Final

Sasmira's Institute of Man-made Textiles

Learning and Assessment Scheme

Programme Name : Diploma in Textile Technology

Programme Code: DTT

Duration of Programme: 6 Semester

Semester: Fourth

With effect from : 2023-24

Duration:15 Weeks

Scheme: S4

Sr. No.	Course Title	Abbrevation	Course Type	Course Code	Learning Scheme: Total IKS hr. for Sem.	Acutal Contact Hr./Week: CL	TL	LL	Self Learning (Term Work + Assignmen	Notional Learning Hrs/Week	Credits	Assessment Scheme: Paper Duration (hrs.)	Theory: FA-TH Max	SA-TH Max	Total Max	Total Min	Based on LL & TL Practical: FA-PR Max	FA-PR Min	SA-PR Max	SA-PR Min	Based on Self SLA: Max	SLA Min	Total Marks
1	Spinning of Other Fibers and Texturising	SOFT	DSC	T231401	2	2	1	3	1	7	3.5	3	30	70	100	40	25	10	50	20	25	10	200
2	Dobby, Jacquard and Drop-box	DJD	DSC	T231402	2	2	1	3	1	7	3.5	3	30	70	100	40	25	10	50	20	25	10	200
3	Fabric Structue - II	FS-II	DSC	T231403	2	2	1	3	1	7	3.5	3	30	70	100	40	25	10	25	10	25	10	175
4	Non Woven and Specility Fabrics	NWSF	DSC	T231404		2	1		1	4	2	3	30	70	100	40					25	10	125
5	Garment Manufacturing Technology	GMT	DSE	T232405		2	1	3	1	7	3.5	3	30	70	100	40	25	10			25	10	150
6	Garment Processing Technology	GPT	INP	T237406		2				2	1						50	20					50
7	Industrial Visit - II	IV-II	INP	C237407				2		2	1						25	10	25	10			50
8	Seminar I	SEM -I	SLE	T233408				1	3	4	2										50	20	50
	Total				6	12	5	15	8	40	20		150	350	500		175		150		175		1000

Abbrevations : CL - Class Learning, TL: Tutorial Learning, LL-Laboratory Learning, FA - Formative Assessment, SA- Summative Assessment, IKS - Indian Knowledge Skills, SLA - Self Learning Assessment

Legends: # - External Assessment, @ - Internal Assessment, * Online Examination

Note:

1. FA-TH repersents average of two class tests of 30 marks each conducted during the semester
2. If candidate is not securing minimum passing marks in FA-PR then the candidate shall be declared 'Fail' in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then candidate shall be declared 'Fail' and will have to repeat and resubmit SLA work.
4. Notional learing hours for the semester are (CL + TL + LL+ SL)hrs * 15 weeks
5. 1 credit is equivalent to 50 notional hours.
6. Self Learning hours shall not be reflected in Time Table

Course Category: DSC - Descipline Sepcific Courses Core, DSE - Descipline Specific Elective, G E - Generic Elective, AEC - Ability Enhasment Course, SEC - Skill Enhasment Course, VEC - Value Education Course, INP - Project and Community

Mr. S. B. Pawar
CDC-Incharge

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HoD DTT, DKT

SASMIRA'S INSTITUTE OF MAN-MADE TEXTILES ★ MUMBAI

Dr. G. R. Andhorikar
Principal

Program Name : Diploma in Textile Chemistry

Program Code : DTC

Semester : Fourth

Course Title : Garment Manufacturing and Processing Technology

Course code : X23140

I RATIONAL

Fabric produced in Mills is mainly used for producing men's, women's and children's wear. It is therefore important for textile engineers to understand the basic features of garments and its manufacturing and processing. Hence, they can take care of needs of garment manufacturing and processing while designing the fabric. In addition, this knowledge of garment manufacturing would also help textile engineers to get jobs in garment industry or set up their own garment manufacturing and processing unit.

II INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

Apply principles of garment manufacturing and processing in selection of raw materials, process control parameters and quality assurance procedures.

III COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

CO1 – Apply the principle of marker planning to reduce fabric waste % of given garment batch.
CO2 – Apply principles of spreading and cutting to spread and cut fabric lay of given batch of garment efficiently.
CO3 - Apply principles of sewing to select type of stitch, seam, needle, sewing thread and sewing machine suitable for sewing given type of garment.
CO4 – Utilize the principles of garment processing and study the machineries used for garment processing
CO5 – Solve the problems related to garment processing, energy conservation and applications of energy sources
CO6 – Solve the problems related to denim washing and use various types of washes.

IV TEACHING-LEARNING AND ASSESSMENT SCHEME

Course Code	Course Title	Course Category	Learning Scheme					Credits	Assessment Scheme												Total Marks
			Actual Contact Hrs/ week			SLH	NLH		Paper Duration (hrs)	Theory				Based on LL and TSL Practical				Based on SL			
			CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA			
										Max	Max	Max	Min	Max	Min	Max	Min	Max	Min		
X231401	Garment manufacturing & proc. technology	DSC	3	1	0	1	5	2.5	3	30	70	100	40	0	0	0	0	50	20	150	

Total IKS hours for semester: 0 Hrs.

Abbreviations: CL- Class room Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH- Notional Learning Hours, FA- Formative Assessment, SA-Summative assessment, IKS - Indian Knowledge System, SLA- Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

Note:

FA-TH represents average of two class tests of 30 marks each conducted during the semester.

1. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
2. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
3. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
4. One credit is equivalent to 30 Notional hrs.
5. * Self-learning hours shall not be reflected in the Time Table.
6. * Self-learning includes micro project/ assignment/ other activities.

V THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No.	Theory Learning Outcomes (TLOs) aligned to Cos	Learning content mapped with Theory Learning Outcomes (TLOs) and (Cos)	Suggested Learning Pedagogies.
		SECTION I	
1	TLO 1.1 Explain sequence of various processes of garment manufacturing with the help of flow chart. TLO 1.2 Elaborate significance of marker planning and enlist various requirements of the same. TLO 1.3 Select suitable marker planning method for required garment batch.	**Unit – I Introduction to Garment Manufacturing** 1.1 Introduction to garment manufacturing industry in India 1.2 Flow chart for garment manufacturing. **Marker Planning** 1.3 Requirements of Marker	Chalk-Board Video Demonstrations Cooperative Learning Site/Industry Visit

		planning. 1.4 Methods of marker planning 1.1 Methods of drawing and reproduction of marker	
2.	TLO 2.1 Explain various objectives and requirements of spreading. TLO 2.2 Select suitable method of spreading for required garment batch. TLO 2.3 Elaborate various objectives and requirements of cutting. TLO 2.4 Select suitable cutting method for given garment batch. TLO 2.5 Describe various features of computer aided cutting.	**Unit – II Fabric Spreading and Cutting** **Spreading** 2.1 Objectives of spreading 2.2 Requirements of spreading. 2.3 Types of fabric. 2.4 Methods of spreading to form a lay. **Cutting** 2.5 Objectives of cutting. 2.6 Requirements of quality cutting. 2.7 Methods of cutting. a) Hand shears b) Straight knife c) Round knife d) Band knife e) Notchers f) Drills g) Die cutting h) Laser cutting i) Ultrasonic cutting j) Computer aided cutting.	Chalk-Board Video Demonstrations Cooperative Learning Site/Industry Visit
3.	TLO 3.1 Draw different types of seams and explain their characteristics. TLO 3.2 Select suitable seam for joining/stitching garment part in a given situation. TLO 3.3 Select suitable stitch type for joining/stitching garment part in a given situation. TLO 3.4 Use sewing machine for joining/stitching garments parts. TLO 3.5 Select type of needle for stitching given garment parts. TLO 3.6 Choose select thread for stitching given garment parts. TLO 3.7 Elaborate various causes and remedies of various sewing problems. TO 3.8 Select various components and trims for given garment stitching	**Unit III - Sewing, Fusing and Pressing** **Sewing** 3.1 Seam – definition, types of seam- Superimposed, Lapped seam, Bound seam, flat seam, decorative seam, edge neatening seams, addition of separate item, Belt loop and belt 3.2 Stitch – definition, intra looping, interloping, interlacing, lockstitch, chain stitch and hand stitch. 3.3 Sewing machine- Types of sewing machine, sewing machine feed mechanism, parts and their function.	Chalk-Board Video Demonstrations Cooperative Learning Site/Industry Visit

	assignment. TLO 3.9 Use type of fusible interlining, fusing equipment and method of fusing for given garment. TLO 3.10 Select method of pressing form given garment.	3.4 Sewing machine needle – parts of needle, their function, needle size, types of needle. 3.5 Sewing threads- Fibre type, thread construction, thread finishes. 3.6 Sewing problems – Problems of stitch formation, formation of pucker, causes and remedies for the same. 3.7 Components and trims – Labels and motifs, linings and interlinings, laces, braids, elastics, buttons and zipper. **Fusing and Pressing** 3.8 Fusing and pressing – advantages of using fusible interlinings, requirements of fusing, fusing equipment, methods of fusing, welding and molding, purpose of pressing, methods of pressing.	
		SECTION II	
4.	TLO 4.1Extend the understanding of garment TLO 4.2 Develop the understanding about the future scope of garment sector TLO 4.3 Select suitable machineries for garment processing TLO 4.4 Extend the understanding of principle and working of garment processing machineries TLO 4.5 Select type Of machines as per type of garments TLO 4.6 apply the standard procedures for processing of garments TLO 4.7 Identify faults and apply relevant rectification methods for different garments TO 4.8 Identify advantages and limitations of garment processing machnaries	**Unit IV- Garment industry and processing machineries** 4.1 garment industry and its requrements for textiles. 4.2 Potential of garment processing industry, 4.3 Parameters of garment industry for export market machine- 4.4 Machineries for garments processing-drum washing machin hydro extractor ,tumble drier, paddle dyeing machine,high temperature dyeing machine etc 4.5 Working process, parameters and precautios for machines 4.6 Advantages and limitations of garment processing	Chalk-Board Video Demonstrations Cooperative Learning Site/Industry Visit

		machines.	
5.	TLO 5.1 Extend the understanding of reasons of garment processing TLO 5.2 Develop the understanding about the preparation process to achieve specific effect. TLO 5.3 Select suitable dyes, pigments and chemicals for garment processing TLO 5.4 Apply the techno commercial aspects of dyeing and printing of garments TLO 5.5 Select type of machines as per type of garments for processing TLO 5.6 Apply the standard procedures for finishing of garments TLO 5.7 Identify faults and apply relevant rectification methods for different garments	**Unit III – Processing of garments** 5.1 Introduction to processing of garments, principle difference in processing of fabrics and garments seam, decorative seam, edge neatening seams, addition of separate item, Belt loop and belt 5.2 Process sequence possibilities In garment processing 5.3 Desizing scouring and bleaching of garments for preparatory process 5.4Principle of dyeing and its advantages and limitations for garments 5.5pigment printing and transfer printing of garments, its advantages and limitations 5.6 finishing of garments, soft finish, wrinkle free finish, and stain removing finish 5.7 Problems and remedies in garment processing .	Chalk-Board Video Demonstrations Cooperative Learning Site/Industry Visit
6.	TLO 6.1 Extend the understanding of reasons of denim demands in the market TLO 6.2 Develop the colour effects for given denim by different fashion washes TLO 6.3 extend the understanding of indigo dye to achieve various effects on denims TLO 6.4 Apply the techno commercial aspects of denim washing by different methods TLO 6.5 Identify faults and apply	**Unit VI – DENIM PROCESSING** 6.1 Introduction to processing of denim, principle difference in processing of denims 6.2 Process sequence possibilities In denim processing 6.3 Principle of indigo dyeing, its Advantages and limitations 6.4 Various fashion washes , stone acid wash, enzyme wash,etc	Chalk-Board Video Demonstrations Cooperative Learning Site/Industry Visit

	relevant rectification methods for denim washing process TLO 6.6 Identify advantages and limitations of denim processing	6.5Various effects by fashion washes on denim and garments. 6.6 Problems and remedies in denim processing	

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES NA

VII - SUGGESTED MICRO PROJECTS / ASSIGNMENTS / ACTIVITIES FOR SPECIFIC LEARNING / SKILL DEVELOPMENT (SELF LEARNING)

Self-Learning

Following are some suggestive self-learning topics:

- Collect information on recent developments in Garment Manufacturing along with their specifications.
- Collect photographs of the Garment Manufacturing machines and prepare a presentation.

Micro project

- Design different garments using mobile software. (Group of 4-5 students)
- Prepare collage of different traditional garments based on different states of India (Group of 4-5 students)
- Collect various types of dyed garments and make their chart.
- Collect various fashionable garments of all types of peoples
- Apply various colored designs on garments with natural colors
- Study fashion washes on denim jeans.

ASSIGNMNTS –

A SUGGESTIVE LIST IS GIVEN HERE,

a) Prepare the garment processing flow chart for processing of garments
b) Draw the diagrams of garment processing machines and describe their working
c) Compare garment processing with woven fabric processing.
d) Study the indigo dyeing with its process stages
e) Collect various garment samples and compare to each other

VIII – LABORATORY EQUIPMENTS / INSTRUMENTS / TOOL AND SOFTWARES REQUIRED. NA

IX SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTES AND ASSESSMENT PURPOSE (Specification Table)

Sr. No.	Unit	Unit Title	Applied Cos	Learning Hours	R- Level	U- Level	A– Level	Total Marks
1	I	Introduction to Garment Manufacturing	CO1	3	2	1	6	9
2	II	Fabric Spreading and Cutting	CO2	10	4	4	6	14
3	III	Sewing, Fusing and Pressing	CO3	10	4	2	6	12
4	IV	Garment industry and processing machineries	CO4	8	2	4	7	13
5	V	Garment processing	CO5	8	2	4	6	12
6	VI	Denim processing	CO6	6	2	4	4	10
				45	16	19	35	70

X ASSESSMENT METHODOLOGY /TOOLS

Formative assessment (Assessment for Learning)

Mid Term Test,
Micro Projects and
assignments Rubrics
Each practical will be assessed considering 60% weightage to process and 40% weightage to product.

Summative Assessment (Assessment of Learning)

End Term Examination Laboratory Performance

XI SUGGESTED CO-PO MATRIX FORM

Course Outcomes Cos	Program Outcomes (Pos)							Program Specific Outcomes (PSOs)*		
	PO-1 Basic & Discipline specific knowledge	PO-2 Problem Analysis	PO-3 Design Development of solutions	PO-4 Engineering tools	PO-5 Engineering practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Lifelong learning	PSO-1	PSO-2	PSO-3
CO1	2	3	1	1	-	1	1	1	2	1
CO2	2	3	2	1	1	2	1	2	1	2
CO3	2	2	2	1	1	1	1	2	1	2
CO4	2	2	3	1	1	1	2	2	1	2
CO5	2	2	2	1	1	2	1	1	1	2
CO6	2	3	2	2	2	1	2	1	1	2

Legends: - High: 03, Medium: 02, Low: 01, 0: No mapping

PROGRAM SPECIFIC OUTCOMES (PSO's)

(What s/he will continue to do in the textile Chemistry specific industry soon after diploma programme)

PSO 1: Perform preparatory, colouration and Finishing of Textiles using various relevant technologies

PSO 2: Perform Quality Identification, evaluation of Textile, fibres, yarns, fabrics dyes and chemicals using various test methods

PSO 3: Maintain various textile machines to produce various types of quality Textiles at optimum and sustainable cost.

XII SUGGESTED LEARNING RESOURCES / BOOKS

Sr. No.	Title	Author	Publisher
1	The Technology of Clothing Manufacture	Harold Carr and Barbara Lathan	Blackwell Science UK.
2	Sewing Lingerie	Singer	Cy De Cosse, UK
3	Garment Technology for Fashion Designer	Garry Cooklin	Blackwell Science UK.
4	Clothing for Moderns	Erain Mabel Clothing	Macmillan Publication New York
5	Pattern making for fashion designs	Armstrong, Helen Joseph	Harper Collins, LA ISBN : 9780136069348
6	Environmental issues-technology options for textile industry	Chavan R B Radhakrishnan J	IIT Delhi publication 1998
7	Energy conservation in Textile industries	Kalyanraman A R	SITRA 1995
8	Garment dyeing	MITTAL R.N	Textile association indis
9	Ecology and textiles	V A SHENAI	Sevak publication mumbai
10	Garment wet processing Technical manual	Tyndall (Michael)	AATCC, 1994

XIII LEARNING WEBSITES AND PORTALS

Sr. No.	Links / Portals	Description
1	http://www.garmentsmerchandising.com/flow-chart-of-garments-manufacturing-process/	Flow chart
2	https://textilelearner.blogspot.com/2012/02/process-flow-chart-of-garments.html	Flow chart
3	https://clothingindustry.blogspot.com/2018/01/fabric-spreading-garment-industry.html	Spreading
4	https://clothingindustry.blogspot.com/2018/01/methods-fabric-cutting.html	Cutting
5	https://clothingindustry.blogspot.com/2018/01/cutting-department-garment-industry.html	Cutting
6	http://fashion2apparel.blogspot.com/2017/04/different-types-seams-uses.html	Seams
7	https://clothingindustry.blogspot.com/2018/03/seam-classification-quality-seam.html	Seams
8	http://fashion2apparel.blogspot.com/2017/04/types-stitches-used-clothing.html	Stitches

9	https://www.onlineclothingstudy.com/2017/03/different-types-of-industrial-sewing.html	Sewing
10	https://www.wikihow.com/Choose-Sewing-Thread	Sewing Thread
11	http://www.garmentsmerchandising.com/8-sewing-faults-with-causes-and-remedies/	Garment Faults
12	http://www.fibre2fashion.com	Fashion washes
13	http:steaveapparel.com	Garment finishing
14	http://m.indiamart.com	Garment dyeing
15	http://textilelearner.net	Garment processing

XIV. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Sr. No.	Name & Designation	Institute	Contact No.	Email
1.	Mr. S. S. Joglekar, Sr. Lecturer (Selection Grade).	Sasmira's Institute of Man-made Textiles, Worli, Mumbai	9833909871	shirishjoglekar@sasmira.edu.in
2.	Shri. Bhagwan R Khade, Lecturer (Textile chemistry)	Sasmira's Institute of Man-made Textiles, Worli, Mumbai	9930602109	bhagwankhade@sasmira.edu.in

SASMIRA'S INSTITUTE OF MAN-MADE TEXTILES

PRINCIPAL

Program Name : Diploma in Textile Chemistry

Program Code : DTC

Semester : Fourth

Course Title : Chemicals & Auxiliaries Evaluation

Course code : X232405

I. RATIONALE

To study the chemistry, application, and efficiency of textile auxiliaries, detergents, resins, softeners, and thickeners in enhancing textile quality and productivity. To examine the degradation of natural and synthetic fibers during chemical processing and its analytical evaluation. To explore the ecological impact of textile auxiliaries, their tolerance limits, and significance. To address water pollution from dye-house effluents, remedial measures, and safe disposal processes. To investigate fabric staining and stain removal techniques and highlight the importance of effluent treatment in wet processing units.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

1. Comprehensive Knowledge of Textile Auxiliaries
   Understanding the purpose and types of textile auxiliaries, such as dyes, detergents, softeners, finishing agents, and others.
   Awareness of their chemical compositions, mechanisms of action, and applications in various textile processes like pre-treatment, dyeing, printing, and finishing.
   Familiarity with sustainable and eco-friendly auxiliary options.
   a. Application in Textile Processing
   The ability to select appropriate auxiliaries for specific textile materials and production processes.
   Optimizing production efficiency by using auxiliaries that improve properties like softness, durability, water resistance, or color fastness.
2. Environmental and Regulatory Awareness
   Understanding the environmental impact of textile auxiliaries and learning about biodegradability, eco-t oxicity, and regulatory compliance
   Awareness of strategies to minimize waste and pollution during the use and disposal of textile auxiliaries.
3. Problem-Solving and Innovation
   Developing problem-solving skills to address challenges in textile production, such as poor dye uptake, uneven finishing, or shrinkage issues.
4. Quality Control and Standardization
   Ability to perform quality control checks on textiles processed with auxiliaries to ensure compliance with industry standards.
   Evaluating auxiliaries based on parameters like toxicity, performance consistency, and cost- effectiveness.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

(a) Analyze various auxiliaries and surfactants suitable for the given fabric.
(b) Study the degradation processes of cellulosic fabrics and identify appropriate precautions.
(c) Identify stains on given fabrics and apply appropriate methods for their removal.
(d) Utilize suitable thickening agents for printing on specified textile fabrics.
(e) Select and apply appropriate wrinkle-free finishes and softeners for the specified textile fabrics.
(f) Analyze dye house effluents and propose methods for their treatment.

IV. TEACHING-LEARNING AND ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category	Learning Scheme					Credits	Assessment Scheme												Total Marks
				Actual Contact Hrs/ week			SLH	NLH		Paper Duration (hrs)	Theory				Based on LL & TL Practical				Based on SL			
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA			
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min		
X232405	Chemicals & Auxiliaries Evaluation	CAE	DSE	3	1	3	1	8	4	3	30	70	100	40	25	10	25	10	25	10	175	

Total IKS hours for semester: 1 Hrs.

Abbreviations: CL- Class room Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH- Notional Learning Hours, FA- Formative Assessment, SA-Summative assessment, IKS - Indian Knowledge System, SLA- Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

Note:

FA-TH represents average of two class tests of 30 marks each conducted during the semester.

1. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
2. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
3. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
4. One credit is equivalent to 30 Notional hrs.
5. * Self learning hours shall not be reflected in the Time Table.
6. * Self learning includes micro project/ assignment/ other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No.	Theory Learning Outcomes (TLOs) aligned to Cos	Learning content mapped with Theory Learning Outcomes (TLOs) and (Cos)	Suggested Learning Pedagogies.
	SECTION I		
1	.1 Explain the importance of the textile auxiliaries and their evaluation. .2 Explain the various auxiliaries in textile processing with their functions. .3 Describe the properties of oil. .4 Explain the functions of surface-active agents. .5 Determine the efficiency of the given wetting agent.	**Unit I - Textile auxiliaries& surfactants** Textile auxiliaries-importance, examples and their functions in wet processing. Textile auxiliaries-importance of the evaluation with example Oil and their properties—determination of diene value, flash point, iodine value etc. of the oil. Epoxidation and rancidity of oils. Definition and importance of the surfactants. Wetting agents-Function and evaluation for efficiency.	Improved Lecture, tutorial, Assignments, Demonstration, Simulation.

2.	.1 Explain the structure of cellulose. .2 Describe the degradation of cellulose with reasons. .3 Explain the formation of oxy-cellulose and hydrocellulose. .4 Identify the reasons of the degradation of cellulose. .5 Determine the copper number and cuprammonium fluidity of the given cellulose sample	**Unit II – Cellulose and degradation** Cellulose –structure and properties Degradation-formation of oxy-cellulose and hydrocellulose. Identification tests for oxy-cellulose and hydrocellulose. Comparison between oxy-cellulose and hydrocellulose. Copper number-definition, method of determination and its significance. Cuprammonium fluidity—its significance and determination method.	Improved Lecture, tutorial, Assignments, Demonstration, Simulation.
3.	.1 Explain the importance of the stain removing .2 Identify the various stains on textile fibres. .3 Select the relevant methods used for stain removing from textiles. .4 Explain the importance of various auxiliaries in wet processing. .5 Explain the evaluation methods for textile auxiliaries.	**Unit – III Stains removing on textiles and auxiliaries.** Object of stain removing. Stains on textiles—definition, identification methods and reasons of staining. Methods used for stain removing—mechanical, chemical solvent, enzyme etc. Importance of evaluations of auxiliaries. Evaluation of textile auxiliaries—dye-fixing agent, levelling agent, dispersing agent, carriers etc. Evaluation methods for textile auxiliaries by application. Criteria for wet processing for various auxiliaries.	Improved Lecture, tutorial, Assignments, Demonstration, Simulation.

SECTION II

	.1 Explain the various properties and sources of the starch. .2 Explain the importance textile thickeners in printing .3 Classify the thickening agents with their properties .4 Describe the properties of sodium alginate and its applications .5 Describe the method of determination of viscosity of the thickener.	**Unit-IV** **Textile thickening agents.** Starch-types, sources and their properties Textile thickener—importance for printing, classification with examples, properties and applications etc. Properties and applications of sodium alginate. Determination of viscosity of the thickeners Comparative testing methods for various thickener	Improved Lecture, tutorial, Assignments, Demonstration, Simulation.

	.1 Explain the importance of resin finishing. .2 Explain the mechanism with examples .3 Describe the method of evaluation of crease recovery angle of the given fabric. .4 Explain the importance of softening. .5 Classify the softeners with their properties. .6 Evaluate the given sample of the softener.	**Unit V – Finishing and softening** Importance of resin finishing. Resin finishing—mechanism and application methods. Various resins and their properties Evaluation of crease recovery angle of resin finished fabric. Softeners-types and their properties. Application methods of softener on textile fabrics. Various methods of evaluation of softener.	**Improved Lecture, tutorial, Assignments, Demonstration, Simulation.**
	.1 Explain the importance of effluent treatment of the process house. .2 Describe the chemical composition of dye house from various departments. .3 Describe the various methods of effluent treatment. .4 Explain the terms-BOD and COD and their significance. .5 Norms for effluent from textile processing.	**Unit -6 Effluent treatments** Dye house effluent and importance of treatments. Chemical composition of various departments of the dye house. Effluent treatments-Equalisation, sedimentation, flocculation, activated carbon, reverse osmosis etc. Definition of BOD, COD and method of determination Norms and criteria for textile effluent.	Improved Lecture, tutorial, Assignments, Demonstration, Simulation.

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr. No.	Laboratory Experiment / Practical Title / Tutorial Title	No. of Hours	Relevant COs
LLO 1.1 Identify various apparatus and glassware used for practical. LLO 1.2 Select suitable apparatus and glassware for the practical execution. LLO 1.3 Use relevant apparatus and glassware for the practical execution and chemicals to identify the size on textile material.	1	Use relevant chemicals to identify the size on textile material and relevant qualitative method for testing the given starch	3	CO a

LLO 2.1 Identify various apparatus and glassware used for practical. LLO 2.2 Select suitable apparatus and glassware for the practical execution. LLO 2.3 Use relevant apparatus and glassware for the practical execution and chemicals to identify the size on textile material.	2	Use relevant chemicals to identify the size on textile material and relevant qualitative method for testing the given starch	3	CO a
LLO 3.1 Identify various apparatus and glassware used for practical. LLO 3.2 Select suitable apparatus and glassware for the practical execution. LLO 3.3 Use relevant apparatus and glassware for the practical execution and understand the degradation or oxidation of cellulose by Determination of Copper Number	3	Use Copper Number to assess the oxidation and degradation level of cellulose.	3	CO b
LLO 4.1 Identify various apparatus and glassware used for practical. LLO 4.2 Select suitable apparatus and glassware for the practical execution. LLO 4.3 Use relevant apparatus and glassware for the practical execution and understand the degradation or oxidation of cellulose by Determination of Cuprammonium fluidity.	4	Use Cuprammonium hydroxide solution and measure the degradation of cellulose by dissolving it in cuprammonium hydroxide and measuring its flow properties or fluidity.	3	CO b
LLO 5.1 Identify various apparatus and glassware used for practical. LLO 5.2 Select suitable apparatus and glassware for the practical execution. LLO 5.3 Use relevant apparatus and glassware for the practical execution and understand the process to remove common stains from different fabrics.	5	Use different reagents and methods to remove stains from the given textile fabric.	3	CO c
LLO 6.1 Identify various apparatus and glassware used for practical. LLO 6.2 Select suitable apparatus and glassware for the practical execution. LLO 6.3 Use relevant apparatus and glassware for the practical	6	Use a viscometer to measure and compare the viscosities of different textile printing thickeners (Natural Thickeners).	3	CO d

execution for Determining the viscosity of textile printing thickeners (Natural Thickeners) ensuring optimal print quality and consistency.				
LLO 7.1 Identify various apparatus and glassware used for practical. LLO 7.2 Select suitable apparatus and glassware for the practical execution. LLO 7.3 Use relevant apparatus and glassware for the practical execution for Determining the viscosity of textile printing thickeners (Synthetic Thickeners) ensuring optimal print quality and consistency.	7	Use a viscometer to measure and compare the viscosities of different textile printing thickeners (Synthetic Thickeners).	3	CO d
LLO 8.1 Identify various apparatus and glassware used for practical. LLO 8.2 Select suitable apparatus and glassware for the practical execution. LLO 8.3 Use relevant apparatus and glassware for the practical execution for Evaluating the Impact of Levelling Agents in Textile Dyeing.	8	Compare K/S values across samples to determine the effect of the levelling agent on color yield. Analyze fastness properties to assess if the levelling agent influences wash durability.	3	CO a
LLO 9.1 Identify various apparatus and glassware used for practical. LLO 9.2 Select suitable apparatus and glassware for the practical execution. LLO 9.3 Use relevant apparatus and glassware for the practical execution to assess the effectiveness of various dye-fixing agents in enhancing the wash fastness of direct-dyed cotton fabrics.	9	Compare the washing fastness ratings, color change evaluations, and color strength values of the samples treated with different dye-fixing agents against the control sample and determine the effectiveness of each dye-fixing agent in enhancing the wash fastness properties of the dyed fabrics.	3	CO a
LLO 10.1 Identify various apparatus and glassware used for practical. LLO 10.2 Select suitable apparatus and glassware for the practical execution. LLO 10.3 Use relevant apparatus and glassware for the practical execution to assess how different concentrations of dispersing agents influence the colour strength and fastness properties	10	Plot the K/S values against the dispersing agent concentrations to observe the relationship between dispersing agent levels and dye uptake and Analyze wash and rubbing fastness ratings to determine the optimal dispersing agent concentration that balances color strength and fastness properties.	3	CO a

of polyester fabrics dyed with disperse dyes.				
LLO 11.1 Identify various apparatus and glassware used for practical. LLO 11.2 Select suitable apparatus and glassware for the practical execution. LLO 11.3 Use relevant apparatus and glassware for the practical execution for Evaluating the crease recovery angle of resin-finished fabrics which is crucial for maintaining a smooth appearance in garments.	11	To measure the crease recovery angle of resin-finished fabrics, thereby assessing their ability to recover from creasing.	3	CO e
LLO 12.1 Identify various apparatus and glassware used for practical. LLO 12.2 Select suitable apparatus and glassware for the practical execution. LLO 12.3 Use relevant apparatus and glassware for the practical execution Eor Evaluating the impact of fabric softeners on finished fabrics	12	To assess the effects of different fabric softeners on the physical and comfort properties of textile fabrics.	3	CO e
LLO 13.1 Identify various apparatus and glassware used for practical. LLO 13.2 Select suitable apparatus and glassware for the practical execution. LLO 13.3 Use relevant apparatus and glassware for the practical execution for Analysing textile dye house effluents	13	To analyze the physicochemical properties of textile dye house effluents and evaluate their potential environmental impact.	3	CO f

VII. SUGGESTED MICRO PROJECTS / ASSIGNMENTS / ACTIVITIES FOR SPECIFIC LEARNING / SKILL DEVELOPMENT (SELF LEARNING)

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

Microprojects

1. **Analysis of Wetting Agents**
   - Objective: Evaluate the performance of different wetting agents used in textile pre-treatment.
   - Steps:
     - Compare wetting agents by measuring their surface tension reduction capacity.
     - Perform penetration tests on fabric samples.
   - Deliverable: Report comparing wetting agents based on key parameters.
2. **Foam Stability Testing of Detergents**
   - Objective: Test the foam stability of different textile detergents.

- Steps:
  - Prepare detergent solutions.
  - Measure foam height and stability over time.
- Deliverable: Graphs showing foam stability with observations and recommendations.

3. **Evaluation of Dye Fixing Agents**
- Objective: Assess the efficacy of dye fixing agents in improving wash fastness.
- Steps:
  - Dye fabric samples and apply fixing agents.
  - Perform wash fastness tests and compare results.
- Deliverable: Comparative study showing effectiveness of different agents.

4. **Assessment of Softening Agents**
- Objective: Test and compare different fabric softeners for hand feel and durability.
- Steps:
  - Treat fabric samples with softening agents.
  - Conduct hand feel and crease recovery tests.
- Deliverable: A detailed report on the pros and cons of each softener.

5. **Stain Removal Efficiency**
- Objective: Evaluate the stain-removal efficiency of textile auxiliaries.
- Steps:
  - Use standard stains (oil, ink, coffee) on fabric.
  - Treat with auxiliaries and analyze the results.
- Deliverable: Visual and quantitative data on stain removal performance.

VIII. SUGGESTED ASSIGNMENTS

A suggestive list is given here. Similar ASSIGNMENTS could be added by the concerned faculty:

Assignments

1. **Comparative Study on Surfactants in Textile Processing**
- Research and compare non-ionic, anionic, and cationic surfactants.
- Analyze their applications, advantages, and limitations.

2. **Role of Enzymes in Textile Pre-Treatment**
- Study the enzymatic scouring and desizing process.
- Include a case study or experiment evaluating enzyme efficiency.

3. **Impact of Auxiliaries on Eco-Friendly Textile Processing**
- Explore how textile auxiliaries contribute to sustainability.
- Include examples of biodegradable or low-impact auxiliaries.

4. **Evaluation of Optical Brightening Agents**
- Study the application and effects of optical brightening agents on textiles.
- Discuss parameters like whiteness index and fluorescence under UV light.

5. **Safety and Toxicity Analysis of Textile Auxiliaries**
- Prepare a report on the safety measures in handling textile auxiliaries.
- Discuss the impact of auxiliaries on human health and the environment.

6. **Role of Antimicrobial Agents in Functional Textiles**
- Investigate antimicrobial agents used in textiles.
- Test treated fabrics for microbial resistance.

IX. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS AND ASSESSMENT PURPOSE (Specification Table)

Sr. No.	Unit	Unit Title	Applied Cos	Learning Hours	R- Level	U- Level	A– Level	Total Marks
1	I	Textile auxiliaries& surfactants	CO1	10	4	6	3	13
2	II	Cellulose and degradation	CO2	08	4	5	3	12
3	III	Stains removing on textiles and auxiliaries.	CO3	06	4	4	2	10
4	IV	Textile thickening agents.	CO4	06	4	4	2	10
5	V	Finishing and softening	CO5	10	4	6	3	13
6	VI	Effluent treatments	CO6	08	4	5	3	12
				48	24	30	16	70

X. ASSESSMENT METHODOLOGY /TOOLS

Formative Assessment (Assessment for learning)

- Lab. Performance (Term work)

Summative Assessment (Assessment of Learning)

- End of Term examination – Practical Exam and Viva-voce

XI. SUGGESTED CO-PO MATRIX FORM

Course Outcomes Cos	Program Outcomes (Pos)							Program Specific Outcomes (PSOs)*		
	PO-1 Basic & Discipline specific knowledge	PO-2 Problem Analysis	PO-3 Design Development of solutions	PO-4 Engineering tools	PO-5 Engineering practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life long learning	PSO-1	PSO-2	PSO-3
CO1	3	2	2	1	1	1	2	2	3	3
CO2	3	2	2	1	1	1	2	2	3	3
CO3	3	2	2	1	1	1	2	2	3	3
CO4	3	2	2	1	1	1	2	2	3	3
CO5	3	2	2	1	1	1	2	2	3	3
CO6	3	2	2	1	1	1	2	2	3	3

Legends: - High: 03, Medium: 02, Low: 01, 0: No mapping

PROGRAM SPECIFIC OUTCOMES (PSO's)

(What s/he will continue to do in the textile and related industry soon after diploma programme)

PSO 1: **Perform preparatory, Colouuration and Finishing of Textiles using various relevant technologies.**

PSO 2: **Perform Quality evaluation of textiles, Fibres, Yarns, Fabrics, Dyes and Chemicals using various standard test methods.**

PSO 3: **Maintain various textile machines to produce various types of quality textiles at optimum and sustainable cost.**

XII. SUGGESTED LEARNING RESOURCES / BOOKS

Sr No.	Title of Book	Author	Publication
1.	"Chemical Processing of Textiles: Fundamentals and Future Trends"	Prakash, R. Senthil Kumar	CRC Press / Woodhead Publishing
2.	"Textile Auxiliaries and Finishing Chemicals"	Dr. R. B. Chavan	National Institute of Technical Teachers' Training & Research (NITTTR)
3.	"Chemical Technology in the Pretreatment Processes of Textiles"	S. R. Karmakar	Elsevier / Woodhead Publishing
4.	"Textile Chemistry" (Vol. 1-3)	V.A. Shenai	Sevak Publications
5.	"Textile Chemical Testing and Analysis"	Author: Q. Wei	Woodhead Publishing / Elsevier
6.	Surfactants and Interfacial Phenomena"	Author: Milton J. Rosen	Wiley
7.	Handbook of Industrial Chemistry and Biotechnology"	James A. Kent	Springer

XIII. SOFTWARE/LEARNING WEBSITES

- NPTEL (www.nptel.ac.in) – Free online courses on Textile Chemistry & Chemical Processing.
- Textile Association of India (www.textileassociationindia.org) – Articles and updates on chemicals & auxiliaries.
- Textile Learner (www.textilelearner.net) – Free online articles on textile chemicals & auxiliaries.
- Springer & Elsevier Journals – Good for research papers on industrial chemical evaluation.
- Coursera / Udemy – Courses on textile chemistry, industrial chemicals, and auxiliaries.

XIV. COURSE CURRICULUM DEVELOPMENT COMMITTEE

S. No.	Name & Designation	Institute	Contact No.	Email
1	Mr. Rajan Kori Lecturer	Sasmira's Institute of Man made Textiles, Worli, Mumbai	9004940950	rajankori@sasmira.edu.in

SASMIRA'S INSTITUTE OF MAN-MADE TEXTILES

PRINCIPAL

Programme Name : Diploma in Textile Chemistry

Programme Code : DTC

Semester : Fourth

Course Title : Ecofriendly Textile Processing

Course Code : X232404

1. RATIONALE

Textile industry uses lots of chemicals in pre-treatments, dyeing, printing, and finishing which are harmful to the environment. This course is introduced to update the students about the present need of the industry, society and the Environmental issues. This course is developed in such a way that the students will imbibe the attitude of eco-friendly processing alternatives and prevent the damage to the environment thereby making the processes sustainable. This will further help them to solve broad based problems in the textile processes from environment viewpoint.

2. INDUSTRY / EMPLOYER EXPECTED OUTCOMES

The aim of this course is to help the student to **"To inculcate the attitude of eco-friendly processing alternatives and prevent the damage to the environment"** and attain the industry identified competency through various teaching learning experiences:

3. COURSE LEVEL LEARNING OUTCOME (CO'S)

The Theory associated with this course is to be taught and implemented, so that the student demonstrates the following industry-oriented CO's associated with the above mentioned competency:

CO1 - Identify the relevant Environmental components, issues and systems.
CO2 – Provide an insight of the Environmental Management Systems for the various pollutions.
CO3 - Conduct SWOT analysis of water and soil pollution in textile industry
CO4 - Apply the relevant measures to assess the environmental impact assessment.
CO5 – Provide Road map for seeking Ecolables through understanding of current global textile laws.
CO6 - Implement the environmental policies & redressal technologies under the relevant legal framework.

IV TEACHING-LEARNING AND ASSESSMENT SCHEME

Course Code	Course Title	Course Category	Learning Scheme					Credits	Assessment Scheme										Total Marks
			Actual Contact Hrs/ week			SLH	NLH		Paper Duration (hrs)	Theory				Based on LL and TSL – Practical				Based on SL		
			CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
										Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
X232404	Ecofriendly Textile Processing	DSE	3	1	0	1	5	2.5	3	30	70	100	40	0	0	0	0	25	10	125

Total IKS hours for semester: 02 Hrs.

Abbreviations: CL- Class room Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH- Notional Learning Hours, FA- Formative Assessment, SA-Summative assessment, IKS - Indian Knowledge System, SLA- Self Learning Assessment

Legends: @Internal Assessment, #External Assessment, *#Online Examination,@$Internal Online Examination

Note:

FA-TH represents average of two class tests of 30 marks each conducted during the semester.

1. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
2. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
3. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.*15 Weeks
4. One credit is equivalent to 30 Notional hours.
5. *Self-learning hours shall not be reflected in the Timetable.
6. *Self-learning includes micro-project/assignment/other activities.

V THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No.	Theory Learning Outcomes (TLOs) aligned to Cos	Learning content mapped with Theory Learning Outcomes (TLOs) and (Cos)	Suggested Learning Pedagogies.
	SECTION I		
1	TLO 1.1 Describe the importance of importance of environmental studies. TLO 1.2 Describe the various environmental issues responsible for deterioration of various ecosystems. TLO 1.3 Describe the relevance of 5R's in combating the environmental pollution. TLO 1.4 Describe the factors contributing to climate change and role of SDG's in restoring the ecosystems. TLO 1.5 Describe the relevance of Zero Carbon Footprint for environment conservation in vedic India.	**Unit - I Environment and climate change** 1.1 Environment and its components, Types of Environments, Need of environmental studies 1.2 Environmental Issues- Climate change, Global warming, Acid rain, Ozone layer depletion, nuclear accidents. Effect of population growth and industrialization 1.3 Concept of 5R, Individuals' participation in i) 5R policy, ii) Segregation of waste, and iii) Creating manure from domestic waste. 1.4 Impact of Climate change, Factors contributing to climate change, Concept of Sustainable development, Sustainable Development Goals (SDGs), Action Plan on Climate Change in Indian perspectives. 1.5 Zero Carbon footprint for sustainable development, (IKS-Environment conservation in Vedic and pre-Vedic India).	Lectures, Presentations, Assignments, Practical, You- tube simulation, Flip classroom.
2.	TLO 2.1 - Identify the different management systems	**Unit II – Environmental Management System.** 2.1 Introduction to Management systems like QMS, EMS, SA & OHSAS, Significance of QMS,	Lectures, Presentations, Assignments, Practical, You- tube simulation, Flip

	TLO 2.2 - Describe the Environment Management Systems TLO 2.3 – Analyze the effects of different types of pollution on environment. TLO 2.4. - Describe the textile water pollutants along with the factors contributing water pollution. TLO 2.5 - Identify the monitoring and control of air and noise pollution.	EMS, SA & OHSAS and Advantages of QMS, EMS, SA and OHSAS. 2.2 Introduction to Environmental Management, Definitions of environment, ecology, pollution, 2.3 Types of pollution and its effects on environment, general waste categorization. 2.4 Textile water pollutants and their characterization. Factors contributing water pollution and their effect, water pollution parameters, physical, biological, chemical standards for quality of treated water. 2.5 Air and noise pollution, causes, effect, monitoring and control, Source of air and noise pollution, its effect and control.	classroom.
3.	TLO 3.1 – Describe the pollution of water and soil due to textile industry. TLO 3.2 – Analyze the impact of dyes on water and soil. TLO 3.3 – Identify the impact of specialty chemicals, chemicals and auxiliaries on eco system. TLO 3.4 - To select occupational safety measures and control health hazards in textile industries TLO 3.5 - Identify the Waste water treatment steps applicable for textile units.	**Unit III – Pollution and health aspects of textile Industry** 3.1 Introduction to water and soil pollution due to textile industry 3.2 Impact of dyes on soil & water parameters 3.3 Impact of specialty chemicals, chemicals and auxiliaries on eco system. 3.4 Occupational safety and health hazards in textile units and control, safety in chemical handling, noise exposure in textile industry, effects on workers, exposure limits, sources, PPE used in textile industry, Material safety data sheets. 3.5 Waste water treatment steps applicable for textile units.	Lectures, Presentations, Assignments, Practical, You- tube simulation, Flip classroom.
	SECTION II		
	TLO 4.1 – Extend the understanding of environmental impact assessment methodology. TLO 4.2 – Analyze the impact of Toxicological considerations of textile processing on the ecology.	**Unit IV – Environmental impact Assessment** 4.1 Introduction to environmental impact assessment methodology. Unit process: Environmental problems and human health, Risk assessment and risk management, 4.2 Ecology and textiles, Toxicological considerations of textile processing. Environmental Impact assessment, Definition & Need, waste	Lectures, Presentations, Assignments, Practical, You- tube simulation, Flip classroom.

	TLO 4.3 – Identify the Ecolables and the factors affecting ecolabelling TLO – 4.4 Extend the importance of Ecolabelling along with its advantages and limitations. TLO – 4.5 Identify the various analytical instruments and principles involved in the testing of ecological parameters.	minimization and recycling. 4.3 Recent Innovations of Eco Fabrics, Eco Labeling, Green Marketing Public awareness, factors affecting Eco Labeling. 4.4 Advantages & limitations of Eco Labeling Importance of Eco Labeling, Eco Labeling Standards 4.5 Testing of ecological parameters using various analytical instruments and principles involved in these testing.	
	TLO 5.1 Identify stages of allergic chemicals & dyes and scope of ecolables TLO 5.2 Describe current practices and innovations in eco labels TLO 5.3 Analyze eco labeling and factors affecting it and Explain advantages and limitations of eco labeling. TLO 5.4 Analyzing the testing of various ecological parameters and defining the testing principle of the same. TLO 5.5 Restate importance of eco labelling standards and enlist the methodology to acquire the same.	**Unit V – Ecology & Ecolabels** 5.1 German ban, Indian banned dyes, sensitizing dye stuff, allergenic dyes, carcinogenic amines, harmful dyes. 5.2 Introduction to Ecolables, Theory of Ecolabeling, Different perspectives of Ecolables, Implementation and consumer awareness 5.3 Ecolables and Eco-standards, different types of ecolables, different standards, norms of different ecolables, banned amines and banned chemicals, 5.4 Do's and don't for the manufacture of eco-friendly textiles, ecofriendly alternatives and ecofriendly processing. 5.5 Current Global Textile Laws for different countries and End uses Eco conformance certifications – Oeko-Tex (Confidence in Textiles), GOTS, REACH, etc	Lectures, Presentations, Assignments, Practical, You- tube simulation, Flip classroom.
	TLO 6.1 - Extend the scope of pollution redressal TLO 6.2 – Analyze the factors constituting sustainable development of textile sector. TLO 6.3 - Extend the understanding alternatives for toxic	**Unit VI – Pollution Redressal Technologies** 6.1 Definition and scope of pollution redressal, redressal mechanism, impact of changing environment human and other components of nature. 6.2 Factors constituting sustainable textiles - raw material extraction, textile production, Life cycle Assessment of clothing products.	Lectures, Presentations, Assignments, Practical, You- tube simulation, Flip classroom.

	chemicals and dyes. TLO 6.4 - Apply the techno-commercial aspects of effluent treatment plan and strategies. TLO 6.5 - Identify the technologies of colour removal from effluents.	6.3 Ecofriendly alternatives for toxic, hazardous & carcinogenic chemicals and heavy metals used in textiles, Green chemicals & green chemistry, Ozone depleting substances used in textiles. 6.4 Textile effluent characteristics, effluent standards, effluent treatments and its importance, corelation of BOD, COD & TOD, effluent treatment plan and strategies. 6.5 Colour in effluents, colour removal technologies Zero discharge concept & policy and its relevance in the present scenario.	

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES

VII. SUGGESTED MICRO PROJECTS / ASSIGNMENTS / ACTIVITIES FOR SPECIFIC LEARNING / SKILL DEVELOPMENT (SELF LEARNING)

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- Market survey of different dyes and auxiliaries: compare their properties, applications and eco-friendliness.
- Library survey regarding new developments in auxiliaries, dyes, and specialty chemicals and their health aspects.
- Prepare MSDS of frequently used chemicals, dyes and auxiliaries.
- Prepare flip charts of pollutions of air, water and soil and ecofriendly alternatives of the same.
- Present seminar on relevant topics.
- Collect information from internet on case studies of life cycle assessment of various textile products.

ASSIGNMENTS –

A suggestive list is given here. Similar ASSIGNMENTS could be added by the concerned faculty:

a. **To develop** list of banned amines along with their structures, properties and application classes to which it belongs to and present your report.
b. Visit industries and collect at least 10 dyed samples of different fibre types and identify the combination of dyes and chemicals used in each sample and comment on the ecofriendly nature of the used dyes. Present your report.
c. **List of chemicals** Collect list of auxiliaries and chemicals used for textile processing and try to find out its GOTS and REACH certification status. Correlate the results and present the report.
d. **Dye and chemical cost:** Visit industry and collect at least five dyeing recipes, price of dyes and chemicals of any two dyeing methods and calculate dyeing cost, water footprint and Carbon Footprint. Propose alternate sustainable option, prepare and present the report.

e. **Water consumption of Dyeing Process:** Visit any textile dye house. Collect information of any two dyeing machines for their water consumption per day. Calculate the quantity of water consumption per kg of fabric for the complete dyeing process. Propose alternate sustainable option, prepare and present your report.

f. Collect different Government policies of various countries, analyze them, prepare and present report.

VIII. LABORATORY EQUIPMENTS / INSTRUMENTS / TOOL AND SOFTWARES REQUIRED.

IX. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTES AND ASSESSMENT PURPOSE (Specification Table)

Sr. No.	Unit	Unit Title		Applied Cos	Learning Hours	R-Level	U-Level	A–Level	Total Marks
1	I	Environment and climate change		CO1	07	02	03	05	10
2	II	Environmental Management System.		CO2	08	02	04	07	13
3	III	Pollution and health aspects of textile Industry		CO3	08	02	04	07	13
4	IV	Environmental impact Assessment		CO4	07	02	03	05	10
5	V	Ecology & Ecolabels		CO5	08	02	04	07	13
6	VI	Pollution Redressal Technologies		CO6	07	02	03	06	11
					45	**12**	**21**	**37**	**70**

X. ASSESSMENT METHODOLOGY /TOOLS

Formative Assessment (Assessment for learning)

- Assignments submission (Term work)

Summative Assessment (Assessment of Learning)

- End of Term examination – Viva-voce

XI. SUGGESTED CO-PO MATRIX FORM

Course Outcomes Cos	Program Outcomes (Pos)							Program Specific Outcomes (PSOs)*		
	PO-1 Basic & Discipline specific knowledge	PO-2 Problem Analysis	PO-3 Design Development of solutions	PO-4 Engineering tools	PO-5 Engineering practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life long learning	PSO-1	PSO-2	PSO-3
CO1	2	2	3	1	3	1	2	2	2	3
CO2	2	2	3	1	3	1	2	2	2	3
CO3	2	2	3	1	3	1	2	2	2	3

CO4	2	2	3	1	3	1	2	2	2	3
CO5	2	2	3	1	3	1	2	2	2	3
CO6	2	2	3	1	1	1	2	2	2	3

Legends: -High: 03, Medium: 02, Low:01,0: No mapping

PROGRAM SPECIFIC OUTCOMES (PSO's)
(What s/he will continue to do in the textile and related industry soon after diploma programme)

PSO 1: **Perform preparatory, Colouration and Finishing of Textiles using various relevant technologies.**

PSO 2: **Perform Quality evaluation of textiles, Fibres, Yarns, Fabrics, Dyes and Chemicals using various standard test methods.**

PSO 3: **Maintain various textile machines to produce various types of quality textiles at optimum and sustainable cost.**

XII. SUGGESTED LEARNING RESOURCES / BOOKS

Sr. No.	Author	Title	Publisher
1	Environmental Science	S.C. Sandra	New central book agency, Kolkata 2004, ISBN:81-7381-404-X
2	Ecology and Environment (12th Edition)	P.D. Sharma	Rastogi publication, Meerut, 2005, ISBN:978-93-5078-068-8
3	Cleaner production in Textile wet processing	Dr. Prasad Modak	United Nation Publication, 1996, ISBN:92-8071608-5
4	Energy Management and Efficiency for Process Industries	Rossiter and Jones	John Wiley and Sons New Jersey US, 2015, ISBN:978-1-118-83825-9
5	Eco friendly Textiles: Challenges to the Textile Industry	Textiles Committee, Mumbai	Textiles Committee, Mumbai 1996
6	Textiles and the Environment	C. N. Shivaramakrishnan	Colour Publications Pvt. Ltd., Mumbai, First Edition, 2013 ISBN: 978-93-83112-08-5
7	Environmental Issues -Technology Options for Textile Industry	Chavan R B, Radhakrishnan J	IIT Delhi Publication, 1998.
8	Energy Conservation in Textile Industries	Kalyanaraman. A.R	SITRA 1995 (Revised)
9	Ecology and textiles	Shenai V.A.	Sevak publication Mumbai 1997

XIII. LEARNING WEBSITES AND PORTALS

Sr. No.	Links / Portals	Description
1	https://www.youtube.com/watch?v=G4H1N_yXBiA	Climate Change by UN
2	https://www.youtube.com/watch?v=xWrIb-9KzaA	Climate Change Series 1-6
3	https://www.youtube.com/watch?v=msPNqnLBXN4	EMS 14000
4	https://www.youtube.com/watch?v=8qyqHtc4cOM	ISO 14001 Aspects & Impacts Simplified
5	https://www.youtube.com/watch?v=ZJPp32ooMdY	ISO 14001 - 2015 Basic of all Clause | EMS (Environmental Management System)
6	https://www.youtube.com/watch?v=FNv1PXBQPwI	ISO 14001:2015 Basic concept on Environmental Management System In Hindi
7	https://www.youtube.com/watch?v=bIfS1G7S0KI	How textile Industries are responsible to create pollution?
8	https://www.youtube.com/watch?v=M_uQhdPFaYo	How Textile Companies Are Controlling Water Pollution? Eco India
9	https://www.youtube.com/watch?v=1seH2Zu9fAE	Viscose in India: Suffering for 'Green' Textiles | Pollution & Worker Exploitation
10	https://www.youtube.com/watch?v=zcxcPVX5ejY	The production of viscose fibres at Kelheim Fibres GmbH
11	https://www.youtube.com/watch?v=9-MEVIXr3Ko&list=PLLy_2iUCG87CkrNdXME16BCptwGx1fl67	Environmental Impact Assessment
12	https://www.youtube.com/watch?v=xCff_WC6se4&list=PLLy_2iUCG87CkrNdXME16BCptwGx1fl67&index=2	Lecture 1: State of Global Environment (Air)
13	https://www.youtube.com/watch?v=BciLqcUOIRo&list=PLLy_2iUCG87CkrNdXME16BCptwGx1fl67&index=3	Lecture 2: State of Global Environment (Biodiversity)
14	https://www.youtube.com/watch?v=eIs4M__2QG0&list=PLLy_2iUCG87CkrNdXME16BCptwGx1fl67&index=4	Lecture 3: State of Global Environment (Oceans and Coasts)
15	https://www.youtube.com/watch?v=IVYKnOmnhCI&list=PLLy_2iUCG87CkrNdXME16BCptwGx1fl67&index=5	Lecture 4: State of Global Environment (Land and Soil)
16	https://www.youtube.com/watch?v=ZDROuj1-lB8&list=PLLy_2iUCG87CkrNdXME16BCptwGx1fl67&index=6	Lecture 5: State of Global Environment (Freshwater)
17	https://www.youtube.com/watch?v=8vymflfip2w&list=PLLy_2iUCG87CkrNdXME16BCptwGx1fl67&index=7	Lecture 6: Definition, Process and Purpose of EIA
18	https://www.youtube.com/watch?v=E_oRwSRdgcQ&list=PLLy_2iUCG87CkrNdXME16BCptwGx1fl67&index=8	Lecture 7: EIA Impact Areas, Current and Emerging (Part 1)
19	https://www.youtube.com/watch?v=PrFskfLGHG8&list=PLLy_2iUCG87CkrNdXME16BCptwGx1fl67&index=9	Lecture 8: EIA Impact Areas, Current and Emerging (Part II)

20	https://www.youtube.com/watch?v=GyyyKMH-NhI&list=PLLy_2iUCG87CkrNdXME16BCptwGx1fl67&index=10	Lecture 9: EIA Origin in USA and World-Wide Development
21	https://www.youtube.com/watch?v=7RXBhYPqoNM&list=PLLy_2iUCG87CkrNdXME16BCptwGx1fl67&index=11	Lecture 10: EIA in India
22	https://www.youtube.com/watch?v=4pR877ZFzyE&list=PLLy_2iUCG87CkrNdXME16BCptwGx1fl67&index=12	Lecture 11: World Sustainable Development Timeline (1970-1999)
23	https://www.youtube.com/watch?v=N8h3ej5FpsE&list=PLLy_2iUCG87CkrNdXME16BCptwGx1fl67&index=13	Lecture 12: World Sustainable Development Timeline (2000-2021)
24	https://www.youtube.com/watch?v=XbgbGE_fqe0	What are Eco-Labels or Sustainability Labels? Different types of Eco Labelling.
25	https://www.youtube.com/watch?v=fBDoppZNa_I	Eco-labelling
26	https://www.youtube.com/watch?v=l7h78eOCdUQ	Life Cycle Assessment
27	https://www.youtube.com/watch?v=_rULClZxe_E	Life Cycle Assessment (LCA) for Beginners | Explained
28	https://www.youtube.com/watch?v=r0ucT1KRiO4	The principles of Life Cycle Assessment (LCA)
29	https://www.youtube.com/watch?v=EuqjWQrHe50	What is a Life Cycle Assessment (LCA)?
30	https://www.youtube.com/watch?v=hntlijTr2tw	BOD, COD, THOD, TOC EXPLAINED In Hindi
31	https://www.youtube.com/watch?v=Wt3qppLGpO4	Zero Discharge concept (Environmental Studies) in hindi with simple examples.
32	https://www.textile-chem.com/?gad_source=2&gclid=EAIaIQobChMIqbSCtKuGiwMVUatmAh199DxDEAEYASABEgIunvD_BwE	Textile Chemicals - Textile Auxiliaries Since 1996 - Research and development.
33	https://www.youtube.com/watch?v=zLVdc4GWPLw	Green Chemistry webinar series: How can the Textile Sector Solve one of its Biggest Challenges? 3/3.

XIV COURSE CURRICULUM DEVELOPMENT COMMITTEE

S. No.	Name	Institute	Contact No.	Email
1	Shri. Anand P. Modgekar HOD in Textile Chemistry	Sasmira, Mumbai	9869210958	hoddmtc@sasmira.edu.in

SASMIRA'S INSTITUTE OF MAN-MADE TEXTILES MUMBAI

SASMIRA'S INSTITUTE OF MAN-MADE TEXTILES

PRINCIPAL

Programme Name : Diploma in Textile Chemistry

Programme Code : DTC

Semester : Fourth

Course : Specialty Finishing Techniques of Textiles

Course Code : X231403

I. RATIONALE:

When the new generation fibre finishing came into existence, the existing finishing techniques require to update. To educate the students regarding the basic terms and calculations involved in finishing of textiles. Finishing technology regards the principle of working of machines and various chemicals to enhance the value-added properties with special precautions of the fabric depending upon the end use of the product for special use. The terms conventional finishing and functional finishing are therefore similar and both play a fundamental role for the commercial Excellency of the results of textiles, strictly depending on market requirements. The students should be given thorough knowledge of the same. The topics intends to impart the modern knowledge of special finishing techniques.

II. Industry/Employer expected outcome:

The aim of this course is to help the student to attain the following industry identified Competency through various teaching learning experiences:

"Undertake Speciality finishing techniques for all textile fibre materials for their various applications."

III. LEARNING OUTCOME (CO'S):

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above-mentioned competency:

(CO 1) Use relevant flame retardant finishing on required textile applications.
(CO 2) Select relevant anti- microbial finish for various textile fabrics.
(CO 3) Use relevant anti-pilling finish for various textile fabrics.
(CO 4) Use basic methods of soil release finish for textiles fabrics
(CO 5) Select foam finishing techniques for textile fabrics.
(CO 6) Select relevant special finishes for textiles as per end use.

IV TEACHING-LEARNING AND ASSESSMENT SCHEME

Course Code	Course Title	Course Category	Learning Scheme					Credits	Assessment Scheme											Total Marks
			Actual Contact Hrs/ week			SLH	NLH		Paper Duration (hrs)	Theory				Based on LL and TSL Practical				Based on SL		
			CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
										Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
X231403	Speciality finishing techniques of Textiles	DSC	3	0	3	1	7	3.5	3	30	70	100	40	50	20	50	20	25	10	225

Total IKS hours for semester: 03 Hrs.
Abbreviations: CL- Class room Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH- Notional Learning Hours, FA- Formative Assessment, SA-Summative assessment, IKS - Indian Knowledge System, SLA- Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

Note:
FA-TH represents average of two class tests of 30 marks each conducted during the semester.
1. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
2. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
3. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
4. One credit is equivalent to 30 Notional hrs.
5. * Self-learning hours shall not be reflected in the Time Table.
6. * Self-learning includes micro project/ assignment/ other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr. No.	Theory Learning Outcomes (TLOs) aligned to Cos	Learning content mapped with Theory Learning Outcomes (TLOs) and (Cos)	Suggested Learning Pedagogies.
		SECTION I	
1	TLO 1.1 Explain the importance of flame retardancy for textile fabrics TLO 1.2 Explain the concept of LOI and its significance for combustion. TLO 1.3 Classify the flame retardants for the given fabrics. TLO 1.4 Describe the method of application of flame retardant finish on the given fabrics **TLO 1.5** Describe the evaluation methods for flame retardants for the given fabric. TLO 1.6 Identify various applications of flame retardant finish	**Unit I – Flame Retardant finishing** 1.1 objective and importance of flame retardant finishing .Burning cycle and thermal behaviour of fibres 1.2 Mechanism and theory of flame retardancy of textiles. 1.3 LOI and its significance in flame Retardancy of textiles 1.4 Types of flame retardants and their method of applications. 1.5 Various methods of evaluation as angular method, vertical method etc. 1.6 Applications of flame retardancy on specified textiles.	Lectures, Presentations, Assignments, Practical, You-tube simulation etc.
2.	TLO 2.1 Explain the importance of antimicrobial finishing for textiles TLO 2.2 – Interpret the properties of a good antimicrobial finish	**Unit II – Antimicrobial Finishing** 2.1Antimicrobial finishing: objective of antimicrobial finishing 2.2 Desirable properties of good	Lectures, Presentations, Assignments, Practical, You-tube simulation etc.

	TLO 2.3 Describe the application methods of antimicrobial agents for given fabrics TLO 2.4 Classify antimicrobial finishes for the given fabrics. TLO 2.5 Describe the evaluation methods of antimicrobial finishes	antimicrobial finish 2.3 Various antimicrobial finishes and their properties. 2.4 Herbal antimicrobial finishes for various fabrics and their properties. 2.5 Evaluation methods for Antimicrobial treated fabrics. 2.6 Summarize the applications of Antimicrobial treated textiles.	
3.	TLO 3.1 Explain the importance of anti- pilling finishing for textiles. TLO 3.2 Interpret the factors affecting Pilling properties of the fibres. TLO 3.3 Describe the application methods for anti-pilling of the fabrics TLO 3.4 Suggest the process parameters for pilling of various fabrics TLO 3.5 . Describe the method of evaluation of anti-pilling	**Unit– III Anti- pilling** 3.1 Pilling: Importance and the objective of anti-pilling . 3.2 Factors affecting pilling properties of the fabrics. 3.3 Various fabrics and methods for anti-pilling 3.4 Physical and chemical methods of anti-pilling 3.5Process parameters and precautions for processes. 3.4 Evaluation of the pilling properties of the fabrics by ICI pilling tester.	Lectures, Presentations, Assignments, Practical, You-tube simulation etc.
		SECTION –II	
04	TLO 4.1 State the objective and importance of soil release finishing TLO 4.2 Identify various types of soils on textiles TLO 4.3 Explain the factors affecting the soiling of textiles TLO 4.4 Suggest the methods used for soil release finishing TLO 4.5 Describe the method used for evaluation of soil release finish	**Unit IV – Soil release finish** 4.1 Soil release finish: objective and importance of soil release finishing 4.2 Types of soils and soiling tendency of textiles 4.3 Factors affecting soiling of various textile fabrics 4.4 Methods used for soil release finishing of textiles. 4.5 Evaluation of soil release finished Fabrics.	Lectures, Presentations, Assignments, Practical, You-tube simulation etc.

05	TLO 5.1 Explain the objectives and importance of foam finishing TLO 5.2 suggest various techniques used for foam finishing TLO 5.3 State the properties of foam and basic terms TLO 5.4 Explain the applications of foam finishing in wet processing. TLO 5. 5 Identify the advantages and limitations of foam finishing.	**Unit V – Foam finishing** 5.1 Foam- Definition and types of foam. 5.2 Objective and importance of the foam finishing. 5.3 Properties of foam, Blow ratio etc. 5.4 Application methods of the foam finishing in textile processing 5.5 Machineries used for foam finishing application 5.5 various applications requirements 5.6Advantages and limitations of the foam finishing	Lectures, Presentations, Assignments, Practical, You-tube simulation etc.
06	TLO 6.1 Identify special finishes for textiles TL0 6.2 Explain importance of special finishes for textiles TLO 6.3 Suggest various special finishes: Nano finishing, bio finishing, silk like finishing etc. TLO 6.4 Describe methods used for application of various special finishes. TLO 6.5 Suggest advantages and limitations of special finishes. TLO 6.6 Identify applications of special finishes on various textiles.	**Unit VI- Speciality finishes for Textiles** 6.1Special finishes for textiles and objectives. 6.2 Explain importance of special finishes for various textiles 6.3 Various special finishes: Nano finishing, bio- polishing, silk like finish, perfume finish etc. 6.4 Methods used for applications 6.5 Advantages and limitations of special finishes. 6.6 Various applications of special finishes for various textiles.	Lectures, Presentations, Assignments, Practical, You-tube simulation etc.

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr. No.	Laboratory Experiment / Practical Title / Tutorial Title	No. of Hours	Relevant COs
LLO 1.1 Identify various apparatus and glassware used for practical. LLO 1.2 Select suitable apparatus and glassware for the practical execution. LLO 1.3 Use relevant apparatus and glassware for the practical execution and understand the effect of change in finish on cotton fabric.	1	Determine percentage expression of the padding mangle for the given fabric samples.	03*	CO1
LLO 2.1 Identify various apparatus and glassware used for practical.	2		3	CO1

LLO 2.2 Select suitable apparatus and glassware for the practical execution. LLO 2.3 Use relevant apparatus and glassware for the practical execution and understand the effect of after treatments on the given cotton fabric.		Apply relevant flame retardant finish on given fabric.		
LLO 2.1 Identify various apparatus and glassware used for practical. LLO 2.2 Select suitable apparatus and glassware for the practical execution. LLO 2.3 Use relevant apparatus and glassware for the practical execution and understand the effect of different concentrations of softening agents on the given fabric.	3	Apply the relevant softener on the given fabric sample.	3	CO3
LLO 2.1 Identify various apparatus and glassware used for practical. LLO 2.2 Select suitable apparatus and glassware for the practical execution. LLO 2.3 Use relevant apparatus and glassware for the practical execution and understand the effect of antimicrobial finish on given fabric.	4	Apply and evaluate the effect of application of relevant antimicrobial on the given blend fabric sample.	3	CO2
LLO 2.1 Identify various apparatus and glassware used for practical. LLO 2.2 Select suitable apparatus and glassware for the practical execution. LLO 2.3 Use relevant apparatus and glassware for the practical execution and understand the effect of flame retardant finish on the the textile fabric.	5	Apply and evaluate flame retardant on the given textile fabric.	3	CO1
LLO 2.1 Identify various apparatus and glassware used for practical. LLO 2.2 Select suitable apparatus and glassware for the practical execution. LLO 2.3 Use relevant apparatus and glassware for the practical execution and understand the effect of anticrease finish on cotton fabric.	6	Apply the resin finish on the given cellulosic fabric by padding	03*	CO3
LLO 2.1 Identify various apparatus and glassware used for practical. LLO 2.2 Select suitable apparatus and glassware for the practical execution. LLO 2.3 Use relevant apparatus and glassware for the practical execution and understand the effect of different stiff finish on the given fabrics.	7	Apply the stiff finish on the given fabric by padding method	3	CO4
LLO 2.1 Identify various apparatus	8		3	CO4

and glassware used for practical. LLO 2.2 Select suitable apparatus and glassware for the practical execution. LLO 2.3 Use relevant apparatus and glassware for the practical execution and understand the effect of soil release finish on cotton fabrics.		Apply the soil releases finish on the cotton fabric by continuous method on padding mangle		
LLO 2.1 Identify various apparatus and glassware used for practical. LLO 2.2 Select suitable apparatus and glassware for the practical execution. LLO 2.3 Use relevant apparatus and glassware for the practical execution and understand the effect of resin finish on the cotton fabric.	9	Apply and evaluate the resin finish on the given blend fabric sample by relevant method	3	CO4
LLO 2.1 Identify various apparatus and glassware used for practical. LLO 2.2 Select suitable apparatus and glassware for the practical execution. LLO 2.3 Use relevant apparatus and glassware for the practical execution and understand the effect of flame retardant on cotton fabric.	10	Apply the flame retardant finish on the cotton fabric.	3	CO6
LLO 2.1 Identify various apparatus and glassware used for practical. LLO 2.2 Select suitable apparatus and glassware for the practical execution. LLO 2.3 Use relevant apparatus and glassware for the practical execution and understand the effect of antimicrobial finish on cotton fabric.	11	Apply the antimicrobial finish on the fabric sample	3	CO2
LLO 2.1 Identify various apparatus and glassware used for practical. LLO 2.2 Select suitable apparatus and glassware for the practical execution. LLO 2.3 Use relevant apparatus and glassware for the practical execution and understand the effect of water repellent on cotton.	12	Apply the water repellent finish on the cotton fabric	3	CO4
LLO 2.1 Identify various apparatus and glassware used for practical. LLO 2.2 Select suitable apparatus and glassware for the practical execution. LLO 2.3 Use relevant apparatus and glassware for the practical execution and understand the effect of different stiff finishes on the given fabric.	13	Apply the relevant stiff finish on the given cotton fabric by padding method	3	CO6
LLO 2.1 Identify various apparatus and glassware used for practical. LLO 2.2 Select suitable apparatus and glassware for the practical execution. LLO 2.3 Use relevant apparatus and glassware for the practical execution	14	Apply the relevant perfume finish on the given blend fabric by	3	CO2

and understand the effect of perfume finish on given blend fabric.		padding method		
LLO 2.1 Identify various apparatus and glassware used for practical. LLO 2.2 Select suitable apparatus and glassware for the practical execution. LLO 2.3 Use relevant apparatus and glassware for the practical execution and understand the effect of silk like finish on the given fabric.	15	Apply the relevant silk like finish on the given blend fabric by padding method	3	CO6
LLO 2.1 Identify various apparatus and glassware used for practical. LLO 2.2 Select suitable apparatus and glassware for the practical execution. LLO 2.3 Use relevant apparatus and glassware for the practical execution and understand the effect of bio polishing of cotton fabric.	16	Apply the bio-polishing treatment on the given cotton fabric sample	3	CO6

VII - SUGGESTED MICRO PROJECTS / ASSIGNMENTS / ACTIVITIES FOR SPECIFIC LEARNING / SKILL DEVELOPMENT (SELF LEARNING)

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

(a) Market survey of different processed fabrics and compare the following points.
Construction and type of weave
Processes carried out
Applications of the given fabric.
(b) Visit any synthetic process house nearby to your house and take the help of processing in-charge to know the various processes.
(d) Write report on visit to dye house and compare the existing process conditions.
(e) Read the safety precautions of various chemicals and machinery used in process house.
(f) Do internet survey and prepare chart of various finishes, chemicals and machines in market.
(g) Guide student(s) in undertaking micro-projects.
(h) Library/ Internet survey of developments in all fibre finishing.
(i) Prepare power point presentation for understanding various finishing processes
(j) Understand faults in finishing and find relevant remedies.
(k) Understand good work practices in synthetic fabric finishing.

ASSIGNMENTS –
A suggestive list is given here. Similar ASSIGNMENTS could be added by the concerned faculty:
(a) Special finishes: Prepare models to demonstration on methods of special finishing techniques.
(b) Flame retardant finish: Prepare models to demonstrate Flame retardant finish on different textile fibre varieties with different agents.
(c) Antimicrobial finish: Prepare models to demonstrate anti-microbial finish, chemicals and machineries, testing of textiles for anti –microbial test
(d) Describe the anti-pilling and foam finishing treatments for various textiles
(e) Collect various special finished fabrics and study their properties

VIII – LABORATORY EQUIPMENTS / INSTRUMENTS / TOOL AND SOFTWARES REQUIRED.

Sr. No	Equipment Name with Borad Specifications	Relevant LLO Number
1	Padding mangle machine, pots each with 250 / 500 ml. capacity.	1, 2,3, 4, 5, 6
2	Water bath with steel dye pots with 250 / 500 ml. capacity.	7,8,9, 10,11,12, 13,14,15
3	Drying, Curing & Setting Chamber (Oven), Max. Temperature -200°C	All
4	Electronic balance with 0.001gm accuracy, capacity 300 gm.	All
5	Glassware – Watch glass, Beaker, Glass rod, Pipette etc.	All
6	Relative finishing agents samples and chemicals	All

IX SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTES AND ASSESSMENT PURPOSE (Specification Table)

Sr. No.	Unit	Unit Title	Applied Cos	Learning Hours	R-Level	U-Level	A–Level	Total Marks
1	I	Flame retardant finishing	CO1	08	2	4	6	12
2	II	Anti-microbial finishing	CO2	09	2	4	7	13
3	III	Anti –pilling finish	CO3	07	2	3	5	10
4	IV	Soil release finish	CO4	09	2	4	6	12
5	V	Foam finishing Technology	CO5	06	2	3	5	10
6	VI	Special finishes	CO6	09	2	4	7	13
				48	12	22	36	70

X. ASSESSMENT METHODOLOGY /TOOLS

Formative Assessment (Assessment for learning)

- Lab. Performance (Term work)

Summative Assessment (Assessment of Learning)

- End of Term examination – Practical Exam and Viva-voce

XI . SUGGESTED CO-PO MATRIX FORM

Course Outcomes Cos	Program Outcomes (Pos)							Program Specific Outcomes (PSOs)*		
	PO-1 Basic & Discipline specific knowledge	PO-2 Problem Analysis	PO-3 Design Development of solutions	PO-4 Engineering tools	PO-5 Engineering practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life long learning	PSO-1	PSO-2	PSO-3
CO1	2	2	3	1	1	1	2	2	3	3
CO2	2	2	3	1	2	1	2	2	3	3
CO3	2	2	3	1	1	1	2	2	3	3
CO4	2	2	3	1	2	1	2	2	3	3
CO5	2	2	3	1	1	1	2	2	3	3
CO6	2	2	3	1	1	1	2	2	3	3

Legends: - High: 03, Medium: 02, Low: 01, 0: No mapping

PROGRAM SPECIFIC OUTCOMES (PSO's)

(What s/he will continue to do in the textile and related industry soon after diploma programme)

PSO 1: **Perform preparatory, Colouration and Finishing of Textiles using various relevant technologies.**

PSO 2: **Perform Quality identification, evaluation of textiles, Fibres, Yarns, Fabrics, Dyes and Chemicals using various standard test methods.**

PSO 3: **Maintain various textile machines to produce various types of quality textiles at optimum and sustainable cost.**

XII SUGGESTED LEARNING RESOURCES / BOOKS

Sr. No.	Author	Title	Publisher
1	Datya .K.V & Vaidya .A.A	Chemical processing of synthetic and its blends	A wiley inter science publication ISBN-0901956740 ,1984
2	Shenai V.A	Technology of finishing Vol-X Edition 3rd	Sevak publication 1990
3	Marsh J.T.	Introduction to textile finishing	B.I publication 1979
4	Heywood	Textile Finishing Heywood	SDC Publications ISBN-9780901950811
5	Gulrajani, M. L.	Silk Dyeing printing and finishing	BPB Publications, New Delhi 2016, ISBN:978-8183331630

6	Grover, E.B; Hamby, D.C.	Hand book of Textile Testing & Quality Control	John Wiley & Sons Inc., 1960, ISBN: 9780470329016
7	Hurst, George and Henry	Silk Dyeing, Printing and Finishing	Ratebooks club.com,2012 ISBN-9781130986525
8	Amutha K.	A Practical Guide to Textile Testing	Wood Head Publishing, New Delhi, 2016. ISBN: 9789385059070
9	Basak Anindita	Environmental Studies	Pearson education
10	R.M Mittal& S Trivedi	Cemical processing of polymer&Cellulosic blends	ATIRA,Ahmedabad

XIII LEARNING WEBSITES AND PORTALS

Sr. No.	Links / Portals	Description
1	Textilelearner.blogspot.in/2011/03/description-of-textile-finishing_1796.html	
2	Textilelearner.blogspot.in/2012/03/textile-softening-fabric-softening.html	
3	www.onlineclothingstudy.com/2015/11/mechanical-finishes-textiles.html	
4	Textileapex.blogspot.in/2015/03/resin-finishing-importance.html	
5	Textilelearner.blogspot.in/2011/05/description-of-optical-brightening_4142.html	
6	www.teonline.com/knowledge-centre/flame-retardants.html	
7	Textilelearner.blogspot.com/printing-method-method-of-printing	
8	www.tikp.co.uk/knowledge/technology/finishing/textile-finishing	
9	Textilefashionstudy.com/finishing-of-textiles-definitions-objective	
10	www.fibre2fashion.com/industry-article/1240/antimicrobial-finishes	

XIV COURSE CURRICULUM DEVELOPMENT COMMITTEEL:

S. No.	Name	Institute	Contact No.	Email
1	Shri. Bhagwan R Khade Lecturer in Textile Chemistry	Sasmira, Mumbai	9930602109	bhagwankhade@sasmira.edu.in

SASMIRA'S INSTITUTE OF MAN-MADE TEXTILES MUMBAI

SASMIRA'S INSTITUTE OF MAN-MADE TEXTILES

PRINCIPAL

Programme Name/s : **Diploma in Textile Chemistry**
Programme Code : **DTC**
Semester : **Fourth**
Course Title : **Technology of Printing Synthetic Fibers**
Course Code : **X231402**

I. RATIONALE

In the textile industry, various natural as well as synthetic textile fibres undergo numerous chemical processes. Printing of synthetic fibres is one of such processes which enhance aesthetic properties and market value of the fabric. Diploma engineers must possess knowledge and skills of using various dyes, chemicals, related auxiliaries, different styles of printing and relevant methodologies for printing different fabrics. This course is designed to equip diploma engineers with skills in printing synthetic textile fibres, and enabling them to solve broad-based problems in textile printing processes.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Use relevant dyes, chemicals, thickeners, and equipment for printing the given synthetic fibres.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

CO1 - Select relevant thickener, ingredients, fixation method and style to print the given polyester fabric.
CO2 - Use relevant dyes, pigments, ingredients and fixation method to print the polyester blended fabric.
CO3 - Use relevant style, dyes, ingredients and fixation method to print the acrylic fabrics.
CO4 - Use relevant style, dyes, ingredients and fixation method to print the nylon fabrics.
CO5 - Use relevant paper printing and transfer printing machines to print the given substrate.
CO6 - Use relevant ink, inkjet printing technology to print the given fabric.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
X231402	TECHNOLOGY OF PRINTING SYNTHETIC FIBRES	TPSF	DSC	3	1	3	1	8	4	03	30	70	100	40	50	20	50	20	25	10	225

Total IKS Hrs for Sem. : 3Hrs

Abbreviations: CL- Class Room Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course, then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL) hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

SECTION - I			
Sr.No	**Theory Learning Outcomes (TLO's)aligned to CO's.**	**Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.**	**Suggested Learning Pedagogies.**
1	TLO 1.1 Describe with flowchart the relevant fabric preparation process before printing the given fabric. TLO 1.2 Choose relevant preparation process for the given polyester fabric with justification. TLO 1.3 Describe with flowchart the stages involved in printing of the given fabric. TLO 1.4 Select relevant print fixation method for development of prints on the given fabric with justification. TLO 1.5 Select relevant thickener based on the given print fixation method with justification. TLO 1.6 Select relevant disperse dye based on the given print fixation method with justification. TLO 1.7 Select relevant ingredients for printing of the given polyester using specified style of printing with justification. TLO 1.8 Describe with flow chart the procedure to develop prints with disperse dye and using specified styles on the given fabric. TLO 1.9 Explain with justification the importance of reduction clearing after-treatment for the given fabric.	**Unit - I Printing of Polyester** 1.1 Fabric preparation: Importance of desizing, scouring, bleaching and heat-setting, 1.2 Printing stages: Fabric preparation, print paste preparation, actual printing, drying, print fixation, after-treatments. 1.3 Print fixation methods: Atmospheric steaming, pressure steaming, high temperature steaming, thermo-fixation, mechanism, machinery, advantages, and disadvantages. 1.4 Thickeners: selection criteria for various fixation methods. 1.5 Disperse dye: Properties, selection criteria based on print fixation method. 1.6 Print paste ingredients: ingredients with their role. 1.7 Printing of polyester: Print paste formulation for direct, discharge and resist style of printing, process sequence. 1.8 After-treatment: Reduction clearing, importance, process parameters.	Lecture Using Chalk-Board Presentations

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Select relevant dye systems and print paste ingredients for printing the given blended fabric with justification. TLO 2.2 Select relevant disperse-reactive dyes for the given method with justification. TLO 2.3 Describe with flow chart the procedure to develop prints with disperse-reactive/ vat system on the given blended fabric. TLO 2.4 Describe with flowchart the application of single dye on the given blend. TLO 2.5 Select relevant ingredients for printing pigments on the given blended fabric with justification. TLO 2.6 Select relevant Polyester / Cotton blend composition for brasso style of printing with justification. TLO 2.7 Describe with flowchart the procedure to develop brasso prints on the given blended fabric. TLO 2.8 Select relevant Polyester / Cotton blend composition for carbonized prints with justification. TLO 2.9 Describe with flowchart the procedure to develop carbonized prints on the given blended fabric.	**Unit - II Printing of Polyester Blends** 2.1 Printing of Polyester/ Cotton blended fabric: Selection criteria of disperse dye, reactive dye, vat dye. 2.2 Print paste: Ingredients, role of ingredients. 2.3 Printing with Disperse reactive system: selection criteria of dyes for single phase method, two phase method, and formulation based on blend composition, print fixation, process sequence, advantages, and limitations. 2.4 Printing with Disperse-Vat system: print paste formulation, print fixation, after-treatment, process sequence, advantages, and limitations. 2.5 Single dye application on Polyester / Cotton blend: Polystyrene dye, print paste ingredients, formulation, print fixation, after-treatment, process sequence. 2.6 Printing of Polyester/Wool and Polyester/Acrylic blend: selection of disperse, acid, basic dyes, print paste ingredients, formulation, print fixation, after-treatment, process sequence. 2.7 Pigment printing: Print paste ingredients, selection criteria of binder, formulation, fixation, process sequence, advantages, and limitations. 2.8 Brasso style of printing: Principle, mechanism, selection criteria of polyester/ cellulosic blend composition, print paste formulation, development of print, after-treatment, process sequence, advantages, and limitations. 2.9 Carbonized prints: Principle, selection criteria of polyester/ cellulosic blend composition, print paste formulation, development of print, after-treatment, process sequence, advantages, and limitations.	Lecture Using Chalk-Board Presentations Video Demonstrations Flipped Classroom
3	TLO 3.1 Select relevant print paste ingredients for printing on the given fabric with justification. TLO 3.2 Select relevant disperse dye based on specified print fixation method with justification. TLO 3.3 Describe with flowchart the procedure to formulate paste for the given dye and fabric. TLO 3.4 Describe with flowchart the procedure to develop prints with cationic dye on the given fabric	**Unit - III Printing of Acrylic** 3.1 Print paste ingredients: ingredients, role. 3.2 Print fixation: Atmospheric steaming, pressure steaming, high temperature steaming, thermo fixation, selection criteria of dyes. 3.3 Paste formulation: Procedure for disperse dye printing on acrylic fabric. 3.4 Printing with disperse dye: Print paste formulation for direct and discharge style of printing, print fixation, after-treatment, process sequence. 3.5 Printing with cationic dyes dye: Print paste formulation for direct and discharge style of printing, print fixation, after-treatment, process sequence.	

SECTION - II			
Sr.No	**Theory Learning Outcomes (TLO's)aligned to CO's.**	**Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.**	**Suggested Learning Pedagogies.**
4	TLO 4.1 Select relevant print paste ingredients for printing on the given fabric with justification. TLO 4.2 Select relevant disperse dye based on specified print fixation method with justification. TLO 4.3 Describe with flowchart the procedure to formulate paste for the given dye and fabric. TLO 4.4 Describe with flowchart the procedure to develop prints with disperse dye/ acid dye/ metal complex dye on the given fabric	**Unit - IV Printing of Nylon** 4.1 Preparation of Nylon fabric: Importance of scouring, bleaching, heat setting. 4.2 Different classes of dyes used: Acid dye, Reactive dyes, (Procion , Procinyl) Reactive-disperse, Metal complex dyes, and pigment colours. 4.3 Paste formulation: Procedure for disperse dye printing on nylon fabric. 4.4Printing with disperse dye: Print paste formulation for direct style of printing, print fixation, after-treatment, process sequence. 4.5 Printing with Acid dye: Print paste formulation for direct and discharge style of printing, print fixation, after-treatment, process sequence. 4.6 Printing with Reactive dye: Print paste formulation for direct style of printing, print fixation, after-treatment, process sequence. 4.6 Printing with metal complex dye: paste formulation for direct style of printing, print fixation, after-treatment, process sequence.	Lecture Using Chalk-Board Video Demonstrations Presentations Site/Industry Visit Flipped Classroom
5	TLO 5.1 Select relevant transfer printing technique to print the given fabric with justification. TLO 5.2 Select relevant transfer printing paper based on the given characteristics with justification TLO 5.3 Select relevant dye and ink to print on the given paper for transfer printing with justification TLO 5.4 Explain with sketch, the working principle of the given paper printing machine. TLO 5.5 Select relevant printing machine to print the paper based on the complexity of design with justification. TLO 5.6 Select relevant transfer printing machine to print the given textile substrate based on the complexity of design with justification. TLO 5.7 Explain with sketch, the working principle of the given transfer printing machine.	**Unit - V Transfer Printing** 5.1 Transfer printing: Concept, Types, Melt transfer, Film release transfer, semi-wet transfer, Vapour/ heat transfer, Mechanism. 5.2Transfer printing paper: characteristics of paper. 5.3Transfer printing ink: characteristics of disperse dye, ink. 5.4Transfer paper printing machine: Gravure printing, Flexographic printing, Lithographic printing, technical features, advantages, and limitations. 5.5Fabric Transfer Printing Machines- Flat bed presses transfer printing machine, Continuous transfer printing machine and Vacuum transfer printing machine : Technical features, Production capacity, advantages and limitations. 5.6 Advantages and limitations of transfer printing over conventional printing.	

6	TLO 6.1 Explain with sketch, the working principle of the given inkjet/ digital printing technology. TLO 6.2 Select relevant inkjet/ digital printing machine to print the given fabric with justification TLO 6.3 Select relevant ink or dye to print the given fabric with justification. TLO 6.4 Distinguish between the given printing and conventional printing processes.	**Unit - VI Digital Printing** 6.1 Digital printing: Concept, Classification of inkjet/ digital printing, types of nozzles. 6.2 Continuous Inkjet printing: Binary deflection inkjet printing, Multi-level deflection inkjet printing, Technical features, advantages, and limitations. 6.3 Drop on demand inkjet printing: technical features, advantages, and limitations. 6.4 Ink for inkjet: Characteristics of ink, dyes for printing. 6.5 Comparison between inkjet/ digital printing and conventional printing.	Lecture Using Chalk-Board Video Demonstrations Presentations Site/Industry Visit

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Use direct style of printing to apply disperse dye on the given polyester fabric sample	1	*Direct style of printing on the given polyester fabric	3	CO1
LLO 2.1 Use direct style of printing to apply disperse dye on the given polyester fabric sample by varying the carrier	2	*Direct style of printing on the given polyester fabric sample by varying carriers	3	CO1
LLO 3.1 Use direct style of printing to apply disperse dye on the given polyester fabric sample by using print fixation methods.	3	Direct style of printing on the given polyester fabric sample by using print fixation methods	3	CO1
LLO 4.1 Use discharge style of printing to produce white and colour discharge effect on the given disperse dyed polyester fabric sample	4	*Discharge style of printing on the given disperse dyed polyester fabric	3	CO1
LLO 5.1 Use resist style of printing to produce white and colour resist effect on the given disperse dyed polyester fabric sample	5	*Resist style of printing on the given disperse dyed polyester fabric.	3	CO1
LLO 6.1 Use single phase method to apply disperse/ reactive dyes on the given Polyester/ Cotton blended fabric. LLO 6.2 Use two phase method to apply disperse/ reactive dyes on the given Polyester/ Cotton blended fabric.	6	*Printing using disperse/ reactive dyes on the given Polyester/ Cotton blended fabric	3	CO2
LLO 7.1 Apply pigment prints on the given Polyester and Polyester/ Cotton blended fabric samples	7	*Pigment printing on the given Polyester and Polyester/ Cotton blended fabric samples	3	CO2
LLO 8.1 Use brasso style of printing to produce brasso effect on the given Polyester/cotton blended fabric.	8	*Brasso style of printing on the given Polyester/cotton blended fabric.	3	CO2
LLO 9.1 Use carbonization process to produce carbonized prints on the given polyester/cotton blended fabric.	9	*Carbonized prints on the given polyester/cotton blended fabric.	3	CO2
LLO 10.1 Use direct style of printing to apply disperse dye on the given acrylic fabric sample	10	*Direct style of printing on the given acrylic fabric sample	3	CO3
LLO 11.1 Use direct style of printing to apply acid dye on the given nylon fabric sample.	11	*Direct style of printing to apply acid dye on the given nylon fabric sample.	3	CO4
LLO 12.1 Use direct style of printing to apply metal complex dye on the given nylon fabric sample	12	Direct style of printing to apply metal complex dye on the given nylon fabric sample	3	CO4
LLO 13.1 Use direct style of printing to apply Disperse dye on the given nylon fabric sample	13	Direct style of printing to apply Disperse dye on the given nylon fabric	3	CO4
LLO 14.1 Use transfer printing method to print the given polyester fabric sample	14	*Transfer printing on the given polyester fabric sample	3	CO5
LLO 15.1 Use digital printing machine to print the given substrate.	15	*Demonstration of digital printing on the the given substrate.	3	CO6

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed. Judicial
- mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Print sample analysis: Visit textile printing industries/ market shops and collect at least 50 different printed samples of Polyester/ Blended/ Acrylic/ Nylon fabrics. Classify them with respect to style of printing, class of dye used for printing. Present the results.
- Print fault analysis: Visit industries and market shops and collect at least 50 samples of different varieties printed on different machines and examine the faults in the printed samples. Present the results.
- Evaluate fastness properties of printed fabric: Collect different printed fabric samples developed by various fixation methods. Evaluate their wash fastness, rubbing fastness and light fastness properties using specified ISO tests. Compare the result. Present the results.
- Optimize the chemical concentration: Compare the effect of different concentrations of chemicals used in print paste on the colour yield of prints and find optimized concentration. Prepare shade card. Present the results
- Optimize the printing process control parameters: Compare the effect of process control parameters e.g. print paste viscosity, number of strokes by squeezee, type of squeezee, print fixation conditions, after-treatments on the colour yield of printed fabric. Prepare shade card. Present the results.
- Short film on working of machine: Visit different textile printing industries. Observe the working operations of machines at various stages and capture video clips. Edit the video clips as per specified process sequence and make a short film. Present the short film.

Note :

Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
If a microproject is assigned, it is expected to be completed as a group activity.
SLA marks shall be awarded as per the continuous assessment record.
For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Wooden Screen 10"x10"	1,2,3,4,5,6,7,8,9,10,11,12,13
2	Rubber Squeeze: 8" width, 0.5 - 1cm thick,	1,2,3,4,5,6,7,8,9,10,11,12,13
3	Laboratory Printing table: 3Ft x 2 Ft and 2.5 Ft Height	1,2,3,4,5,6,7,8,9,10,11,12,13
4	Laboratory Stirrer: High Speed Mechanical Stirrer- 300 to 500 rpm	1,2,3,4,5,6,7,8,9,10,11,12,13
5	Laboratory Pressure Steamer: Pressure up to 30 psi and Temperature up to 150 degree celcius	1,2,3,4,5,6,7,8,9,10,11,12,13
6	Laboratory Padding Mangle: Horizontal (60-80% Expression)	3,4
7	Dye Pots: 250 ml, 500 ml	All
8	Beaker: 50 ml, 100 ml, 150 ml, 200 ml, 500 ml, 1000 ml	All
9	Measuring cylinder of capacity 10 ml, 25 ml, 100 ml and 1 lit	All
10	Pipette: 1 ml, 10 ml, 25 ml	All
11	Plastic or metal Tray: 12" x 18"	All
12	Electric drier: 230V, 200W	All
13	Electric Iron: 230 V, 1000W	All
14	Laboratory Drying, Curing and setting Chamber: temperature up to 220 degree Celsius, working width- 450 mm, length 1.7 meter, heater capacity- 8/16/24 kilo-watt.	All
15	Plastic Mug: 0.5, 1 and 2 lit capacity	All
16	Digital Weighing balance: 0.02 gm accuracy (300 gm) All	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Printing of Polyester	CO1	11	3	6	6	15
2	II	Printing of Polyester Blends	CO2	08	2	4	6	12
3	III	Printing of Acrylic	CO3	05	2	2	4	08
4	IV	Printing of Nylon	CO4	11	3	6	6	15
5	V	Transfer Printing	CO5	7	2	2	6	11
6	VI	Digital Printing	CO6	6	2	4	4	09
Grand Total				**48**	**14**	**24**	**32**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

Two periodic theory tests
Assessment of Practical
60% weightage to process and 40% weightage to product during laboratory learning

Summative Assessment (Assessment of Learning)

End Semester Examination- Laboratory
End Semester Examination- Theory

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	2	3	2	2	2	2	3	3	3
CO2	3	2	3	2	2	2	2	3	3	3
CO3	3	2	3	2	2	2	2	3	3	3
CO4	3	2	3	2	2	2	2	3	3	3
CO5	3	2	2	2	2	2	2	3	3	3
CO6	3	2	2	2	2	2	2	3	3	3

Legends :- High:03, Medium:02,Low:01, No Mapping: -

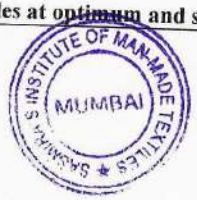
PROGRAM SPECIFIC OUTCOMES (PSO's)

(What s/he will continue to do in the textile and related industry soon after diploma programme)

PSO 1: Perform preparatory, Colouration and Finishing of Textiles using various relevant technologies

PSO 2: Perform Quality evaluation of textiles, Fibres, Yarns, Fabrics, Dyes and Chemicals using various standard test methods.

PSO 3: Maintain various textile machines to produce various types of quality textiles at optimum and sustainable cost.



XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Shenai, V. A.	Technology of Printing. Volume – IV	Sevak Publications, Mumbai, 1990
2	Miles, L.W.C.	Textile Printing	Society of Dyers and Colourists, UK, 1981, ISBN: 9780901956330
3	Cockett, S. R.; Hilton, K. A.	Dyeing and Printing	Leonard Hill Books Ltd. London, 1961, ISBN: 9781114785724
4	Clarke, W	Introduction to Textile Printing	Wood-head Publishing Ltd. Swaston, Cambridge , 1974 ISBN: 9781855739949
5	Dawn Dupree	Heat Transfer Techniques	Bloomsbury publishing India Private 1 Jan. 2011, ISBN: 9781408109113
6	Joanna Kinnersly Taylor	Dyeing and Screen Printing on Textiles	A & C Black Publishers Ltd., London, UK. 1 Jan 2012 ISBN: 9781408124758
7	Chrinstina Cie	Inkjet Textile Printing	Wood-head Publishing Ltd. Swaston, Cambridge, 3 Feb 2015 ISBN: 9780857092304
8	NIIR Board of consultants and Engineers	Textile Spinning, Weaving, Finishing and Printing	Asia Pacific Business Press Inc. Delhi, 2016, ISBN: 9788178331638
9	H. Ujiie	Digital Printing of Textiles	Woodhead Publishing Ltd, Cambrige, England ISBN 13: 9781855739512 (Book), ISBN 13: 9781845691585(EBook)
10	N. N. Mahapatra	Textile Printing	CRC Press, Woodhead Publishing India, Pvt. Ltd. ISBN: 9781032630106 (PBook), ISBN: 9781032630113 (EBook), DOI: 10.1201/9781032630113

XIII. LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://textilelearner.net/printing-polyester-by-varying- the -print-fixation-methods/#google_vignette	Direct Style of Printing on 100% Polyester
2	Transfer Printing- youtu.be/vRgs915qg50	A video on- Paper for transfer printing, Heat transfer printing machine, how to start T Shirt printing business
3	https://textilelearner.net/digital-inkjet-printing-in- textil e/	Digital Inkjet Printing in Textile: Properties, Types and Advantages
4	https://www.youtube.com/watch?v=xO14nSbidBI	Video on - Inside a Digital Textile Printing Factory
5	https://www.youtube.com/watch?v=cxEqPKq5Se8	A video of a complete process of digital textile printing solution | Pretreatment | Post Treatment |Reactive
6	https://archive.nptel.ac.in/courses/116/102/116102052/	Video lectures on Advanced Textile Printing Technology

XIV COURSE CURRICULUM DEVELOPMENT COMMITTEE

S. No.	Name	Institute	Contact No.	Email
1	Shri. Sukhdev B. Pawar Lecturer (Selection Grade) Textile Chemistry	Sasmira, Mumbai	9004032649	sukhdevpawar@sasmira.edu.in

SASMIRA'S INSTITUTE OF MAN-MADE TEXTILES

PRINCIPAL