink Proofing. **Total lecture required = 8**

**Total no. of lectures =42**

**Reference & Text 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
6. Chemistry of Dyes & Colour Chemistry/ Fabric Structure & Analysis (L T P 3-1-0 =4)  
   a) Chemistry of Dyes & Colour Chemistry  

   Unit 1: Fractional distillation of coal tar and its products, and their use in textile industry (3), Isolation of Xylene, Benzene, Toluene, Naphthalene and Anthracene, **Total lectures required = 8**  

   Unit 2: (4) Unit organic process/operation sulphonation, nitration, amination and hydroxy compound **Total lectures required = 8**  

   Unit 3: Classification of dyes according to chemical constitution Relation between coulour and chemical constitution. Methods of preparation of Nitro,nitroso, Azo:-mono-azo and di-azo, diphenyl methane and tri phenyl methane dyes., **Total lectures required = 10**  

   Unit 4: Chemistry of anthraquionone, acridine Chemistry of reactive dyes- monochloro triazine and dichlorotriazine, identification of dyes on fibres. **Total lectures required = 8**  

   **Grand total lectures required = 36**  

   **Text Book:** -  
   1. Synthetic dye stuff: Cain & thrope  

   **Reference Book:**  
   3. Process of dye chemistry: Fierz, David & Ballengray  
   4. Dyeing and chemical technology of fibre: E.K. Frotran  
   5. Processing of textile fibres: Sadov  
   6. Chemistry of synthetic dyes: Venkataraman  

b) Fabric Structure & Analysis (L T P 3-1-0=4)  

   Unit (1): Classification of various fabrics, construction of plain weave and its derivatives (rib and mat weave), ordinary twill, right hand twill, warp faced, weft faced & balanced twills, **Total Lectures required = 8**  

   Unit (2): Satin regular, irregular and their extension. Combined twills, end to end and pick-to-pick combination, elongated twills, steep twills, broken twill, curved twill, Fancy twills-large diagonal shaded twills, Wave/ zig-zag, herringbone twill. **Total Lectures Required = 8**  

   Unit (3): Regular and irregular satin, sateen base diagonals and brained twills, Diamond, mock leno, ordinary honeycomb, brighten honeycomb , Huck-a-back and crepe weave. **Total Lectures Required = 9**  

   Unit (4): derivatives of hopsack, barley corn stitched hopsack and twilled hopsack, Ripstop weave, Simple and wadded bed ford cords (1), weft and piques (1), principle of figuring with extra material extra warp figuring, extra weft, limitation of extra thread.
Total Lectures Required = 9
Grand Total Lectures Required = 34

Reference Book: -
2. Z.J Grosicki Watson’s Textile design and colour Newnes Butter Worth, London.

Laboratory work: As per the lab Syllabus
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#### PRACTICALS

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7th SEMESTER, B. TECH TEXTILE CHEMISTRY

1. Open Elective 1: (L T P 3-0-0) Syllabus As decided by AKTU

2. Departmental Elective-5

a) 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, 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

b) 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

Total Lectures Required =9

Total Lectures Required =8
Total Lectures Required =8

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. Department Elective-4

a) 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
3. Pierce’s geometry- Textile institute

b) Quality Control in Chemical Processing

Unit 1: Reviewing various areas of chemical processing of textiles. Pretreatment: Optimized process parameters imparted to textiles in pretreatment and quality of products obtained, viz. singeing, desizing, scouring, bleaching, mercerization,
Unit 2: Assessment of quality of pretreated product after each stage. Colouration: Optimized dyeing parameters for dyeing of natural, manmade and blended textiles and quality of dyed product,
Unit 3: Quality printing in various styles and methods. Finishing: Optimized finishing parameters to impart various finishes on different fibres. Process parameters / process modification / any other changes.
Unit 4: Change in quality due to selection of impure chemicals / faulty fabric / machine handing. Methods to assess quality of processed product after every stage of processing and that of final product.
Unit 5: Standardization of instruments / machineries, analysis of colour to check impurity percentage, evaluation of chemicals to check their efficiencies.
Books Recommended

4. Technology of Finishing-II

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

5. Advances in Chemical Processing

Combined pretreatment methods: Basic criteria for combining pretreatment methods, combined desizing and bleaching, scouring and bleaching, desizing - scouring and bleaching of natural, manmade and blended textiles. Controlled application techniques: Concept of short liquor processing: advantages and limitations, Short liquor pretreatment and dyeing of various textiles, Performance assessment of each method. Fastness determination: Various Fastness criteria of dyed and printed textile. Grading and methods to determine fastness

6. Books Recommended:


8TH SEMESTER B. TECH TEXTILE CHEMISTRY

1. OPEN ELECTIVE(L T P 3-0-0) Syllabus as Decided by AKTU
2. Departmental Elective-5
a) Coating of Textiles

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

b) Technical Textiles


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:
2. Smart fibre, fabrics and clothing Tao X
3. Shears handbook of industrial Textiles

3. Departmental Elective-6
a) Process House Planning & Management

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.BRattan, Abhishek Publication, Chandigarh.
5-Water and effluents in textile by ATIRA.
6-Economy, energy and environment in textile wet processing by S.S. Trived.
7-Occupational Health and Safety inn Textile mills by Dr. V.A.Shenai,Sevak Publication, Mumbai
8-Energy Conservation in Textile WET Processing by Dr.M.L. Gulrajani, Mahajan publication, Ahmedabad.

b) **Garment Processing**

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

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.

chromatic dyes –, Garment Printing Machinery, Table printing- Multi arm flat bed printing machine for Garments, Digital printing, Transfer printing

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

Unit 5: Garment Washing, Introduction – Various wash down effect - Flow chart – Stone washing – Various stone, less stone washing effects like enzyme wash, Mud wash, Ion wash, Chalk wash and Monkey wash. Other novel wash down effects like Acid wash, Antique wash, Denim Hand Sand / Scraping- Sand Blasting – Ball Blasting - Whiskering – Ozone Fading – Back Staining- It’s causes and remedies, Laundering, Objective – Laundering procedure for garments made up of various fibers like cotton, linen, wool, silk and manmade textiles – various laundering equipments

References Books:
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