

**M.D. UNIVERSITY, ROHTAK
SCHEME OF STUDIES AND
EXAMINATION**

**B.TECH (TEXTILE CHEMISTRY)
SEMESTER 7TH AND 8TH**

SCHEME EFFECTIVE FROM 2021-22

M.D. UNIVERSITY, ROHTAK
SCHEME OF STUDIES AND EXAMINATION effective from 2021-22
4 year Curriculum structure
Undergraduate Degree in Engineering & Technology
Branch / Course: Bachelor of Technology (Textile Chemistry)
Total credits (4 year course) 160
Seventh Semester

Sr No.	Category	Course Code	Course Title	Hours per week			Total Contact hrs/week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Class work	Theory	Practical	Total	
1	Professional Elective Courses	PEC-III	Elective-III	3	0	0	3	3	25	75	-	100	3
2	Professional Elective Courses	PEC-IV	Elective-IV	3	0	0	3	3	25	75	-	100	3
3	Open Elective Courses	OEC-IV	Open Elective-IV	3	0	0	3	3	25	75	-	100	3
4	Professional Core Course	LC-TC-401G	Colour Measurement & CCM Lab	1	0	3	4	2	25	-	25	50	3
5	Project/Internship	PROJ-TC-401G	Mill Practice (Evaluation)	0	0	0	0	5	100	-	100	200	Viva
6	Project/Internship	PROJ-TC-402G	Seminar	0	0	2	2	-	-	-	-	-	-
7	Project/Internship	PROJ-TC-403G	Project Work (Mid Term Evaluation)	0	0	4	4	2	100	-	-	100	Viva
TOTAL CREDITS								18	300	225	125	650	

S.No.	Category	Course Code	Name of the Course	Preferred Semester
Elective-III				
1.	PEC-III	PEC-TC-401G	Colour Measurement & Computer Colour Matching	VII
2.		PEC-TC-402G	Theory of Colouration of Textiles	VII
3.		PEC-TC-403G	Sustainable Textile Chemical Processing	VII
Elective-IV				
1.	PEC-IV	PEC-TC-404G	Developments in Textile Chemical Processing	VII
2.		PEC-TC-406G	Advance Chemical Processing	VII
3.		PEC-TC-407G	Emerging trends in Chemical Processing of Textiles	VII
Open Elective-IV				
1.	OEC-IV	OEC-TT/TC-401G	Production and Operation Management in Textile	VII
2.		OEC-TT/TC-402G	Finance, Material & Human Resource Management	VII
3.		OEC-TT/TC/FAE-403G	Fashion Retailing and Promotion	VII

M.D. UNIVERSITY, ROHTAK
SCHEME OF STUDIES AND EXAMINATION effective from 2021-22
4 year Curriculum structure
Undergraduate Degree in Engineering & Technology
Branch / Course: Bachelor of Technology (Textile Chemistry)
Total credits (4 year course) 160
Eighth Semester

Sr No.	Category	Course Code	Course Title	Hours per week			Total Contact hrs/week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Class work	Theory	Practical	Total	
1	Professional Elective Courses	PEC-V	Elective-V	3	0	0	3	3	25	75		100	3
2	Professional Elective Courses	PEC-VI	Elective-VI	3	0	0	3	3	25	75		100	3
3	Open Elective Courses	OEC-V	Open Elective-V	3	0	0	3	3	25	75		100	3
4	Project/Internship	PROJ-TC-402G	Seminar	0	0	4	4	2	200			200	Presentation
5	Project/Internship	PROJ-TC-404G	Project Work (Final Evaluation)	0	0	12	12	6	100		100	200	Viva
TOTAL CREDITS								17	375	225	100	700	

S.No.	Category	Course Code	Name of the Course	Preferred Semester
Elective-V				
1.	PEC-V	PEC-TC-408G	Process & Quality Control in Chemical Processing	VIII
2.		PEC-TC-409G	Energy Conservation in Wet Processing	VIII
3.		PEC-TC-410G	Textile Process House Management	VIII
Elective-VI				
1.	PEC-VI	PEC-TC-411G	Environmental Aspects of Textile Processing	VIII
2.		PEC-TC-412G	Eco-friendly Processing & Manufacturing of Textiles	VIII
3.		PEC-TT/TC-405G	Non-Woven Technology	VIII
Open Elective-V				
1.	OEC-V	OEC-TT/TC-407G	Technical Textiles	VIII
2.		OEC-TT/TC/FAE-404G	High Performance Fibres	VIII
3.		OEC-TC/FAE-405G	Sportswear Textiles and Accessories	VIII

DETAIL SYLLABUS

Semester 7th

PEC–TC–401G Colour Measurement & Computer Colour Matching

Course code	PEC-TC-401G				
Category	Professional Elective Course (PEC-III)				
Course title	Colour Measurement & Computer Colour Matching				
Scheme and Credits	L	T	P	Credits	Semester–VII
	3	0	0	3	
Branch	Textile Chemistry				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre–requisites: Elementary idea of colour physic.

Course Objectives:

1. To understand the basis of the perception of color.
2. To know various methods of quantification of colour like Munsell, CIE, Hunter etc.
3. To discuss the working principle of spectrophotometers and their types.
4. To understand the applications of CCM in textile industry like shade matching, recipe prediction, shade sorting etc.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Basic concept of colour. Perception of colour and human colour vision. Colour order systems: Munsell's colour order system. Relationship of Hue, Value and Chroma. Additive and subtractive colour mixing laws. Laws of absorption & scattering of light (Beer-Lambert's law). Source of natural light and artificial light.

UNIT-II

Principle of colour measurement: CIE illuminants. Standard observer colour matching functions. Concept of 2° and 10° observer angle. Quantification of colour: The CIE System, Tristimulus Values, Chromaticity co-ordinates. Limitations of CIE system. Transformations and

improvements in CIE system: CIE L,a,b values. Colour difference equations or formulae and concept of shade matching. Metamerism and its types.

UNIT-III

Colour Measurement Instruments. Introduction to colorimeter. Principle and working of Reflectance and transmission spectrophotometers. Brief idea on types of Spectrophotometers (single beam, double beam, dual beam and microflash spectrophotometers). Precautions to be taken for spectrophotometer. Calibration of Spectrophotometers. Main features of modern spectrophotometers. Variables affecting visual and instrumental estimates of colour.

UNIT-IV

Application to textile processing: Kubelka-Munk Theory and Equation, relative dye strength and tone analysis, Recipe formulation, batch correction, shade library and shade sorting. Assessment of whiteness, yellowness and brightness in textiles. Colour measurement and fastness assessment. Computing and analyzing CCM results. On-line colour measurement. Advantages & limitations of CCM.

Reading List

Title	Author
Instrumental Colour Measurements and Computer Aided Colour Matching for Textiles	H S Shah & R S Gandhi
Computer Colour Matching	A D Sule
Colour Technology: Tools, Techniques & Applications	V C Gupte
Total Colour Management in Textiles	John H Xin
Colour Measurement: Principles, advances and industrial applications	M L Gulrajni

Course Outcomes:

At the end of the course, the students will be:

1. Able to understand the concept of color perception by human.
2. Able to understand the various methods of color quantification.
3. Aware of working of spectrophotometer and their types.
4. Able to understand the various applications of CCM in textile industry.

PEC-TC-402G Theory of Colouration of Textiles

Course code	PEC-TC-402G				
Category	Professional Elective Course (PEC-III)				
Course title	Theory of Colouration of Textiles				
Scheme and Credits	L	T	P	Credits	Semester-VII
	3	0	0	3	
Branch	Textile Chemistry				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre-requisites: Knowledge of Physical chemistry, Chemistry of Fibres and Dyeing of textiles.

Course Objectives:

1. To explain theoretical aspect of dyeing and related thermodynamics.
2. To discuss kinetics of dyeing process.
3. To discuss theoretical aspect of dyeing of synthetic fibres.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Introduction to the theory of dyeing. Physical chemistry essential for dyeing theory. Definition of terms and mathematical equation relevant to physio-chemical aspect of dyeing such as, standard affinity, heat of dyeing, entropy of dyeing, saturation value, adsorption on sites etc. Chemical potential of dyes, activity of dye in solution and in fibre.

UNIT-II

Thermodynamics of dyeing: Adsorption isotherms and experimental design their determination. Classification of adsorption isotherm and their applicability to different dye fibre systems. Standard affinity equation representing different adsorption isotherm. Dye fibre interactions and analytical methods for their investigations. Monolayer technique and continuous variable method to identify dye – fibre bonds.

UNIT-III

Kinetics of Dyeing: Methods for measurement of diffusion coefficient and different equation used for calculation of diffusion coefficient. Significance of diffusion coefficient in relation of physical structure of fibre. Determination of diffusion coefficient of dyes suitable for natural and synthetic fibres.

UNIT-IV

Role of fibre structure in dyeing. Glass transition temperature and its effect on dye ability and dye diffusion. Factors affecting dye diffusion, Fick's first and second laws of diffusion, William Landel ferry (WLF) equation and its significance.

Reading List

Title	Author
Physical chemistry of dyeing	Thomas Vickerstaff
Theory of Coloration of Textiles (Society of Dyers and Colourists)	Alan Johnson
Theory of Coloration of Textiles	C L Bird and Boston
Chemical Processing of Synthetic fibres	Dr. K. V. Datye & A. A. Vaidya

Course Outcomes:

At the end of the course, the students will be:

1. Illustrate theoretical aspect of dyeing and related thermodynamics.
2. Interpret theoretical aspect of dyeing of natural fibres.
3. Interpret theoretical aspect of dyeing of synthetic fibres.

PEC-TC-403G Sustainable Textile Chemical Processing

Course code	PEC-TC-403G				
Category	Professional Elective Course (PEC-III)				
Course title	Sustainable Textile Chemical Processing				
Scheme and Credits	L	T	P	Credits	Semester-VII
	3	0	0	3	
Branch	Textile Chemistry				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre-requisites: Basic idea of textile chemical processing: pre-treatments, dyeing, printing and finishing of textiles.

Course Objectives:

1. To understand concept of sustainability for chemical processing.
2. To discuss the application of enzymes in textile chemical processing for sustainability.
3. To understand the sustainable developments related to textile dyeing and printing.
4. To explain the concept sustainability in waste water treatment for textile processing.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Sustainability, Principles of sustainability, Sustainability issues in current textile production, Sustainable processing: Greener textile materials, Greener preparatory processes, Sustainable fibre production introduction.

UNIT-II

Eco-friendly Processing: Enzyme with their definition, sources, types, mechanism of application. Various types of enzyme used in textile processing, advantage and disadvantage of enzymes, different process of textile processing with enzyme application.

UNIT-III

Sustainable approaches in textile coloration: Water-less dyeing (supercritical CO₂ dyeing). Digital Printing technique. Greener dyeing processes, Salt free reactive dyeing concept. Plasma technology in textile processing.

UNIT-IV

Sustainable Waste water treatment: Effluent load and effluent treatment plant. Alternative ways of reduction waste water load in processing. Sustainable chemical management and zero discharges. E-control in textile chemical processing.

Reading List

Title

Author

Sustainable Innovations in Textile Chemical Processes

S S Muthu

Biotechnology in Textile processing

G. M. Guebitz, A. Cavaco-Paulo, R. Kozlowski

Chemical Finishing of Textiles

W.D. Schindler and P.J. Hauser

Sustainable Fibres and Textiles

S S Muthu

Course Outcomes:

At the end of the course, the students will be able to:

1. Substitute the existing chemical processes with new techniques for sustainability.
2. Adapt green chemistry for textile chemical processing.
3. Describe the sustainable approaches in textile dyeing and printing.
4. Invent the alternative application techniques to reduce water pollution load.

PEC-TC-404G Developments in Textile Chemical Processing

Course code	PEC-TC-404G				
Category	Professional Elective Course (PEC-IV)				
Course title	Developments in Textile Chemical Processing				
Scheme and Credits	L	T	P	Credits	Semester-VII
	3	0	0	3	
Branch	Textile Chemistry				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre-requisites: Elementary idea of colour physic.

Course Objectives:

1. To understand recent developments in pre-treatment of textiles related to process and machinery.
2. To explain the recent advancements in dyes, mechanism of dyeing and techniques of dyeing of various substrate.
3. To discuss the concept of digital printing and transfer printing with its salient features.
4. To understand the developments related to textile finishing processes.
5. To explain the significance of minimum application techniques and foam finishing in textile.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Developments in pre-treatment: Combined pre-treatments, continuous open width processing, enzymes in textile processing, liquid ammonia mercerization. Introduction to Plasma technology in textile processing. Developments in Washers and Mangles used in textile processing.

UNIT-II

Developments in dyeing and dyes: Continuous dyeing, right-first-time approach. New developments in reactive dyes like HF dyes, low and no salt reactive dyes, multifunctional dyes, neutral fixing and acid fixing reactive dyes.

Photo chromic dyes, thermo chromic dyes, fluorescent dyes. German Ban on dyes. Dyeing of microfiber fabrics. Super critical CO₂ dyeing concept.

UNIT-III

Novel printing techniques like Digital (Ink-Jet and Xerographic) printing, transfer printing etc. Use of CAD in printing, laser screen engraving, automated colour kitchens.

UNIT-IV

Developments in finishing: Zero formaldehyde easy-care finishes, polysiloxanes based softeners, chlorine free shrink-resist treatment of wool. Application techniques of Finishes including Minimum application techniques and foam finishing.

Reading List

Title

Biotechnology in Textile processing
Engineering in Textile coloration
Textile Finishing
Chemical Finishing of Textiles
Coloration Technology Journal
Asian Dyers
Colourage
AATCC Review

Author

G M Guebitz, A Cavaco-paulo, R Kozlowski
C. Duckworth
Derek Heywood
W.D. Schindler and P.J. Hauser

Course Outcomes:

At the end of the course, the students will be able to:

1. Devise enzymatic pre-treatments and modified eco-friendly process for textiles.
2. Substitute in existing dyes and dyeing systems with recent dyes and techniques for superior quality.
3. Adapt to digital printing and transfer printing technique for superior printing quality.
4. Invent the applications of plasma technology minimum application techniques for minimization of pollution and cost reduction in textiles.

PEC–TC–406G Advance Chemical Processing

Course code	PEC-TC-406G				
Category	Professional Elective Course (PEC-IV)				
Course title	Advance Chemical Processing				
Scheme and Credits	L	T	P	Credits	Semester–VII
	3	0	0	3	
Branch	Textile Chemistry				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre–requisites: Basic idea of various conventional textile chemical processing.

Course Objectives:

1. To understand advancements in pre-treatment of textiles related to process and machinery.
2. To explain the recent developments in dyes, mechanism of dyeing and techniques of dyeing of various substrate.
3. To discuss the concept of digital printing and transfer printing with its salient features.
4. To understand the developments related to textile finishing.
5. To explain the significance of minimum application techniques and foam finishing in textile.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Advancements in pre-treatment: Combined pre-treatments, continuous open width processing, enzymes in textile processing, Eco-friendly peracetic acid bleaching, Eco-friendly retting of Jute. Combined bio-scouring and bleaching of cotton fibers, enzymatic degumming.

UNIT-II

Advancements in dyeing: Dyeing and its eco-aspects, new dyes and their advantages, Eco-friendly dyeing with sulphur & vat dyes. New developments in reactive dyes like HF dyes, low and no salt reactive dyes, multifunctional dyes, neutral fixing and acid fixing reactive dyes, Photo chromic dyes, thermo chromic dyes, fluorescent dyes. Super critical CO₂ dyeing – concept, mechanism, methods and techno-economical features. Ultrasound in dyeing - Concept, mechanism, methods and techno-economical features.

UNIT-III

Advancements in Printing: Concept, methods of inkjet printing, colour separation, selection of dyes and developments in inks, techno-economical features.

Concept, selection of dyes and paper, mechanism of dye transfer, process sequences, techno-economical features, various transfer-printing machines.

UNIT-IV

Nano-finishes - Super hydrophobicity and lotus effect, self-cleaning, UV protection finish, Antimicrobial finishes. Concept of UV-A and UV-B, factors affecting UV protection. Various UV-protection finishes and their evaluation.

Plasma concept, Types of Plasma and their generation, Plasma treatment for textile for water and oil repellence, interfacial engineering of functional textile for Bio medical application.

Reading List

Title	Author
Biotechnology in Textile processing	Georg M Guebitz, Artur Cavaco-paulo, Ryszard Kozlowski
Engineering in Textile coloration	C. Duckworth
Textile Finishing	Derek Heywood
Chemical Finishing of Textiles	W.D. Schindler and P.J. Hauser
Coloration Technology Journal	

Course Outcomes:

At the end of the course, the students will be able to:

1. Devise enzymatic pre-treatments and modified eco-friendly process for textiles.
2. Substitute in existing dyes and dyeing systems with recent dyes and techniques for superior quality.
3. Adapt to digital printing and transfer printing technique for superior printing quality.
4. Explore the applications of plasma technology, nano technology and UV protection techniques in textiles.

PEC-TC-407G Emerging Trends in Chemical Processing of Textiles

Course code	PEC-TC-407G				
Category	Professional Elective Course (PEC-IV)				
Course title	Emerging Trends in Chemical Processing of Textiles				
Scheme and Credits	L	T	P	Credits	Semester-VII
	3	0	0	3	
Branch	Textile Chemistry				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre-requisites: Basic idea of chemical processing of textiles

Course Objectives:

1. To understand concept of eco-friendly chemical processing using enzymes
2. Developments in pre-treatment of textiles related to process and machinery.
3. To discuss the concept of digital printing and transfer printing with its salient features.
4. To understand the developments related to textile finishing.
5. To explain the concept of nano technology and its application in chemical processing.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Different types of enzyme used in textile processing, sources of enzyme, advantage and disadvantage of enzymes, different process of textile processing with enzyme application.

UNIT-II

Ultra sound processing, combined operations like desizing-scouring-bleaching, Bio-scouring and Bio-bleaching of cotton fibres, Liquid ammonia mercerization. Idea of Coating and laminations, water proofing, multiple finishing effects.

UNIT-III

E-control in chemical processing, supercritical carbon dioxide dyeing of textiles, digital printing. Plasma concept, types of Plasma and their manufacturing, Plasma treatment of textile.

UNIT-IV

Nano technology and its importance in textile, different route used for synthesis of different nano particles, nano clays and their treatment, Carbon nano tubes and its applications in textiles, different method of application of nano particles on textile.

Reading List

Title	Author
Biotechnology in Textile processing	G. M. Guebitz, A. Cavaco-Paulo, R. Kozlowski
Chemical Technology in the Pre-treatment Processes of Textiles	S R Karmakar
Engineering in Textile coloration	C. Duckworth
Textile Finishing	Derek Heywood
Chemical Finishing of Textiles	W.D. Schindler and P.J. Hauser

Course Outcomes:

At the end of the course, the students will be able to:

1. Devise enzymatic pre-treatments and modified eco-friendly process for textiles.
2. Substitute in existing pre-treatment processes with new techniques for superior quality.
3. Adapt to digital printing and transfer printing technique for superior printing quality.
4. Invent the applications of plasma technology and nano technology in textiles.

OEC-TT/TC-401G Production and Operation Management in Textile

Course code	OEC-TT/TC-401G				
Category	Open Elective Course (OEC-IV)				
Course Title	Production and Operation Management in Textile				
Scheme and Credits	L	T	P	Credits	Semester–VII
	3	0	0	3	
Branch	Textile Technology, Textile Chemistry				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre-requisites: Knowledge on textile processes

Course Objectives:

1. To make the students aware of importance of planning and activities involved in production
2. To enable the students enable to calculate productivity and factors affecting this.
3. To enable the students to carry out time study and to determine standard time.
4. To impart knowledge on quality control and quality management.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Scope and function of Production and operation .Functions involved in production and operation management. Macro & Micro level Production planning in textile mill. Objectives of production planning. Functions involved in planning and control. MIS in a textile mill. Classification of production system based on production method and market demand with example MIS in a textile organization

UNIT-II

Concept of Productivity: Various measures of productivity and their relative merits and demerits. Factors affecting productivity of an organization with special reference to a textile mill. Concept of Business Process Reengineering.

Work study - scope and objective with special reference to textile industry. Steps involved in Method Study. Objectives of work measurement. Techniques of Work measurement. Various steps involved in Time Study and determination of standard time. Application of Snap Study in Textile Industry.

UNIT-III

Inspection process followed in a textile organization. Types of inspection. AQL level. Customer and producer risk involved in AQL. Single and double inspection plan. Limitation of inspection system. Quality control and application of statistics in quality and process control. Quality control chart and its importance. Construction of various types of control chart and their scope of application in a textile mill. Interpretation of quality control chart. Limitation of quality control.

UNIT-IV

Evolution of Concept of Quality & Quality Management System (Q.M.S). Overview of Quality Management System Standard - ISO 9000. Formulation of Quality Policy, Quality Objective & Quality plan. Implementation Procedure of Q.M.S with special reference to Textile industry. Documentation of quality management and preparation of Quality manual Quality Audit. Preparation of audit report. Types of audit.

Suggested Reading List:

Title	Author
Production and Operation management	S N Charry
Production and Operation management	N G Nair
Quality management	L Suganthi and Samuel
Fundamentals of quality control and improvement	A Mitra

Course Outcomes:

After completion of the course, students will:

1. Understand the job of a production manager.
2. Understand the importance of planning in production management.
3. Get a brief idea of MIS in textile industry.
4. Understand concept of productivity and various measures of productivity.
5. Get knowledge on quality management system and its implementation process.
6. Be able to conduct quality cycle and 5s

OEC-TT/TC-402G Finance, Material and Human Resource Management

Course code	OEC-TT/TC-402G				
Category	Open Elective Course (OEC-IV)				
Course Title	Finance, Material and Human Resource Management				
Scheme and Credits	L	T	P	Credits	Semester–VII
	3	0	0	3	
Branch	Textile Technology, Textile Chemistry				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre-requisites: Basic knowledge on economics and management

Course objectives:

1. Enable the student to understand the sources of finance for a business organization
2. Enable the student to understand the importance of budget and working capital
3. Enable the student to understand the basics of human resource management

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Sources Of Financing: Long-term and Short-term financial requirements. Sources of Finance. Need and importance of capital budgeting. Capital Budgeting Process, Methods of Capital Budgeting of Pay-back period, uneven cash inflows. Post pay-back profitability method. Accounting rate of return or Average rate of return. Net present value Internal rate of return.

UNIT -II

Capital Structure: Meaning: Essentials of an ideal/optimum Capital Structure, Difference between capital, Capitalization and Capital Structure. Management of Working Capital: Definition; Nature Classification of Working Capital – (i) Permanent working Capital and (ii) Variable Working Capital; Factors affecting requirement of working capital, Presentation of cash flow statements and its benefits.

UNIT -III

Personal Management and HRD, Job Analysis: Meaning and Importance; Processes of Job Analysis, Job Description and Job Specification.

UNIT -IV

Materials Management: Definition and Objectives: Inventory Management. Inventory Control: Techniques of Inventory control - ROL, FOR Value Analysis, ABC Analysis, VED Analysis; Factors affecting Inventory Control, Ordering Costs, Carrying Costs, Stock-out costs, Buffer Stock, Stock Turnover & Lead.

Reading List

Title	Author
Accounting for Managers	Paresh Shah
Financial Accounting	D K Goyal
HRM	R S Dwivedi
Accounting Principles	Robert N Anthony & S James Reece
Financial Accounting	S M Shukla
Cost Mgt. Accounting & Control	Hansen & Mowen
Financial Accounting	P C Tulsian

Course Outcomes:

After studying the course

1. The student will understand the various sources capitals.
2. Student will get idea on inventory control.
3. Student will understand different methods of Costing, their scope of application.

OEC-TT/TC/FAE-403G Fashion Retailing and Promotion

Course code	OEC-TT/TC/FAE-403G				
Category	Open Elective Course (OEC-IV)				
Course Title	Fashion Retailing and Promotion				
Scheme and Credits	L	T	P	Credits	Semester–VII
	3	0	0	3	
Branch	TT, TC, FAE				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre–requisites: Textile Raw Materials, Yarn formation, Fabric formation, Coloration techniques, Accessory designing.

Course Objectives:

1. To impart knowledge of fashion retail formats and services being offered by them.
2. To understand the role of Wholesalers and to differentiate with that of a retailer.
3. To introduce various aspects of retail marketing mix and its elements.
4. To familiarize the students with the changing dimensions of fashion Retailing.
5. To introduce the basics of retail in an apparel supply chain.
6. To learn the retail decisions with emphasis on site selection and retail pricing.
7. To learn the fashion promotion, advertising and communication to the other retailers and consumers.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set up by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT – I

Retailing Environment: Introduction to Retailing, Types of Retailers/retailing. Multi-channel retailing.

Retail strategy: Retailing decisions- Decisions related to target market, pricing, store positioning, retail site selection etc. Store Organization, Retail communication, Retail audit.

UNIT – II

Wholesalers-difference between retailers and wholesalers, types of wholesalers, major functions and services provided by wholesalers, product line of wholesalers.

Retail store management: Store layout, Store design, Visual merchandising, Retail services.

Retail Arithmetic- product price setting, price change, Numerics of different types of mark ups, mark downs, price settlement at retail level.

Retail Inventory planning, Inventory control and management.

UNIT – III

Fashion communication: Fashion shows, Portfolio presentation, Moodboards, Storyboards. Fashion advertising, Fashion photography. Planning and Direction of Fashion advertising and different kinds of Advertising, Scheduling and planning (Public Media, Newspaper, Magazine, radio, Television, Direct mailing etc.), Advertising department in a retail store, Advertising agencies, Publicity, Special events.

UNIT – IV

Changing dimensions of fashion retailing - growth of private labels: retailers into manufacturing, concentration of retail power, globalization of retailing.

Fashion communication: Fashion shows, Portfolio presentation, Moodboards, Storyboards. Fashion advertising, Fashion photography. Planning and Direction of Fashion advertising and different kinds of Advertising, Scheduling and planning (Public Media, Newspaper, Magazine, radio, Television, Direct mailing etc.), Advertising department in a retail store, Advertising agencies, Publicity, Special events.

Suggested Reading List:

Title	Author
Inside Fashion Design	Sharon Lee Tate
Inside the Fashion Business	Kitty G Dickerson
Marketing Management, 13 th Ed, Prentice Hall Higher Education, 2008	Philip Kotler, Kevin Keller
Marketing Management, 13 th Ed, Prentice Hall Higher Education, 2008	Philip Kotler, Gary Armstrong
Fashion Marketing, Blackwell Publishers, 2008	Mike Easey

Course Outcomes:

At the end of the course, students will be able to:

1. Analyze the fashion retail, various formats and levels of services offered by retailers.
2. Develop the skills of differentiate fashion retailers and Wholesalers and their operations.
3. Analyze the retail Marketing process and modes of Fashion sales Promotion.
4. Implement the changes in dimensions of Fashion Retail and Globalization.

LC-TC-401G Colour Measurement & CCM Lab

Course code	LC-TC-401G				
Category	Laboratory Course (Professional Core Course)				
Course title	Colour Measurement & Computer Colour Matching Lab				
Scheme and Credits	L	T	P	Credits	Semester-VII
	1	0	3	2	
Branch	Textile Chemistry				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Pre-requisites: Basic knowledge of quantification of colour and idea of computer colour matching system used in textiles (spectrophotometers).

Course Objective:

Lab course is designed to give practical exposure of colour measurement in textile materials. Also experience the practical application of computer colour matching system in textile processing industry.

Contents

Introduction to the working principle of Spectrophotometer and discuss the various applications of computer colour matching (CCM) system in textile processing industry. Fundamental of colour quantification: Tristimulus values, chromaticity coordinates, CIE L,a,b values. Practical application of CCM in shade matching/Pass-Fail concept (calculate colour difference) for textile materials. Elementary idea of Metamerism and evaluation of various indices (whiteness, yellowness and Brightness Index) for textile products. Understand the concept of recipe prediction/formulation and batch correction using CCM system in textiles.

List of Experiments

1. Understand the working principle of spectrophotometer along with the various applications of CCM system for textile industry.
2. What is the purpose of calibration and how the CCM systems are calibrated?
3. Measurement of sample using CCM and to obtain the reflectance values and reflectance curve for the different colored samples.
4. Understanding the quantification of colour using spectrophotometer and obtain the various colour values (Tristimulus values, chromaticity coordinates, CIE L,a,b values) of the samples using CCM system as well as theoretically calculate them using reflectance value.
5. Understand the concept of colour difference and colour difference equation. Also to calculate the colour difference between two samples and understand shade matching in textiles.
6. To study the relationship between concentration and K/S value and to practically understand the features of Kubelka-Monk equation.
7. To dye the samples with different dyes at different levels of shade percentage and understand practically the concept of Data base preparation in CCM for recipe formulation.
8. Understand the concept of recipe prediction/formulation and batch correction process using CCM system in textiles.
9. To obtain the various indices (Whiteness, Yellowness & Brightness Index) of the white samples from CCM system as well as theoretically using Reflectance/Colour values.
10. To understand the concept of Metamerism using CCM system.
11. To evaluate the fastness rating of the samples using the colour difference obtained from the CCM system.

Course Outcomes:

At the end of the course students will be able to:

1. Understand basic concept of computer colour matching system.
2. Various applications of CCM system for textile processing industry.
3. Understanding the shade matching concept in textiles.
4. Understanding the complete concept of recipe prediction using CCM system.

PROJ–TC–401G Mill Practice

Course code	PROJ–TC–401G				
Category	Project/Internship				
Course title	Mill Practice (Evaluation)				
Scheme and Credits	L	T	P	Credits	Semester–VII
	0	0	0	5	
Branch	Textile Chemistry				
Class work	100 Marks				
Exam	100 Marks				
Total	200 Marks				
Duration of Exam	Viva				

Course Objective:

1. To give exposure to the industrial environment and its work culture.
2. To explore the machineries and processes involved in the industries.
3. To provide hands-on training on machines and instruments.
4. To develop understanding of techniques like Production Planning, Quality Assurance, Maintenance practices, Environment and Pollution Control, Management Information System.

Course Content

At the end of 6th semester, each student, individual or in association with some other students has to undergo Practical Training of 6 weeks in an Industry/Mill/ Professional Organization with the approval of the Director, TIT&S and submit a typed report along with a certificate from the organization to the Head of the Department.

Following points to be considered by the students for studies during mill practice:

General Studies:

Process Flow Chart,
Visit to various departments and study of machineries,
Important adjustments and settings,
Speed of Important Parts,
Modern Developments in machines/process,
Chemicals, Dyes used for carrying out various processes,
Process parameters and effect on quality of product,

Actual Production and Efficiency,
Production Planning and Control,
Maintenance Practices, maintenance tools and gauges, maintenance schedule,
Study of lubrications,
Process Control and Quality Control activities,
Roles and responsibilities of various categories of workers/technical Staffs',
Labour allocation.

Special Studies:

Management information systems,
Waste study,
Costing,
Production planning and control,
Target achievement,
Information regarding humidification plant,
Utility,
Electrical supply,
Store, purchase,
Marketing,
Sales,
Samples,
Lay-out of Plant.

Project:

Objectives,
Procedures,
Observations,
Analysis and Conclusion of the projects carried-out.

Course Outcomes:

At the end of the course student will be able:

1. To understand the environment and work culture of the industries.
2. To understand the machineries and processes followed in industries.
3. To use hand on training skills.
4. To reproduce the techniques like Production Planning, Quality Assurance, Students will be able to maintenance practices, Environment and Pollution Control, Management Information System.

PROJ–TC–402G Seminar

Course code	PROJ–TC–402G				
Category	Project/Internship				
Course title	Seminar				
Scheme and Credits	L	T	P	Credits	Semester–VII
	0	0	2	0	
Branch	Textile Chemistry				
Class work	-				
Exam	-				
Total	(Evaluation will be done in 8 th Semester)				
Duration of Exam	Presentation				

Course Objective:

1. To develop the presentation skills in the students.
2. To develop the skills of preparing presentations.
3. To boost the communication skills in the students.

Course Content

Each student will have to deliver a talk on the topic in the weekly period allotted to this subject, either pertaining to his project work or any topic assigned by Head of the Department. A Board of Examiners would judge the performance of the student in the class and students will also submit a report with the relevant content used for preparing presentation.

Final evaluation of this will be done in 8th Semester after completion of the whole class presentation.

Course Outcomes:

At the end of the course student will be able:

1. To prepare presentations for the meetings etc.
2. To give presentations/talks with in the relevant domain.
3. To prepare general reports.

PROJ–TC–403G Project Work (Mid Term Evaluation)

Course code	PROJ–TC–403G				
Category	Project/Internship				
Course title	Project Work (Mid Term Evaluation)				
Scheme and Credits	L	T	P	Credits	Semester–VII
	0	0	4	2	
Branch	Textile Chemistry				
Class work	100 Marks				
Exam	-				
Total	100 Marks				
Duration of Exam	Viva				

Course Objective:

1. To identify the problem or idea and summarize the literature for the topic of the identified problem
2. To describe the process for undertaking the research.
3. To explain various tools and methods employed for testing and evaluation to draw relevant conclusions.
4. To exhibit effective team work and communication skills.

Course Content:

Each student individually, or an association with some other students will carry out project of an experimental and/or theoretical nature in one of the main branches of textile chemical processing.

Guidelines for Project Work Submission (Mid Term):

Students should provide a systematic manner in a typed report form duly approved and signed by his Supervisor/Guide (to be nominated by the Head of Department/Institution).

The report is to normally include:

1. Literature Review/Survey

Literature related to topic selected should be searched from Reputed Research Journals, Books, and internet.

2. Preliminary Approach to the problem relating to the assigned topic/Plan of work

Proposed plan of work in consultation with guide should be prepared. Plan of work consists of Raw Material details and Methodology to be adopted.

3. Preliminary Analysis/ Modelling/ Simulation/ Experiment/Testing/Design/ Feasibility

Evaluation:

Spiral bound copy of Introduction, Literature review and plan of work as per the standard format should be submitted in front of project evaluation committee. If any recommendations are suggested by committee, those should be implemented and resubmitted.

Term work marks are allotted by continuous monitoring of the progress in the work and submission of spiral bound copy.

Course Outcomes:

At the end of the course student will be able to:

1. Identify the problem /idea and collect the literature for the concerned topic.
2. Design suitable experimental plan.
3. Understand and use various tools of testing and analysis for the data in order to draw relevant conclusions.
4. Communicate and work effectively as a member of team.

DETAIL SYLLABUS

Semester 8th

PEC-TC-408G Process & Quality Control in Chemical Processing

Course code	PEC-TC-408G				
Category	Professional Elective Course (PEC-V)				
Course title	Process & Quality Control in Chemical Processing				
Scheme and Credits	L	T	P	Credits	Semester–VIII
	3	0	0	3	
Branch	Textile Chemistry				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre-requisites: Knowledge of complete Textile Chemical Processing: Pre-treatment, Dyeing/Printing and Finishing.

Course Objectives:

1. To learn the process control parameters of each and every process involved in the textile chemical processing.
2. To understand the importance of quality and quality aspects of various raw materials, intermediate material and final processed fabric involved in chemical processing of textiles.
3. To have an idea of control systems involved in textile chemical processing.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Introduction to Process Control and various areas of process & quality control in textile chemical processing. Quality of Grey Fabric inspection, process control in stitching of greige pieces. Process control in Pretreatment: Optimized process parameters imparted to textiles in pretreatment and quality of products obtained, viz. singeing, desizing, scouring, bleaching, mercerization.

UNIT-II

Process Control in Dyeing: Optimized dyeing parameters for dyeing of natural, manmade and blended textiles and quality of dyed product. Process control in batch-wise and continuous dyeing machines.

Process Control in Printing: Optimized parameters for printing of natural, manmade and blended textiles and quality of printed product. Process control in roller and screen printing machines.

UNIT-III

Process Control in Finishing: General Process control, process control in finishing machines. Process control in Stenter, Calendaring, Surface-raising, Pre-shrinking, Softeners, Resin finish, Fire-retardant and water repellent finishes. Change in quality due to selection of impure chemicals/ faulty fabric/machine handling.

UNIT-IV

Methods to assess quality of processed product after every stage of processing and that of final product. Introduction to fabric inspection systems. Basic principles of control systems in textile Manufacturing. Application of control systems in textile processing. Monitoring and on line process control devices.

Reading List

Title	Author
Process Control in Textile Manufacturing (Woodhead Publishing Series in Textiles: Number 131)	Majumdar A, Das A, Alagirusamy R and Kothari V K
Process and Quality Control in Chemical Processing of Textiles (ATIRA, Ahmedabad)	Gokhale S V and Modi J R
Quality and Process Control (Chemical Processing Tablet IX) (The Textile Association Education System, Ed. P C Mehta)	Doshi S M and Shah H A
Chemical Technology in the pretreatment processes of Textiles (Textile Science and Technology Series, Vol-12, 1st Edition, Elsevier, 1999)	Karmakar S R
Chemical Processing of Synthetic Fibres and Blends (John Wiley and Sons, New York, 1984)	Datye K V and Vaidye A A

Course Outcomes:

At the end of the course, the students will be:

1. Familiar with the process control parameters for the each steps involved in textile chemical processing.
2. Having the knowledge of basic control systems and their application in textile processing.
3. Able to understand the quality aspects of the various materials involved in textile chemical processing including raw material, quality at intermediate stages and final product.

PEC–TC–409G Energy Conservation in Wet Processing

Course code	PEC-TC-409G				
Category	Professional Elective Course (PEC-V)				
Course title	Energy Conservation in Wet Processing				
Scheme and Credits	L	T	P	Credits	Semester–VIII
	3	0	0	3	
Branch	Textile Chemistry				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre-requisites: Basic knowledge of physics, wet processing machinery, complete textile chemical processing

Course Objectives:

1. To learn the sources of energy and the energy requirements for the various processes involved in the textile chemical processing.
2. To understand the importance of energy conservation in textile chemical processing.
3. To have an idea energy audits required for textile industries
4. To explore the areas of conservation of energy in textile processing.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT – I

Basics of Energy: Types and sources of Energy, Forms of energy and units of measurement; Need of various Energy Sources required in Textile Processing like thermal, electrical and compressed air; Concept and need of Energy Management.

UNIT-II

Need of thermal energy in textile, Basics of thermal energy, Steam: Thermal behaviour of water, heat balance equation, Methods of generation of Steam and its quality requirement, efficient

steam generation – boiler. Calculation related to measurement of thermal energy – Direct heating, Indirect heating, Batch process unit operations, Continuous process and thermopac, Calculation related to measurement of Steam Consumption in textile processing, norms and capacity requirement of boiler. Drying of Textile and its economics, machinery required.

UNIT-III

Need of energy audit, method & types of energy audits, Energy audit performance, instruments required. Energy consumption of various textile machines.

Conservation of water and steam in chemical processing of textiles, Electrical energy saving, Study of different wastage in chemical processing of Textiles. Methods of energy conservation in various departments of process house with regards to thermal energy, electrical Energy, lighting, compressed air and water.

UNIT-IV

Concepts of Reduce, Reuse and Recycle with textile specific examples. Energy saving through process modification, machine modification or alternative chemical /technology with textile specific examples.

Non-conventional energy sources and their application areas in textile like Wind, Biogas and Solar energy either for thermal or electrical energy generation.

Reading List

Title	Author
Energy Conservation in Industries – Vol.I & II	Centre of Plant Engg. Services, Hyderabad.
Energy Consumption & Conservation in Fibre Producing & Textile Industries (Textile Progress Vol.13, No.3)	
Conventional Energy Technology	S.B. Pandya
Mill Endavours to conserve electricity (ATIRA – Circular Report June, 1988)	D.H. Shah & J.S. Parajia
Renewable Energy Resources	John Twidell
Coloration Technology Journal	
AATCC review Journal	

Course Outcomes:

At the end of the course, the students will be able to:

1. Describe the energy resources and their utilization in textile chemical processing.
2. Understand the concept of energy audits involved in textile industries.
3. Describe the various ways of conservation of energy in textile processing.
4. Explore new techniques for the energy conservation in textile applications.

PEC-TC-410G Textile Process House Management

Course code	PEC-TC-410G				
Category	Professional Elective Course (PEC -V)				
Course title	Textile Process House Management				
Scheme and Credits	L	T	P	Credits	Semester-VIII
	3	0	0	3	
Branch	Textile Chemistry				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre-requisites: Knowledge of various processes involved in textile processing industry.

Course Objectives:

1. To describe the general objectives, organization structure of dye-house and the principle and functions of management to comply with quality with respect to ISO.
2. Explain the location, site and factors to be considered for building construction with respect to work place.
3. To learn the management information system for various inventories involved in textile chemical processing.
4. To learn the costing associated with various processes involved in textile process house.
5. To understand the pollution involved in process house and various methods of reduction of pollution.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Objectives of process house, Structure of the organization, Principle and functions of management, Duties and responsibilities of process house staff. Concept and process of human resource planning. Setting up of modern process house: - Selection of location, Selection of site, Construction of building for modern process.

UNIT-II

Objective of material management, nature and scope of material management, Handling of chemicals, Process goods, Storing of Goods for subsequent Operations or for Final product, ventilation and lighting system; Causes of accidents in process house, safety device, method for minimising accidents.

UNIT- III

Economics at different stages of production in textile industry, Factors influencing the cost of production, Methods of reduction in cost of production such as recycling of chemicals, raw materials, energy conservation, substitution by cost effective techniques, right first time approach, Rearranging number of processes, cost of quality.

UNIT- IV

Types of pollution in textile industry, Precautions to minimize pollution such as source reduction; Methods of recovery, reuse and neutralization of various ingredients present in the effluents, cost of effluents treatment, Advantages of pollution control in relation to textile industry, Banned dyes, red listed chemicals and their eco-friendly substitutes, ISO 14000 certification.

Reading List

Title	Author
Dye-house management manual	James Park and John Shore
Plant-layout and material handling	Fred E. Meyers
Management of Textile Industry	V.D. Dudeja
Management perspectives in textile industry	BITRA
Textile Manufacturing	M.G. Kulkarni

Course Outcomes:

At the end of the course, the students will be able to:

1. Describe the objectives and organization structure of dye-house with the role of management, HRD and ISO quality management.
2. Summarize important factors for selection of location, site and building construction & understand the norms with production calculations for unit operations in textile chemical processing.
3. Material handling and equipment used, lighting positioning and norms, costing and its classification, chemical cost in various operations in textile chemical processing.
4. Analyze the methods of reduction of cost in a process house.
5. Describe the waste water and pollution load associated with process house.

PEC–TC–411G Environmental Aspects of Textile Processing

Course code	PEC-TC-411G				
Category	Professional Elective Course (PEC-VI)				
Course title	Environmental Aspects of Textile Processing				
Scheme and Credits	L	T	P	Credits	Semester–VIII
	3	0	0	3	
Branch	Textile Chemistry				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre–requisites: Basic knowledge of textile chemical processing and the dyes, chemicals and auxiliaries used in them.

Course Objectives:

1. Discuss the impact of textile chemical processing using carbon, water and energy footprint assessment.
2. Discuss the current environmental legislation to textile industry. Illustrate the toxicity of chemicals, dyes and auxiliaries used in the textile chemical processing.
3. Explain the characteristics of textile processing effluent and various techniques for effluent treatment.
4. Discuss the waste minimization and zero discharge concept for textile industry.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Environmental impact assessment - Definition & need, ways of measuring environmental impact of textile processing. Current environmental legislations relating to textiles. Current environmental standards and schemes in the industry: Global Organic Textile Standard (GOTS), Bluesign, Oeko-Tex standards, Eco- labels etc.

UNIT-II

Introduction to Textile processing and greenhouse gas emissions: Carbon Footprint Assessment of textile products, water and energy footprints of textile products and ecological footprint of textile products. Estimating the overall environmental impact of textile processing: life cycle assessment (LCA) of textile products. End-of-life management of textile products: waste minimization, reuse and recycling of textile products. Biodegradation of textile products.

UNIT-III

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) textile effluent and their characterization.

UNIT-IV

Degradation of toxic dyes, Biological methods of removal of dyes from textile effluents, environmentally responsible dye application, water conservation in textile industry, zero liquid discharge in textile industry.

Reading List

Title	Author
Assessing the Environmental Impact of Textiles and the Clothing Supply Chain	S S Muthu
Environmental Aspects of Textile Dyeing	R M Christie
Environmental Impact of Textiles (Production, processes and protection)	Keith Slater
Pollution Control in Textile Industry	S C Bhatia
Textiles and Environment	N N Mahapatra

Course Outcomes:

At the end of the course, the students will be:

1. Describe the environmental impact of textile chemical processing industry.
2. Describe the life cycle assessment of textile products.
3. Describe the toxicity associated with dyes and chemicals and their evaluation.
4. Explain the effluent treatment as well as zero liquid discharge concept for textile industry.

PEC–TC–412G Eco-friendly Processing & Manufacturing of Textiles

Course code	PEC-TC-412G				
Category	Professional Elective Course (PEC-VI)				
Course title	Eco-friendly Processing & Manufacturing of Textiles				
Scheme and Credits	L	T	P	Credits	Semester–VIII
	3	0	0	3	
Branch	Textile Chemistry				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre–requisites: Basic knowledge of textile chemical processing

Course Objectives:

1. Describe the concepts of eco-friendly chemical processing of textiles.
2. Understand the application of biotechnology in chemical processing of textiles.
3. Describe the biological techniques for textile effluent treatment.
4. Understand the production, properties and applications of eco-friendly fibres.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Bio-processing of natural (cotton, jute, flax, wool, silk etc.) as well as synthetic (polyester, polyamides and regenerated) fibres. Plasma treatment and ultrasound assisted textile processing.

UNIT-II

Emerging concepts in eco-friendly chemical processing (Greener textile materials, Greener bleaching methods, Greener dyeing) – trends and practices. Natural dyes – merits and demerits, naturally coloured cotton.

UNIT-III

Environment friendly finishing processes, low liquor ratio wet-treatments and machinery. Biological and novel techniques for textile waste water treatment. Alternative methods to reduce waste water load in processing. Recycling and re-use of textile chemicals.

UNIT-IV

Eco-friendly fibres – PLA (Polylactic acid), Soyabean fibre, Bamboo fibre, Chitosan fibre, production, properties and application. Biotechnology for manufacture and modification of cellulosic fibres. Recycling and use of waste as raw materials.

Reading List

Title	Author
Bioprocessing of textiles	C. Vigneswaran, M. Ananthasubramanian, P. Kandhavadi
Advances in Textile Biotechnology	V. A. Nierstrasz and A. Cavaco-Paulo
Ecotextiles	M. Mirafteb and A. R. Horrocks
Biodegradable and sustainable fibres	R. S. Blackburn
Recycling in textiles	Youjiang Wang
Sustainable Fibres and Textiles	S S Muthu
Textiles and Environment	N N Mahapatra

Course Outcomes:

At the end of the course, the students will be:

1. Discuss application of enzymes in textile chemical processing.
2. Describe the biotechnological methods for textile waste water treatment.
3. Describe the concept and application of natural dyes in textiles.
4. Explain the production and properties of some natural fibres.

PEC-TT/TC-405G Nonwoven Technology

Course code	PEC-TT/TC-405G				
Category	Professional Elective Course (PEC-VI)				
Course Title	Nonwoven Technology				
Scheme and Credits	L	T	P	Credits	Semester–VIII
	3	0	0	3	
Branch	Textile Technology, Textile Chemistry				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre-requisites: Concepts of textile raw materials (TRM), fundamentals of yarn and fabric formation

Course Objectives:

1. To familiarize the students about nonwovens, technology, and classification
2. To familiarize the students about different nonwoven web preparation techniques
3. To familiarize the students about different web bonding techniques
4. To familiarize the students about nonwoven fabric structure-properties and common test methods

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Non-woven fabrics: Characterization, classification, uses.

Web preparation: requirements, orientations, types – their technology and machineries.

UNIT-II

Needle Punching: technology, machineries, needling parameters, felting needle, needle parameters, and applications.

Spun-lacing: principle, machineries, and applications.

Stitch bonding – principle, and applications.

UNIT-III

Chemical bonding: principle, binders – their types and properties, binder application techniques, and applications.

Spun Bonding and melt blown techniques: principle, machineries, and applications.

UNIT-IV

Thermal bonding: technology, binders – their types and properties, machineries (hot calendaring, hot-air systems), and applications.

Nonwoven fabric structure-properties, factors affecting structure-properties.

Some common standard tests of nonwoven fabrics.

Suggested Reading List:

Title	Author
Handbook of nonwovens	S J Russell
Nonwoven Fabrics	W Albrecht, H Fuchs, W Kittelmann

Course Outcomes:

After completion of the course, students will be able to:

1. Understand the technology of nonwovens, classification and application areas.
2. Understand the types and machineries of different web formation techniques.
3. Understand the technology and machineries of different web bonding techniques.
4. Understand the structure-property of nonwoven fabrics.
5. Know the common test methods of nonwovens.

OEC-TT/TC-407G Technical Textiles

Course code	OEC-TT/TC-407G				
Category	Open Elective Course (OEC-V)				
Course Title	Technical Textiles				
Scheme and Credits	L	T	P	Credits	Semester–VIII
	3	0	0	3	
Branch	Textile Technology, Textile Chemistry				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre-requisites: Concepts of textile raw materials (TRM), fundamentals of yarn and fabric formation

Course Objectives:

1. To familiarize the students about technical applications of textile materials; fibres suitable for technical applications and their properties
2. To familiarize the students about Geotextiles, medical textiles and automotive textiles and their types and applications
3. To familiarize the students about protective clothing and their different types
4. To familiarize the students about composites, their construction, properties and applications
5. To familiarize the students about the concept of filtration and filters
6. To familiarize the students about the structure and production of ropes and cordage

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Introduction: Definition, Textile materials in technical applications.

Fibres: Natural and Man-made fibres suitable for technical applications and their relevant properties.

UNIT-II

Geotextile: Mechanics of reinforcement, Separation, filtration and drainage of soils by geotextile. Types: woven, nonwoven, Geonets, Geogrids, etc. Fiber and fabric construction details of Geotextile in typical applications like road construction, river embankment, earth quake proof building.

Medical textiles: Textiles in various medical applications; Medical fibers and their properties, Hygiene and non-implantable medical textile, Biotextiles, application oriented design of typical medical textile (e.g. porous graft or trashed tube). Materials used and design procedure for wounds dressing, scaffolds, Sutures, etc.

UNIT-III

Automotive Textiles: Fibres used for automotive applications-upholstery, carpets, preformed parts, tires, safety devices, filters and engine compartment items. Brief description for the manufacture and application of these devices or parts.

Protective clothing: Thermal protection. Ballistic protection, Protection from electromagnetic radiations and hazards, Protection against micro-organisms, chemicals and pesticides.

UNIT-IV

Composites: Type of fibers and resins used, Methods of construction, Type of preforms and their properties, typical applications, 3 dimensional fabrics and triaxially braided materials for composites.

Filtration: Principles and some mathematical models of wet and dry filtrations. Characteristics properties of fibers and fabrics in selective examples of filtration.

Ropes and Cordage: Method of production. Application oriented structure and production of ropes, cordages and twines.

Suggested Reading List:

Title	Author
Handbook of Technical Textiles	A. Richard Horrocks, Subhash C. Anand
Technical Textile yarns: Industrial and medical applications	R. Alagirusamy, A. Das
Progress in Textiles: Science & Technology Volume 2 – Textile Fibres: Developments & Innovations	V K Kothari
Progress in Textiles: Science & Technology Volume 3 – Technical Textiles: Technology, Development and Applications	V K Kothari
Technical Textile	NCUTE series

Course Outcomes:

After completion of the course, students will be able to:

1. Understand the technical applications of textiles and different fibres used in such applications
2. Understand the types and applications of geotextiles, medical textiles, automotive textiles and protective clothing.
3. Comprehend the concept of filtration and filters.
4. Understand the types and production of composites, ropes and cordages.

OEC-TT/TC/FAE-404G High Performance Fibres

Course code	OEC-TT/TC/FAE-404G				
Category	Open Elective Course (OEC-V)				
Course Title	High Performance Fibres				
Scheme and Credits	L	T	P	Credits	Semester–VIII
	3	0	0	3	
Branch	TT/TC/FAE				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre–requisites: Man-made fibre production, Drawing and Heat setting

Course Objectives:

The course is designed to impart the following:

1. Polymers for high performance fibres
2. Various fibre spinning systems
3. Manufacturing of inorganic fibre

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Introduction to high performance fibres: fully aromatic polyamide or aramid fibres; Liquid crystals. Kevlar: manufacture, structure, properties and applications. Dry-jet wet spinning, Polyarylate fibres viz. Vectran - manufacture, properties and applications.

UNIT-II

Ordered polymeric fibres; Aromatic heterocyclic rigid rod polymeric fibres like PBO – their production, structure properties and applications.

Flexible chain high performance fibres: Ultra high molecular weight polyethylene; gel spinning and melt spinning / drawing. Routes for fibre manufacture. Manufacturing, structure, properties and applications these fibres

UNIT-III

Carbon fibres: Different precursors for carbon fibres like viscose rayon, PAN and pitch; Pre-oxidation, carbonization and graphitization. Chemical and physical changes in structure during these processes: Structure, properties and applications of carbon fibre.

Brief introduction to the manufacturing methods, properties and applications of nano fibres

UNIT-IV

Manufacturing of glass fibre, types of glass fibres; Manufacturing of PEEK fibre, Ceramic fibre; Manufacturing process of optical fibres, classification of optical fibres, applications of optical fibre

Suggested Reading List:

Title	Author
High Performance Fibres	P Bajaj & A K Sengupta
High Technology Fibres (Part A, B, C, D)	M. Lewin & J Preston
High Performance Fibres	J W S Hearle

Course Outcomes:

After completion of the course, students will be able to:

1. Know the type of polymers for manufacturing high performance fibres.
2. Know variants of fiber spinning systems.
3. Get familiarized with manufacturing techniques of inorganic fibres.

OEC-TC/ FAE-405G Sportswear Textiles & Accessories

Course code	OEC-TC/FAE-405G				
Category	Open Elective Course (OEC-V)				
Course Title	Sportswear Textiles & Accessories				
Scheme and Credits	L	T	P	Credits	Semester–VIII
	3	0	0	3	
Branch	TC/FAE				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Prerequisites: Textile Raw Materials, Yarn formation, Fabric Manufacture, Material Studies, Fashion Accessories.

Course Objective:

1. Imparting knowledge about:
2. Selection criteria and raw materials for sportswear design
3. Properties and comfort aspects of sportswear
4. Functional aspects of elastic & cold weather Sportswear
5. Testing & evaluation of sportswear

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT – I

Introduction, classification of sportswear. Sporting culture. Influence of sports on fashion
Definition of sports and leisure wear. Influence of sportswear on everyday sports and leisure
wear fashion. Requirements and properties of sportswear in accordance with specific sports. Key
trends in sportswear design

UNIT – II

Material requirements for the design of performance sportswear – design development process: the application of technical textiles in performance sportswear, Emerging trends. Innovations in fibres and textile materials for sportswear. Designing for speed and comfort, Balance of fashion and functionality, smart textile applications in sports.

UNIT – III

Elastic textiles- sportswear accessories – wrist bands, head bands, socks, stockings etc. Fulfilment of requirements i.e. freedom of movement, enhanced performance, recovery and well being

Sportswear & sports footwear industry - functional design of sport footwear, functional fit of sport footwear, functional components and materials in sport footwear

UNIT – IV

Cold weather sportswear , Water vapor transfer, Condensation problem in water proof breathable fabrics for sportswear, Sports clothing for protection from injury. Protection effect of protective clothing and equipment on human performance, Sportswear & comfort – physiological comfort of sportswear, aspects of wear comfort, measurement of Physiological comfort. Testing & evaluation of sportswear.

Reading List

Title

Textiles in sport

Sports Tech Revolutionary Fabrics, Fashion & Design

Science in Clothing Comfort

Improving comfort in clothing

Smart clothes & wearable technology

Smart Clothing technology & applications

Author

R. Shishoo

Thames & Hudson

Apurba Das & R. Alagirusamy

Guowen Song

J.McCann & D. Bryson

Gilsoo Cho

Course Outcome:

At the course completion, students will learn about:

1. Selection criteria and raw materials for sportswear design
2. Properties and comfort aspects of sportswear
3. Functional aspects of elastic & cold weather Sportswear
4. Testing & Evaluation of sportswear.

PROJ–TC–402G Seminar

Course code	PROJ–TC–402G				
Category	Project/Internship				
Course title	Seminar				
Scheme and Credits	L	T	P	Credits	Semester–VIII
	0	0	4	2	
Branch	Textile Chemistry				
Class work	200 Marks				
Exam	-				
Total	200 Marks				
Duration of Exam	Presentation				

Course Objective:

1. To develop the presentation skills in the students.
2. To develop the skills of preparing presentations.
3. To boost the communication skills in the students.

Course Content

Each student will have to deliver a talk on the topic in the weekly period allotted to this subject, either pertaining to his project work or any topic assigned by Head of the Department. A Board of Examiners would judge the performance of the student in the class and students will also submit a report with the relevant content used for preparing presentation.

Course Objective:

At the end of the course student will be able:

1. To prepare presentations for the meetings etc.
2. To give presentations/talks with in the relevant domain.
3. To prepare general reports.

PROJ–TC–404G Project Work (Final Evaluation)

Course code	PROJ–TC–403G				
Category	Project/Internship				
Course title	Project Work (Final Evaluation)				
Scheme and Credits	L	T	P	Credits	Semester–VIII
	0	0	12	6	
Branch	Textile Chemistry				
Class work	100 Marks				
Exam	100 Marks				
Total	200 Marks				
Duration of Exam	Viva				

Course Objective:

1. To identify the problem or idea and summarize the literature for the topic of the identified problem
2. To describe the process for undertaking the research.
3. To explain various tools and methods employed for testing and evaluation to draw relevant conclusions.
4. To exhibit effective team work and communication skills.

Course Content:

Each student individually, or an association with some other students will carry out project of an experimental and/or theoretical nature in one of the main branches of textile chemical processing and present his findings in a systematic manner in the report form duly approved and signed by his Supervisor/Guide (to be nominated by the Head of Department/Institution).

Guidelines for Project Work Submission (Final):

Experimentation work:

Students should start their experimental work as per the approved plan of work in consultation with Guide.

Report Writing:

After completion of work, students should prepare the report as per the standard format and guidelines in consultation with guide. This report will include the Literature review, Project Plan,

Methodology, Experimental Work Performed, Results & Discussions, Conclusions and References.

Submission of Final Report:

Each candidate or group would submit 3 typed copies of Project Report to the Head of the Department/Institution at least 15 days before the commencement of Second Semester Examination. One copy of the project report will be returned to the candidate after viva-voce examination. The original Report and a copy of the same will be retained by the concerned Department/Institution and the Supervisor respectively

Internal Evaluation:

Term work marks will be allotted by continuous monitoring of the progress in the work and submission of final report.

End Evaluation:

Students have to submit their work in front of Internal and External examiners. Examiners assess the project work and allocate the marks according to viva and submitted report.

Course Outcomes:

At the end of the course student will be able to:

1. Identify the problem /idea and collect the literature for the concerned topic.
2. Design suitable experimental plan.
3. Understand and use various tools of testing and analysis for the data in order to draw relevant conclusions.
4. Communicate and work effectively as a member of team.