# DKTE Society's

# **TEXTILE & ENGINEERING INSTITUTE**

Rajwada, Ichalkaranji 416115 (An Autonomous Institute)

**DEPARTMENT: TEXTILES** 

# CURRICULUM

# **B. Tech. Textile Chemistry Program**

## Second Year

With Effect From

2021-2022



Promoting Excellence in Teaching Learning & Research

				Teaching Scheme				
Sr. No.	Course Code	Name of the Course	Group	Theory Hrs/ Week	Tutorial Hrs/ Week	Practical Hrs/ Week	Total	Credits
1	TCL231	Textile Mathematics - III	BSC	3	-	-	3	3
2	TCL232	Thermal Engineering	ESC	3	-	-	3	3
3	TCL233	Polymer Science	ESC	3	-	-	3	3
4	TCL234	Chemistry of Fibre - I	PCC	3	-	-	3	3
5	TCL235	Technology of Pretreatment - I	PCC	3	-	-	3	3
6	TCL236	Spinning Technology	PCC	3	-	-	3	3
7	TCP237	Chemistry of Fibre - I Lab	PCC	-	-	2	2	1
8	TCP238	Technology of Pretreatment - I Lab	PCC	-	-	2	2	1
9	TCP239	Spinning Technology Lab	PCC	-	-	2	2	1
10	TCP240	Textile Design and Colour Lab	PCC	-	2	-	2	2
11	ADL201-A	Environmental Studies	HSMC	2	-	-	2	-
		Total		20	2	6	28	23

### Second Year B. Tech Textile Chemistry Semester- III

#### **Group Details**

- HSMC: Humanities, Social Science & Management Courses
  - BSC: Basic Science Courses
  - ESC: Engineering Science Courses
  - PCC: Professional Core Courses
  - PEC: Professional Electives Courses
  - OEC: Open Elective Courses
  - PST: Project / Seminar / Ind. Training
  - MC: Mandatory Courses

### DKTES Textile and Engineering Institute, Ichalkaranji Second Year B. Tech. Textile Chemistry (Semester – III) TCL231: TEXTILE MATHEMATIC-III

Teaching	Scheme:	Credits		Evaluation Scheme:		
Lectures:	03 Hrs./ Week	03		SE-I: 25 Marks		
				SE-II: 25 Marks		
Course O	bjectives:					
	o explain ordinary differ	ential equation and solve problems.				
	o apply ordinary differen	tial equations for solving simple m	echanical and elec	etrical problems.		
	explain linear different	al equation and solve problems.		1 11		
	o apply linear differentia	a equations for solving simple meet	ianical and electri	cal problems.		
	explain theory of small	sample tests ( $\chi^2$ t and E tests) with	the application in t	avtilac		
	o explain theory of small	sample tests $(\chi^2)$ , t and 1-tests) with	tra application in u	extines.		
	o explain theory of estim	ation and theory of statistical quali	ty control for proc	cess control		
a Course O						
At the end	of the course students y	vill be able to				
	olve problems related to	ordinary differential equations and	its applications			
	olve linear differential ec	uations and its applications.				
🗆 Id	entify textile data for tes	ting, test the hypothesis. Calculate	and interpret large	e sample Z-tests.		
C	alculate and interpret sm	all sample t-tests. Calculate and int	erpret Chi-square	and F-tests.		
	pply estimation for unkn	own parameters. Evaluate and inter	pret process and	ot control methods.		
		<b>Course Contents</b>				
Unit I	Differentia	l equations of first order & first	degree	07 Hours		
a. D	efinition of exact differe	ntial equation, method of solution a	nd examples			
b. D	efinition of non-exact di	fferential equation, method of solut	ion and examples			
c. D	efinition of linear differe	ntial equation, method of solution a	and examples			
d. D	efinition of non-linear di	fferential equation, method of solut	tion and examples			
Unit II	Linear differential	equations of nth order with const	ant coefficients	07 Hours		
a. D	efinition of LD equations.	methods of finding Solution in the f	form $y = C.F. + P.I$			
ar	id examples					
b. Ca	auchy's homogeneous line	ear differential equations with consta	nt coefficients and			
th	eir solution.	e 11 - 111 - 1100 - 11 1				
Unit III	Applications o	f ordinary and linear differential	equations	06 Hours		
a. A	pplications of ordinary d	ifferential equations to solve simple	e electrical and m	echanical		
er	engineering problems					
b. A	pplications of LD equati	ons to solve simple electrical and m	echanical engine	ering problems		
Unit IV	Testing	of hypothesis and Large sample f	ests	07 Hours		
a. In	troduction to testing of h	ypothesis,				
b. B	asic Concepts viz. Hypor	hesis, Statistic, Critical Region, Er	rors in testing, Le	vel of Significance.		
c. La	arge sample tests for pop	ulation mean, equality of populatio	n means and exar	nples		
d. La	. Large sample tests for population proportion, equality of population proportions and examples					

Unit	Unit V Small sample tests and estimation		07 Hours	
a.	Sma	ll sample tests for population mean, equality of population means and exar	nples	
b.	Test	for variance and equality of variances and examples		
с.	Test	for goodness of fit and examples		
d.	Test	for independence of attributes and examples		
Unit	VI	Statistical quality Control	05 Hours	
a.	Intro	duction to statistical quality control with types process control and lot con	trol.	
b.	Con	trol charts, $\overline{X}$ , $R$ , $np$ , $p$ and $C$ control charts and examples		
c.	Sing	le and double sampling plans. Concepts of lot control AQL, LTPD, AOQ,	AOQL, O.C. Curve	
Refere	nces	Books:		
1.	A Text Book of Applied Mathematics: by J.N. & P.N. Wartikar.			
2.	Higher Engineering Mathematics by B. S. Grewal.			
3.	A Text Book on Engineering Mathematics by Bali, Saxena & Iyengar.			
4.	Mathematical Statistics by J. Fruend.			
5.	App	lied Statistics & Probability of Engineers by Montgomery & Runger.		
6.	Prob	ability & Statistics for Engineers by Johnson.		

#### DKTES Textile and Engineering Institute, Ichalkaranji Second Year B. Tech. Textile Chemistry (Semester – III) TCL232: THERMAL ENGINEERING

Teaching Scheme:	Credits	Evaluation Scheme:
Lectures: 03 Hrs/Week	03	SE-I: 25Marks
	05	SE-II: 25Marks
		SEE: 50Marks

#### **Course Objectives:**

- □ To understand basics of Thermodynamics, Thermodynamics processes and Air standard cycles. To get familiar with the procedure for solving numerical based on the same.
- □ To understand the properties of steam, its types and applications in textile. Different types of steam boilers, its construction, accessories and mountings. To get familiar with the procedure for finding performance of boiler.
- □ To understand basics of Refrigeration, Air Conditioning and Thermic fluid heating system, concerned parameters, psychometric processes, application of the same in textile industry.
- □ To get acquainted with various types of compressors, pumps and pneumatic symbols, application of the same in textile industry.

#### **Course Outcomes:**

- □ Explain basics of Thermodynamics, thermodynamic processes and air standard cycles by drawing concerned diagrams, derive the necessary expressions and solve numericals based on the same.
- Explain the properties of steam, its types and applications in textile. To describe construction and working of different types of steam boilers, its accessories and mountings with the help of diagrams. To solve the numericals based on performance of boiler.
- □ Explain basics of refrigeration, air conditioning and thermic fluid heating system and its application in textile industry. To read and interpret psychometric chart. To describe psychometric processes with the help of diagrams and derive necessary expressions for the same.
- Describe construction and working of various types of compressors, pumps and their applications in textile industry. To draw symbols for pneumatic systems.

Course Contents						
Unit I		Introduction to Thermodynamics and Air standard cycle	09 Hours			
a. t t	<ol> <li>Introduction to Thermodynamics: Laws of thermodynamics – zeroth law, first Law, second law of thermodynamics. Thermodynamic Processes – constant volume, constant pressure, constant temperature, adiabatic, polytropic&amp; throttling process with P-V &amp; T–S diagrams, numericals based on the same.</li> </ol>					
b. t	<ul> <li>b. Air standard cycle: Introduction, assumptions in thermodynamic cycles, terms used in thermodynamic cycles, efficiency of a cycle, representation of Carnot cycle, Otto cycle, Diesel cycle on P-V and T-S diagram and numericals based on the same.</li> </ul>					
Unit II	[	Properties of Steam	06 Hours			
Formation of steam at constant pressure, temperature vs. total heat graph during steam formation, enthalpy, enthalpy of water, enthalpy of evaporation, enthalpy of dry saturated steam, wet steam, superheated steam, specific volume of steam, steam table, external work done during evaporation, internal energy of steam, difference between gas & vapour, types of calorimeter, numericals based of the same. Applications of steam in textiles.						

Unit	ш	Steam boilers, mountings & accessories	07 Hours		
a	Ste	am boiler: Introduction classification of boilers Important terms for steam	boilers essentials of		
b.	good steam boiler, selection of a steam boiler, construction & working of fire tube boilers such as Cochran boiler, Locomotive boiler, construction & working of water tube boiler such as Babcock & Wilcox boiler, equivalent evaporation, efficiency of boiler & numericals based on the same. Boiler mountings & accessories: Mountings - safety valve – dead weight safety valve, lever safety valve, spring loaded safety valve, water level indicator, fusible plug, steam pressure gauge, feed				
	chee	ek valve, stop valve, blow off cock. Accessories - feed water pump, injecto	r, economizer, super		
	heat	er	1		
Unit	IV	Thermic Fluid Heating System	02 Hours		
	Intro	oduction, thermic heating system, expansion & deaeration tank, their sele	ection, requirements of		
Unit	V	Refrigeration and Air Conditioning	12 Hours		
a.	Ref	rigeration: Introduction, unit of refrigeration, coefficient of performance (C	COP), difference		
	betv with	veen heat engine, refrigerator & heat pump. Air refrigerator working on rev P-V &T-S diagram, derivation for expression of COP.	versed Carnot cycle		
ь.	<ul> <li>b. Air Conditioning: Introduction, psychrometric terms, Dalton's law of partial pressure, psychrometric chart, psychrometric processes - sensible heating &amp; cooling, bypass factor of heating &amp; cooling coil, humidification &amp; dehumidification, sensible heat factor, cooling with dehumidification, cooling with adiabatic humidification of air, adiabatic chemical dehumidification, humidification by steam injection, mixing of air streams, objectives, methods &amp; features of modern humidification plant in textile mills, effect of moisture on textile fibres, sling psychrometer, hair type humidistat</li> </ul>				
Unit	VI	Pumps, Compressors and Introduction to Pneumatics	03 Hours		
a.	Pur Con com	nps & Compressors: Pumps – reciprocating, centrifugal (construction and v pressors - classification, reciprocating, rotary - vane & screw compressor, pressor, axial flow compressor.	vorking principle). centrifugal valves check valves		
	Air popp Tex	treatment – symbols for air filter, refrigerated dryer, lubricators, Control va pet valve, pilot operated check valve and spool valve. Application of Pneur tile machines.	ilves – symbols for natic circuits in		
Refere	ences	Books:			
1. 2. 3. 4.	A T . Th A c Ref	extbook of Engineering Thermodynamics by R.K. Rajput. ermal Engineering by R.S.Khurmi& Gupta. ourse in Refrigeration & Air conditioning by Arora &Domkundwar. rigeration & Air conditioning by R. K. Rajput.			
5.	Pne	sumatic Systems by Majumdar.			
6.	Hy	draulics & Pneumatics by Andrew & Parr.			
7.	Hu	midification & Air conditioning by S. P. Patel. 8. Textile Humidification by	y K. G. Vaze.		

	DKTES Textile and Engineering Institute, Ichalkaranji				
	Second Y	ear B. Tech. Textile Chemistry (	Semester –III)		
		TCL233: POLYMER SCIENC	JE		
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	ig Scheme:	Credits		Evaluation Scheme:	
Lecture	es: 03 Hrs / week	03		SE-I: 25 Marks	
				SE-II: 25 Marks	
				SEE: 50 Marks	
Course	Objectives:				
	To describe the basic deter	minants of fibre forming polymers			
	To discuss condensation, a	iddition and co-polymerization.			
	To discuss the techniques	of polymerization.			
	To explain the concept of i	molecular weight of polymers and p	polymer degradati	ion.	
Course	Outcomes:				
At the e	end of the course, students v	will be able to			
	Understand the basic deter	minants of fibre forming polymers			
	Explain the mechanisms of	f condensation, addition and co-pol	ymerization		
	Explain the techniques of p	polymerization.			
	Understand the concept of	molecular weight of polymers and	polymer degradat	tion.	
		<b>Course Contents</b>			
Unit	I Basic Det	erminants of Fibre Forming Poly	mers	06 Hours	
я	Importance of polymer sci	ence Various applications of polyr	ners Classificatio	on of polymers	
h	Definition of monomer of	igomer high polymer mesomer of	phesive energy de	nsity solubility	
0.	narameter glass transition	temperature functionality and deg	ree of polymeriza	tion	
c	Concept of basic determine	ants of fibre forming polymer		lioni	
d	Effect of molecular weight	Symmetry rigidity and chemical	reactivity of poly	meric chain on the	
u.	properties of polymer	, symmetry, ingrarty and onemical	reactivity of poly	inerie enam on the	
e	Concept of rubber plastic	and fibre			
f.	Essential requirements of s	suitability of a polymer for apparel	wear and industri	al applications	
Unit	Π	Condensation Polymerization		06 Hours	
	Machanism types feature	e essential requirements and impor	tance of condense	ation polymerization	
a. h	Carother's equation Signi	ficance of Carother's equation		ation porymenzation.	
0. C	Concept of gelation & cycl	lic polymer formation			
с. d	Effect of functionality on a	valation. Eactors affecting evelicati	on		
u.	Kinetics of condensation n	alymetrisation Stoichiometry of re-	on. actants and degree	e of polymerization	
Unit l		Addition polymerization	actains and degree	06 Hours	
Unit	Martaniana famor factores		:4:	00110013	
a. 1.	a. Mechanism, types, teatures and essential requirements of addition polymerization.				
D.	b. Types of initiation, chemistry of initiators, retarders and inhibitors.				
c.	Effect of catalyst, temperat	ture, pressure, solvents, modifiers,	emulsifying and s	suspending agents on	
	addition polymerisation.				
d.	d. Kinetics of addition polymerisation.				
e.	industrial applications of a	dation polymerisation.			
Unit		<b>Co-polymerization</b>		06 Hours	
a.	Concept of graft and block	co-polymerization and their impor	tance. Various te	chniques of grafting.	
b.	Various factors such as	temperature, time, dose-rate, c	oncentration of	monomers, diffusion,	
	scavengers, initiators & ph	vsical state on copolymerization.			

с.	Concept of ideal, alternating and azeotropic co-polymerisation.					
d.	Rea	Reactivity ratios of monomers and its significance. Concept of Q-e scheme.				
e.	Kin	etics of co-polymerisation and numerical based on reactivity ratio.				
Unit	V	Techniques of polymerization	04 Hours			
a.	Bull	x polymerization: mechanism, salient features and applications	1			
b.	Solı	tion polymerization: mechanism, salient features and applications				
c.	Sus	pension polymerization: mechanism, salient features and applications				
d.	Emu	Ilsion polymerization: Mechanism, salient features and applications				
e.	Soli	d-state polymerization and plasma polymerization: Concept, salient feature	s and applications			
Unit	VI	Molecular Weight and Polymer Degradation	11 Hours			
a.	Con	cept of $M_n$ , $M_w$ and poly-dispersibility-index, their significance.				
b.	Effe	cts molecular weight distribution of polymer on spinnability & drawability	r.			
c.	Ligl	nt scattering and ultra-centrifuge techniques to determine M <sub>w</sub> .				
d.	End	-group analysis, osmotic pressure, cryscopy and viscosity methods to deter	mine $M_n$ and $M_w$ .			
e.	Cha	racteristics of polymer using DSC, TGA and DTA.				
f.	Cha	racteristics of polymer using DMA and GPC				
g.	Con	cept of chain end and random polymer degradation.				
h.	Poly	mer degradation: thermal, mechanical, chemical and other agencies				
Refere	ences	Books:				
1.	Poly	mer sciences and technology by Joel R. Fried.				
2.	Tex	t book of polymer science by Fred W. Billmeyer, Jr.				
3.	Poly	mers and their properties by J.W.S. Hearle.				
4.	Org	anic chemistry of high polymers by Lenz.				
5.	5. Applied Polymer science by Flory.					
6.	6. Fundamentals of polymers by Anilkumar and Rakesh K. Gupta.					
7.	7. Principles of Polymerisation by George Odian.					
8.	Poly	mer science by Steven.				
9.	Intro	oduction to polymer chemistry by G.S. Mishra.				
10	. Poly	mer science and technology of plastics & rubbers by Dr. Premamoy Ghosl	1.			
11	11. Polymer Science by V.R. Gowarikar, N.V. Viswanathan & Jaydev Shreedhar.					

#### DKTES Textile and Engineering Institute, Ichalkaranji Second Year B. Tech. Textile Chemistry (Semester – III) TCL234: CHEMISTRY OF FIBRE- I

Teaching Scheme:	Credits	Evaluation Scheme:
Lectures: 03 Hrs/ Week	03	SE-I: 25 Marks
	05	SE-II: 25 Marks
		SEE: 50 Marks

**Course Objectives:** 

 $\hfill\square$  To describe basic concepts of textile fibres.

- $\hfill\square$  To describe chemistry and morphological structure natural of fibres.
- □ To impart knowledge about physical, mechanical & chemical properties and applications of fibres.
- □ To describe concept of spinning technologies and fibre manufacturing process.

#### **Course Outcomes:**

- $\Box$  Describe basic concept of textile fibres.
- Describe morphological and chemical structure of natural fibres
- □ Enunciate physical, mechanical & chemical properties and applications of fibres.
- □ Describe concept of various spinning technologies and fibre manufacturing process.

	Course Contents						
Unit I		Introduction	05 Hours				
a.	Con	cepts of Fibre, Yarn, Fabric, Staple fibre, Filament, Degree of polymerization	ion, Cohesive Energy				
	Density						
b.	Clas	sification of fibres according to their chemical nature and origin					
c.	Esse	ntial and desirable properties of fibres					
d.	Con	cept of crystalline region, amorphous region, mesomorphous region and th	eir importance				
Unit	Π	Natural Cellulosic Fibre: Cotton	09 Hours				
a.	Cult	ivation of cotton and varieties of cotton	·				
b.	Mor	phological structure and chemical composition of cotton.					
с.	Cher	nical structure of cotton					
d.	Cher	nistry of cellulose					
e.	Stru	ctures and reactions of cellulose					
f.	Phys	ical, mechanical & chemical properties and applications of cotton fibre.					
Unit	nit III Unconventional Natural Fibres 05 Hours						
a.	Mor	phological structure and chemical constitution of Jute and Flax	1				
b.	Cond	cept of hemicellulose, lignin and their chemistry					
с.	Retti	ng and extraction of Jute and Flax					
d.	Phys	ical, mechanical & chemical properties and applications of Jute and Flax					
Unit	IV	Regenerated Cellulosic Fibres	08 Hours				
a.	Cond	cept and essential requirements of wet spinning	1				
b.	Concept of extrusion and spinning						
c.	Theory of solidification of polymer in wet spinning						
d.	Raw	material, manufacturing process of viscose rayon, Polynosic rayon and Ten	cel.				
e.	Phys	ical, mechanical & chemical properties and applications of viscose rayor	n, Polynosic rayon and				
	Tenc	cel.					

Unit	V Modified cellulosic Fibres	04 Hours				
a.	Concept and essential requirements of dry spinning					
b.	b. Theory of solidification of polymer in dry spinning					
c.	Raw materials, manufacturing process of cellulose acetate					
d.	Physical, mechanical & chemical properties and applications of cellulose aceta	te				
Unit	VI Animal Protein Fibres	08 Hours				
a.	Chemistry of protein and amino acids					
b.	Types and grading of wool					
с.	Morphological structure, chemical composition and chemical structure of wool fibr	re				
d.	Bonds present in wool					
e.	Physical properties, chemical properties and applications of wool					
I.	Types and production of slik					
g.	Morphological structure, chemical composition and chemical structure of silk nore	;				
п. D. С	Physical, mechanical & chemical properties and applications of sitk					
Refere 1	V A Shenai Technology of Textile Processing Volume 1: Textile Fibres	Third Edition revised				
1.	Sevak Publication Mumbai (1991)	Third Edition Tevised				
2	V P Gowariker Polymer Science New Age International Publishers:	Third edition ISBN:				
2.	9387788644, (1 January 2019).	Third califon, 13DN.				
3.	J. Gordon Cook, Handbook of Textile Fibres. Volume 1 Natural Fibres, Wood	head Publishing Series				
	in Textiles ISBN:978-1-85573-484-5 (1984).					
4.	J. Gordon Cook, Handbook of Textile Fibres. Volume 2 Man-Made Fibres, Series in Textiles, ISBN: 978-1-85573-485-2 (1984).	Woodhead Publishing				
5.	Murthy, H. V. Sreenivasa, Introduction to Textile Fibres, Woodhead Publish ISBN:978-93-85059-57-5 (1984)	hing India in Textiles,				
6.	S.P. Mishra, A Textbook of Fibre Science and Technology, New Age Inter	rnational (P.) Limited,				
_	ISBN: 81-224-1250-5 (2000).					
7.	S. P. Mishra, Science and Technology of Man-Made Fibres, Suraj Publications	., ISBN:				
8.	R. R. Franck, Bast and other plant fibres, Woodhead Publication Ltd, England, (2005).	ISBN: 1-85573-684-5				
9.	W. S. Simpson and G. H. Crawshaw, Wool, Science and Technology, Wood England, ISBN: 1 85573 574 1 (2002)	lhead Publication Ltd,				
10.	M. L. Gulrajani, Silk Dyeing, Printing and Finishing, Dept. of Textile Techn of Technology, Hauz Khas, New Delhi, 1988.	ology, Indian Institute				

#### DKTES Textile and Engineering Institute, Ichalkaranji Second Year B. Tech. Textile Chemistry (Semester – III) TCL235: TECHNOLOGY OF PRETREATMENT - I

Teaching Scheme:	Credits	Evaluation Scheme:
Lectures: 03 Hrs / Week	03	SE-I: 25 Marks
	05	SE-II: 25 Marks
		SEE: 50 Marks

**Course Objectives:** 

- □ To describe individual operation used in pre-treatment and physical chemical changes brought int to textile material.
- □ To explain chemical formulations and process parameters used in unit operations of pre-treatment and properties of chemicals used.
- □ To explain machinery used in pre-treatments operations.
- □ To discuss quality parameters and environmental impact of pre-treatment operations.

#### **Course Outcomes:**

- □ Illustrate individual operation used in pre-treatment and physical chemical changes brought int to textile material.
- Demonstrate chemical formulations and process parameters used in unit operations of pre-treatment and properties of chemicals used.
- □ Explain machinery used in pre-treatments operations.
- □ Explain quality parameters and environmental impact of pre-treatment operations.

Course Contents						
Unit ISizing06 Ho						
a.	Obje	ectives of sizing, ingredients used in sizing.				
b.	Che	mistry and properties of natural, modified and synthetic adhesives; softener	S.			
c.	Prep	aration of size paste and properties like viscosity, congealing and keeping.				
d.	Form	nulation of size paste with respect to nature of fibre and yarn				
e.	Con	ponents of sizing machine				
Unit	II	Grey Inspection & Mechanical Cleaning Processes	06 Hours			
a.	Yarı	n and fabric faults, their types				
b.	Grey	y inspection - importance, equipment, four-point and ten-point systems and	l acceptance of grey			
	fabr	ic.				
c.	Obje	ectives of shearing and cropping process, working principle and features of	shearing and			
	crop	ping machine				
d.	Obje	ectives and methods of singeing,				
e.	Gas	singeing machine for yarn, woven and knitted fabric				
f.	Eval	uation of the efficiency of mechanical cleaning processes.				
Unit ]	Ш	Desizing	06 Hours			
a.	a. Impurities in cotton, introduction to unit operations in pre-treatment and their sequence.					
b.	Objective and methods of desizing, mechanism involved.					
c.	Machinery used in desizing					
d.	Desi	zing of synthetic size				
e.	Evaluation of the efficiency of desizing, size identification					

Unit IV		IV Scouring	06 Hours						
	a.	. Objects of scouring							
	b.	Natural impurities in cotton and mechanism of their removal							
	c.	Properties of various chemicals used in scouring like - sodium hydroxide, sodium carbonate, lime,							
		surfactants, sequestering agents, solvents and their functions.							
	d.	Formulation of scouring bath and process parameters							
	e.	Batch and continuous scouring processes							
	f.	Solvent assisted scouring and bio scouring							
	g.	Evaluation of the efficiency of scouring and degradation of cotton.							
	Unit	V Bleaching	07 Hours						
	a.	Objective of bleaching, different bleaching agents							
	b.	Bleaching with hypochlorite - properties, factor affecting, advantages and disa	dvantages.						
	с.	Bleaching with peroxide - properties, factor affecting, advantages and disadvantages and disadvantages and disadvantages and disadvantages are set of the	ntages.						
	d.	Chemical formulations and process parameters of cotton bleaching							
	e.	Evaluation of the efficiency of bleaching and degradation of cotton.							
	f.	Concept of single step preparatory processes, cold pad batch, semi-continuous	and continuous						
		bleaching – process parameters							
	g.	Evaluation of bleaching efficiency							
	Unit	VI Introduction to Mercerization	07 Hours						
	a.	Objects of Mercerization							
	b.	Various changes brought in to cotton by mercerization							
	c.	Various factors affecting the process of mercerization							
	d.	Concept of Hydrate formation and swelling							
	e.	Structural changes in cotton crystal							
	t.	Evaluation of efficiency of mercerization.							
	Refere	nces Books: Chamical tasks alogy in the maturation of tages of tagetiles. S. P. Kormalian, J.	Flaarvier						
	1.	Chemical technology in the pretreatment processes of textiles, S K Karmaker, J	Elsevier						
	2. 2	Sizing by Prol. D. B. Ajgaonkar, Dr. M.K. Talukdar& V.K. Wadekar							
	з. Л	Chemical rectiniology of holous materials by F. Sadov	vedi						
	- <del>1</del> . 5	Technology of Mercerizing by LT March	veui.						
	5. 6	Bleaching Dueing & Chemical Technology of Textile Fibres by F.R. Trotman							
	0. 7	Technology of Bleaching by Dr. V A. Shenai	•						
	,. 8	Warn Sizing by Paul V Seydel							
	9. 9	Bleaching & Mercerizing _ BTRA Silver Jubilee Monograph series							
	<i>.</i>	9. Bleaching & Mercerizing – BIRA Silver Jubilee Monograph series							

### DKTES Textile and Engineering Institute, Ichalkaranji Second Year B. Tech. Textile Chemistry (Semester – III) TCL236: SPINNING TECHNOLOGY

Teaching Scheme:	Credits	Evaluation Scheme:
Lectures: 03 Hrs. / Week	03	SE-I: 25 Marks
	05	SE-II: 25 Marks
		SEE: 50 Marks

#### **Course Objectives:**

- □ To explain cotton cultivation, ginning and yarn numbering systems.
- □ To explain process flow charts of different yarns and its preparatory processes.
- □ To discuss the ring spinning and yarn doubling.
- □ To describe principles and manufacturing processes of unconventional yarns.

#### **Course Outcomes:**

- $\hfill\square$  Understand the cotton cultivation, ginning and yarn numbering systems.
- $\Box$  Understand the process flow charts of different yarns and its preparatory processes.
- $\hfill\square$  Understand the ring spinning and yarn doubling process.
- □ Illustrate the principles and manufacturing processes of unconventional yarns.

Course Contents								
Unit I	Unit ICotton cultivation and flow charts07 Hours							
A) Cott	A) Cotton Fibre Cultivation & Ginning:							
□ C	otton cultivation in India.							
	efinition of picking and types of picking, their effect on cotton quality							
	efinition of Ginning and types of Ginning.							
B) Yarı	ns Numbering System:							
□ Iı	ntroduction to Direct system, indirect system.							
	tudy of Tex, Denier, English, Metric, Worsted, Woolen etc. systems.							
□ C	onversions between different systems of yarn numbering.							
	tudy of folded yarn, resultant yarn count calculations.							
C) Proc	ess flow charts:							
	onversion of staple fibres into Carded / Combed / Rotor / Air-jet yarn							
Unit II	Mixing and Blow room	07 Hours						
Mixi	ing & Blow-room –							
	Objects of mixing and blow-room.							
	Importance of opening & cleaning. Sequence of blow-room machines used.							
	Material feed to the card (Lap feed / Chute feed System).							
Unit III	Carding and Draw frame	<b>08 Hours</b>						
A) Car	A) Carding –							
	Objects of carding, Study of card, Introduction to carding and stripping action.							
	Passage of material through carding.							
	Production Calculation.							

<b>B</b> )	Draw frame –					
	□ Concept of drafting, requirement of doubling,					
	Objects of draw frame. Working of Draw frame.					
	□ Production calculations.					
Unit	V Comber preparatory and Comber	06 Hours				
C	omber Preparatory and Comber:					
	□ Objects of comber preparatory, Machines used. Passage of material through	Sliver lap and Ribbon				
	lap machines.	-				
	Dijects of comber, working of comber and passage of material through combe	er.				
	□ Production Calculations.					
Unit	V Spinning	07 Hours				
A)	Speed frame –					
	□ Object of speed frame. Passage of material through speed frame.					
	□ Production Calculations.					
B)	Ring Spinning –					
, í	□ Ring Frame – Objectives of ring frame, Passage of material through ring fram	e,				
	□ Ring yarn properties,	,				
	□ Production Calculations.					
C)	Yarn Doubling –					
	□ Objects, Passage of material through varn doubling machine.					
Unit	/I Unconventional Spinning	04 Hours				
U	iconventional Spinning Systems –	·				
	□ Advantages and limitations of ring spinning system					
	□ Introduction to following unconventional spinning techniques.					
	Compact spinning system.					
	• Rotor spinning system.					
	• Air Jet spinning system.					
	□ Properties of varns produced on above systems.					
Refere	nces Books:					
1)	The technology of short staple spinning by W. Klein, Vol. I. II, III, IV and V.					
2)	Cotton Ginning, Textile Progress, The Textile Institute Publication.					
3)	Cotton production and blow room by Dr. Ramesh N. Narkhedkar					
4)	Carding and Drawing by Prof A R Khare					
5)	Ring spinning and doubling by A. R. Khare					
5)	Cotton Cording by G. P. Marrill					
	Two for One Technology and Technicity for Sever Very hy Dr. U.S. Verlie	i and Dr. H. V. C.				
/)	Murthy.	и анц Dr. п. V. S.				
8)	Cotton Spinning by Ganesh and Garde					
9)	Spun Yarn Technology by Oxtoby					

#### DKTES Textile and Engineering Institute, Ichalkaranji Second Year B. Tech. Textile Chemistry (Semester – III) TCP237: CHEMISTRY OF FIBRE -I LAB

Lab Scheme:		Credits	Evaluation Scheme:
Practicals: 02 Hrs/ Week		01	CIE: 50 Marks
		VI	SEE: 50 Marks
List of Expe	riments		
1	Identification of f	ibres by chemical method. – I	
2	Identification of f	ibres by chemical method II	
3	Identification of f	ibres by Microscope Method.	
4	Identification of fibres by density gradient column.		
5	Determination of moisture regain of fibre.		
6	Determination of fibre length of cotton by using the Grease plate method.		
7	Determination of	fibre length of wool by using the	Grease plate method.
8	Detection of Hone	ey dew of cotton.	
9	Measurement of maturity of cotton by caustic soda method.		
10	Detection of cellulosic fibre damage.		
11	Detection of animal protein fibre damage.		
12	Determination of accessible region of cotton.		

#### DKTES Textile and Engineering Institute, Ichalkaranji Second Year B. Tech. Textile Chemistry (Semester – III) TCP238: TECHNOLOGY OF PRETREATMENT - I LAB

Lab Scheme:		Credits	Evaluation Scheme:
Practical: 02 Hrs / Week		01	CIE: 50 Marks
List of Exp	eriments		
1	Identification of size	on different types of grey cloth	
2	Desizing of textile fa	bric by various methods	
3	Alkaline scouring an	d solvent assisted scouring of text	ile goods
4	Bio-Scouring of texts	lle	
5	Bleaching of textile	abrics using Sodium Hypochlorit	e
6	Bleaching of textile	àbrics using Hydrogen Peroxide	
7	Pre-treatment of Silk		
8	Pre-treatment of Wo	ol	
9	Chlorite bleaching of	f textile fabric	
10	Bleaching of textiles	using potassium permanganate	
11	Determination of Car	rboxyl group content	
12	Mercerization of cott	on yarn and fabric	
13	Determination of Bar	rium Activity Number	

#### DKTES Textile and Engineering Institute, Ichalkaranji Second Year B. Tech. Textile Chemistry (Semester – III) TCP239: SPINNING TECHNOLOGY LAB

	Credits	Evaluation Scheme:
Hrs. / Week	01	CIE: 50 Marks
	UT UT	SEE: 50 Marks
iments		
To draw process f	low chart for carded yarn, comb	oed yarn & rotor yarn. (Mill Visit)
Study of hank and	l count calculation by wrapping	method.
Sequence of mach	hines in blow-room.	
Passage of materia	al through bale opener, mild cle	aner.
Study of intensive opener and Chute feed system.		
Study of passage	of material and production calcu	lation of carding machine.
Study of passage	of material and production calcu	lation of draw frame machine.
Study of passage	of material through comber prep	paratory machine.
Study of passage of material and production calculation of comber.		
Study of passage of material and production calculation of speed frame machine.		
Study of passage of material and production calculation of ring frame machine.		
12 Study of ring Doubler and TFO.		
	Hrs. / Week iments To draw process f Study of hank and Sequence of mach Passage of materia Study of intensive Study of passage Study of passage	Hrs. / WeekCredits 01imentsTo draw process flow chart for carded yarn, comb Study of hank and count calculation by wrapping Sequence of machines in blow-room.Passage of material through bale opener, mild cle Study of intensive opener and Chute feed system.Study of passage of material and production calcu Study of passage of material and production calcu

#### DKTES Textile and Engineering Institute, Ichalkaranji Second Year B. Tech. Textile Chemistry (Semester – III) TCP240: TEXTILE DESIGN AND COLOUR LAB

Lab Scheme:		Credits	Evaluation Scheme:
Tutorial: 02 Hrs/ Week		02	CIE: 50 Marks
List of Assig	gnments		
1	Elements of art- Line	e, Direction, Size, Shape, Colour,	Value, Texture.
2	Colour modification	chart- Primary, Secondary and Te	rtiary colour modification.
3	Colour theory chart - (Additive)	Pigment theory of colour (Subtra	ctive)and light theory of colour
4	Textile design development with the help of designing principles -Principle of Repetitions,		
5	Principle of Alteration - Change in colour, Change in size, Change in direction, Permutation a combination. (Any one of list.)		
6	Principle of Grade, H	Iarmony, Balance, Contrast, Domi	inance (Any one of list.)
7	Composition of textile design by - Rectangle base, Drop base – half drop or full drop.		
8 Composition of text		ttile design by Diamond base, Ogee base, Sateen base. (Any one of list)	
9 Development of tex		ile design for screen printing.	

#### **Submission – Completed Assignments**

#### **DKTES Textile and Engineering Institute, Ichalkaranji** Second Year B. Tech. Textile Chemistry (Semester - III) **ADL201-A: ENVIRONMENTAL STUDIES** Teaching Scheme: **Evaluation Scheme:** Lectures: 02 Hrs/ Week SEE-: 70 Marks CIE (Project work) -: 30 Marks (Annual Evaluation in Sem. IV) \*Evaluation of the course will be in Sem. IV based on syllabus of Sem. III and Sem. IV **Course Objectives:** □ To recall fundamental physical and biological principles those govern natural processes. □ To state the importance of ecological balance for sustainable development. □ To describe the impacts of developmental activities and mitigation measures and to further understand the environmental policies and regulations. To identify the complex relationships between scientific approaches to environmental issues and political, social, economic, and ethical perspectives on the environment. **Course Outcomes:** At the end of the course, students will be able to □ Develop an understanding of different natural resources including renewable resources. □ Realize the importance of ecosystem and biodiversity for maintaining ecological balance. Aware of important acts and laws in respect of environment. Demonstrate critical thinking skills in relation to environmental affairs **Course Contents** Unit I Significance of environmental studies **09 Hours** Multidisciplinary nature of environmental studies Need for public awareness. a. b. Forest resources: Use and over-exploitation, deforestation, Timber extraction, mining, dams and their effects on forests and tribal people. c. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. d. Mineral resources: Usage and exploitation, environmental effects of extracting and using mineral resources. e. Food resources: World food problem, changes caused by agriculture effects of modern agriculture, fertilizer-pesticide problems. f. Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. g. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. h. Role of an individual in conservation of natural resources. i. Equitable use of resources for sustainable lifestyle. **Unit II Ecosystems 09 Hours** Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristics features, structure and function of the following Ecosystem: - a) Forest ecosystem, b) Grassland ecosystem, c) Desert ecosystem, d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit III	<b>Biodiversity and its Conservation</b>	08 Hours	
	· · · · · · · · · · · · · · · · · · ·		

Introduction – Definition: genetic, species and ecosystem diversity, Biogeographical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.; Biodiversity at global, National and local levels.; India as a mega-diversity nation; Western Ghats as a bio-diversity region; Hot-spots of biodiversity; Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; Endangered and endemic species of India; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

#### **References Books:**

- 1. Clark R. S., Marine Pollution, Clanderson Press Oxford (TB) Pg No. 6.
- 2. Cunningham, W. P. Cooper, T. H. Gorhani, E. & Hepworth, M. T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p.
- 3. De A. K., Environmental Chemistry, Wiley Eastern Ltd.
- 4. Down to Earth, Centre for Science and Environment ®
- Gleick, H., 1993, Water in crisis, Pacific Institute for Studies in Dev., Environment & security. Stockholm Env. Institute. Oxford Univ. Press 473p.
- 6. Hawkins R. e., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay

		Course Name of the Course			Teaching Scheme			
Sr. No.	Course Code		Group	Theory Hrs/ Week	Tutorial Hrs/ Week	Practical Hrs/ Week	Practical Hrs/ Total Week	
1	TCL251	Textile Mathematics - IV	BSC	3	-	-	3	3
2	TCL252	Textile Electronics	ESC	4	-	-	4	4
3	TCL253	Chemistry of Fibre - II	PCC	3	-	-	3	3
4	TCL254	Technology of Pretreatment - II	PCC	3	-	-	3	3
5	TCL255	Chemistry of Dyes and Pigments	PCC	3	-	-	3	3
6	TCL256	Weaving and Knitting Technology	PCC	3	-	-	3	3
7	TCP257	Textile Electronics Lab	ESC	-	-	2	2	1
8	TCP258	Chemistry of Fibre - II Lab	PCC	-	-	2	2	1
9	TCP259	Chemistry of Dyes and Pigments Lab	PCC	-	-	2	2	1
10	TCP260	Weaving and Knitting Technology Lab	PCC	-	-	2	2	1
12	ADL201	Environmental Studies *	HSMC	-	2	-	2	-
		Total		19	2	8	29	23

### Second Year B. Tech Textile Chemistry Semester- IV

#### **Group Details**

- HSMC: Humanities, Social Science & Management Courses
  - BSC: Basic Science Courses
  - ESC: Engineering Science Courses
  - PCC: Professional Core Courses
  - PEC: Professional Electives Courses
  - OEC: Open Elective Courses
  - PST: Project / Seminar / Ind. Training
  - MC: Mandatory Courses

DKTES Textile and Engineering Institute, Ichalkaranji Second Year B. Tech. Textile Chemistry (Semester –IV) TCL251: TEXTILE MATHEMATICS-IV					
Teachi	ng Sc	heme:	Credits		Evaluation Scheme:
Lecture	es: 03	Hrs./ Week	03		SE-I: 25 Marks
			05		SE-II: 25 Marks
					SEE: 50 Marks
Course	e Obj	ectives:			
	To e	explain Laplace transfo	orm & inverse of it with examples.		
	To a	pply Laplace transform	n for solving L.D. equations		
	To t	each vector differentia	tion with examples.		
	Тос	lefine Fourier series ar	nd explain formulae and solve exan	nples.	
	To e	explain Analysis of Va	riance types one way, two way ana	lysis of variance a	and examples.
	To e	explain DOE with its in	nportance, basic principles, basic d	lesigns CRD, RBI	D, LSD and factorial
	expe	eriments			
Course	e Out	comes:	· · · · · · · · · · · · · · · · · · ·		
At the	end o	t the course, students y	will be able to	orms and L.D. ag	untions using
	Lan	lace transforms	Laplace and inverse Laplace transit	ornis and L.D. eq	uations using
	Soly	e problems of Fourier	series and Solve problems of vector	or differentiation	
	Solv	e and interpret problem	ns of one-way and two-way ANO		
	Solv	e and interpret problem	ns of CRD_RBD_I SD two factor	ил. and three factor f	actorial experiments
	501	e une interpret proble	Course Contents		actoriai experiments.
Unit	+ T	Lanlace Trans	forms and its application to L.D.	Faustions	08 Hours
a.	Defi	nition, Laplace transfo	orms of standard functions, of deriv	atives and integra	is with examples.
b.	Inve	erse Laplace transforms	s by simplification, partial fraction	and convolution i	nethod
C.	Met	nod of solving L.D. eq	uations with initial conditions usin	g Laplace transfor	rms and examples.
Unit	п		Vector differentiation		05 Hours
a.	Defi	nition of vector function	on of scalar $t$ and its derivative wit	h interpretation. V	/ector tangent,
	velo	city and acceleration v	vectors with examples.		
b.	Defi	nition of scalar, vector	valued function of point $p(x, y, z)$	. Definition of gra	adient, divergence,
	curl	, directional derivative	, solenoidal, irrotational vector fiel	ds with examples	
Unit	Ш		Fourier Series		06 Hours
a.	Full	range Fourier series, c	lefinition, Euler's formulae for con	stants with examp	oles of
	(0,2	$(2\pi), (-\pi, \pi), (0, 2C), (0, $	-C, C).		
b.	Hal	range Fourier series, d	efinition, Euler's formulae for cons	stants with examp	les of
	(0,τ	t), (0, C).			
Unit	IV	1	Analysis of Multivariate Data		04 Hours
a.	Mul	tivariate data, multiple	correlation coefficients, partial con	rrelation coefficie	nts with examples.
b.	Mul	tiple regression, multip	ole regression equations with exam	ples.	-
Unit	V		Analysis of Variance		08 Hours
a.	Intr	oduction of Analysis of	of Variance, One-way analysis of v	ariance with exam	nples.
b.	Tw	o-way analysis of varia	ance with one observation per cell	and examples.	1
с.	c. Two-way analysis of variance with $m$ observations per cell and examples.				

Unit	VI	Design of experiments with basic designs and factorial experiments 08 Hours
a.	Intro	duction of design of experiments, basic principles and basic designs.
b.	Basi	c designs CRD, RBD, and LSD with examples.
c.	Facto	orial experiments, $2^2$ and $2^3$ factorial experiments with examples.
Refere	ences I	Books:
1.	ΑTe	ext Book of Applied Mathematics: by J.N. & P.N. Wartikar.
2.	High	er Engineering Mathematics by B. S. Grewal.
3.	A Te	ext Book on Engineering Mathematics by Bali, Saxena & Iyengar.
4.	Math	nematical Statistics by J. Fruend.
5.	Appl	lied Statistics & Probability of Engineers by Montgomery & Runger.

6. Probability & Statistics for Engineers by Johnson.

#### DKTES Textile and Engineering Institute, Ichalkaranji Second Year B. Tech. Textile Chemistry (Semester – IV) TCL252: TEXTILE ELECTRONICS

Teaching Scheme:	Credits	Evaluation Scheme:
Lectures: 04 Hrs/ Week	04	SE-I: 25 Marks
	04	SE-II: 25 Marks
		SEE: 50 Marks

#### **Course Objectives:**

- □ To explain the operation and applications of semiconductor devices, power semiconductor devices and electromechanical devices
- □ To describe working principle of different types of sensors and transducers
- □ To explain working of digital circuits, microprocessor, microcontroller and PLC
- □ To demonstrate applications of electronics in textiles

#### **Course Outcomes:**

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

- Describe operation and application of semiconductor devices, power semiconductor devices and electromechanical devices
- □ Explain working principle of different types of sensors and transducers
- □ Explain working of digital circuits, microprocessor, microcontroller and PLC
- □ Demonstrate applications of electronics in textiles

#### **Course Contents**

Unit I	<b>Basic Electronics and Semiconductor devices</b>	19 Hours		
Classific	ation of materials- conductors, insulators and semiconductors;			
Electron	ics components, passive components- resistors, capacitors and inductors;			
Semicon	ductor diode, Rectifiers- half wave and full wave; Filters-shunt capacitor fi	lter, series inductor		
filter; Ze	mer diode, zener regulator; Transistor- Construction, working, configuratio	ns, common emitter		
characte	ristics, Basic CE amplifier			
Unit II	<b>Op-amp and power semiconductor devices</b>	<b>08 Hours</b>		
Op-amp	- Introduction, block diagram, symbol, ideal op-amp, IC741-pinout and sp	ecifications;		
Open loo	op op-amp configuration, drawbacks of open loop configuration;			
Concept	of feedback in amplifier, +ve and -ve feedback, closed loop op-amp config	guration		
Power s	Power semiconductor devices: SCR construction, operation, turning ON and OFF of SCR, SCR			
characte	ristics, SCR in DC Motor speed control; Triac- Construction, working and	characteristics, diac-		
Construe	ction, working and characteristics, AC power control using triac			
Unit III	Transducers and electromechanical devices	<b>08 Hours</b>		
Introduction, transducer classification – Primary and secondary transducers, active and passive				
transducers, analog and digital transducers, basic requirements of transducers;				
Photodic	Photodiode, phototransistor, LDR, LED, Optocouplers, Optical shaft encoders;			
Pressure	Pressure measurement -bourdon tubes; Temperature Transducers - RTD, Thermocouple, Thermistors;			
Strain ga	Strain gauge- working principle, bonded type strain gauge; Linear variable differential transformers			

(LVDT), Capacitive transducers, Piezo electric transducers, Proximity sensors

Electromechanical devices- relay, solenoid valve

Unit IV	Digital Electronics	09 Hours			
Differ	Difference between analog and digital electronics, digital gates, 4:1 multiplexer, 1:4 demultiplexer, 3:5				
decod	er, 8:3 encoder, level triggered RS flip flop, edge triggered D, 4-bit register, 1	memory & its types			
Unit V	Microprocessor, Microcontroller and PLC	04 Hours			
8085	nicroprocessor features, pin diagram and architecture;				
8051	nicrocontroller features, block diagram; PLC block diagram				
Unit VI	Automation in Textiles	04 Hours			
Autor	natic textile control systems- feedback, feed forward and combined; applicati	ons of electronics in			
spinni	ng, weaving, testing and finishing				
Reference	s Books:				
1. E	. Electronics Components and Materials by Madhuri Joshi				
2. A	2. A Textbook of Applied Electronics by R. S. Sedha				
3. B	asic Electronics by B. L. Therja				
4. E	ectrical and Electronics Measurements and Instrumentation by A.K.Sawh	ney, Dhanpat Ria and			
S	ons Pub.				
5. Ir	strumentation Devices & Systems by C.S. Rangan, G.R. Sharma, TMH Pub				
6. O	6. Op-amp and Linear Integrated Circuits by Ramakant Gaykwad				
7. D	7. Digital Principles and applications by Malvino and leach				
8. M	icroprocessor Architecture, Programming and applications with 8085				
b	Ramesh Gaonkar.				
9. T	ne 8051 Microcontroller Architecture, Programming and Applications by Ker	nneth J, Ayala.			
10. E	10. Electronic Controls for Textile Machine – Hiren Joshi and Gouri Joshi, NCUTE				
11. 80	11. 8085 Microprocessor by Vibhute & Borole				

#### DKTES Textile and Engineering Institute, Ichalkaranji Second Year B. Tech. Textile Chemistry (Semester – IV) TCL253: CHEMISTRY OF FIBRE - II

Teaching Scheme:	Credits	Evaluation Scheme:
Lectures: 03 Hrs/ Week	03	SE-I: 25 Marks
	05	SE-II: 25 Marks
		SEE: 50 Marks

#### **Course Objectives:**

- □ To describe basic concepts of various spinning technologies and fibre manufacturing processes.
- □ To impart knowledge about the chemistry & chemical composition of synthetic fibres
- □ To give details about physical, mechanical & chemical properties of fibres and use knowledge of fibres properties in wet processing of textiles
- □ To describe concept of modification of fibres and to give examples of various application of fibres

#### **Course Outcomes:**

- □ Understand the basic concepts of various spinning technologies and fibre manufacturing processes.
- □ Illustrate chemistry & chemical composition of synthetic fibres
- □ Enunciate physical, mechanical & chemical properties and use knowledge of fibres properties in wet processing of textiles
- □ Understand various modifications of fibres and applications of fibres

<b>Course Contents</b>				
Unit I		Fundamentals of Fibre Spinning	09 Hours	
a.	Gen	eral principles of the spinning process		
b.	Cone	cept and essential requirements of melt spinning		
c.	Tota	l sequence of polymer flow in melt spinning process		
d.	Vari	ables in melt spinning		
e.	Cone	cept of high-speed spinning		
f.	Cone	cept of LOY, MOY, POY, HOY, FOY yarns		
g.	Theo	ories of drawing		
h.	Spin	-draw process		
i.	Cone	cept of direct melt spinning		
j.	Cone	cept of gel spinning		
k.	Cone	cept of Microfibres		
1.	Cone	cept of Nanofibres		
Unit	Π	Polyester Fibre	07 Hours	
a.	Raw	materials required		
b.	Man	ufacturing process of polyester		
c.	Side	chain reaction taking place during manufacturing		
d.	Phys	ical, mechanical & chemical properties and applications of polyester		
e.	Cone	cept of recycled polyester		
f.	Deve	elopments of polyester fibre -hollow fibre, hydrophilic fibre, low pilling	g, flame retardant fibre	
	CDP	ET, biodegradable polyester		
g.	Poly	ester fibres other than polyethylene terephthalate-Polypropylene	terephthalate (PPT),	
	Poly	butylene terephthalate (PBT)		

Unit	ш	Polyamide Fibres	07 Hours
a.	Intro	oduction to polyamide	2
b.	Raw	materials required for Nylon-6 and Nylon-66	
c.	Mar	ufacturing process of Nylon-6 and Nylon-66	
d.	Phys	sical, mechanical & chemical properties and applications of Nylon-6 and Nylo	on-66
e.	Dev	elopments of nylon fibre - hydrophilic, low pilling, flame retardant, differentia	lly dyeable nylon
Unit	IV	Acrylic Fibres	05 Hours
a.	Raw	materials required for acrylic and modacrylics	
b.	Mar	ufacturing process of acrylic and modacrylics	
c.	Phys	sical, mechanical & chemical properties and applications of acrylic and modac	rylics
d.	Dev	elopments of acrylic fibre - hydrophilic fibre, low pilling, flame retardant, dif	ferentially dyeable, high
	shrii	nkage fibre, bicomponent fibre	
Unit	t V	Polyolefin Fibres	06 Hours
a.	Raw	materials required for PE and PP fibre	
b.	Mar	ufacturing process of PE fibre	
c.	Mar	ufacturing process of PP fibre	
d.	Phys	sical, mechanical & chemical properties and applications of PE and PP fibre	
Unit	VI	Polyurethane and Glass Fibre	06 Hours
	a.	Polyurethane Fibre: Introduction	
b.	Raw	materials required for polyurethane fibre.	
c.	Man	ufacture of polyurethane fibre.	
d.	Con	cept of power of spandex	
e.	Phys	ical, mechanical & chemical properties and applications of polyurethane fibr	e.
f.	Glas	ss Fibre: Introduction	
g.	Туре	es of Glass	
h.	Fibr	e manufacture and Fibre finishing process	
i.	Phys	ical, mechanical & chemical properties and applications of Glass fibre	
j.	Glas	s fibre composites	
Refere	ences	Books:	
1.	V. (	C. Gupta & V. K. Kothari, Manufactured Fibre Technology, Springer Sc	ience+Business Media
	Dor	drecht, ISBN 978-94-010-6473-6 (1997).	~ .
2.	S. P. I	Mishra, Science and Technology of Man-Made Fibres, Suraj Publications,	Orissa.
3.	A. A. 2578-	Vaidya, Production of Synthetic fibres, Prentice-Hall of India Private L: 6 (1988).	imited, ISBN: 0-8769-
4.	Mena	chem Lewin, Handbook of Fibre chemistry, CRC Press Web, Third edition	ı, ISBN: 0-8247-2562-
	4(20 D-1	U/) Deceme D. Aleximum M. Iseli, J.D. C. (D. D. 1)	
5.	B. L. Wood	beopura, R. Alagirusamy, M. Josni and B. Gupta, Polyesters and p head Publication Ltd, England, ISBN: 978-1-84569-298-8 (2008)	olyamides Edited by,
6.	V. R 93877	. Gowariker, Polymer Science, New Age International Publishers; 788644 (1 January 2019)	Third edition, ISBN:
7.	J. Go	rdon Cook, Handbook of Textile Fibres. Volume 2 Man-Made Fibres,	Woodhead Publishing
	Series	in Textiles, ISBN: 978-1-85573-485-2 (1984).	
8.	R. W.	Moncrieff, Man-made Fibres, Heywood Books, Open Library-OL5656433	3M (1966).
9.	R. M (2004	eredith, Elastomeric Fibres, Woodhead Publishing Limited, England, I	SBN: 1 85573 979 8
10	IWS	/ Hearle, High Performance Fibres, Woodhead Publishing Limited, Englar	nd ISBN: 1 85573 530
10.	3 (200	)2)	In, 1991. 1 09979 999

#### DKTES Textile and Engineering Institute, Ichalkaranji Second Year B. Tech. Textile Chemistry (Semester – IV) TCL254: TECHNOLOGY OF PRETREATMENT - II

Teaching Scheme:	Credits	Evaluation Scheme:
Lectures: 03 Hrs / Week	03	SE-I: 25 Marks
		SE-II: 25 Marks
		SEE: 50 Marks

#### **Course Objectives:**

- $\hfill\square$  To describe chemistry of pretreatment operation.
- □ To describe pretreatment, operation sequence of various natural, regenerated and synthetic material.
- □ To discuss the quality parameters, environmental impact of textile pretreatment processes.
- □ To discuss machinery used in pretreatment and their techno-economical aspects.

#### **Course Outcomes:**

- $\Box$  To demonstrate chemistry of pretreatment operation.
- □ To explain pretreatment, operation sequence of various natural, regenerated and synthetic material.
- □ To explain the quality parameters, environmental impact of textile pretreatment processes.
- □ To explain machinery used in pretreatment and their techno-economical aspects.

Course Contents					
Unit	Ι	Preparatory process for Protein fibres	05 Hours		
a.	Prep	aratory process sequence for worsted and woolen goods			
b.	Scot	ring of wool fibres, crabbing and potting of wool, carbonization			
с.	Woo	l bleaching – oxidative and reductive			
d.	Deg	umming of silk, various methods			
e.	Blea	ching of silk			
f.	Prec	autions, problems associated and remedies of pretreatment protein fibres			
Unit	II	Preparatory Processes for synthetics and their blends	10 Hours		
a.	Obje	ects of heat setting, thermal behavior of synthetic fibres			
b.	b. Methods of heat setting and heat setting of polyester, nylon, textured material and other fibres				
c.	Effect of heat setting on properties of synthetic fibres, assessment of degree of heat setting.				
d.	Scou	ring of regenerated and synthetic fibres			
e.	Blea	ching of regenerated and synthetic fibres			
f.	Proc	ess sequence for P/C, P/V, P/W and other commonly used blends			
Unit l	Ш	Preparatory Processes for non-conventional fibres	05 Hours		
a.	Scou	ring and bleaching of jute, degumming of remie, woollenization of jute	'		
b.	. Scouring and bleaching of linen, process sequence				
с.	Preparatory process: sequence and conditions for Spandex containing fabric				
d.	Preparatory process for top dyed woven goods				
e.	e. Practical problems and remedies				

Unit	V Preparatory chemicals and environmental impact	05 Hours
а	Bleaching with sodium chlorite	
b.	Bleaching with peracetic acid	
с.	Environmental impact of conventional preparatory processes	
d.	Biotechnology in preparatory – various enzymes, types, mechanism of action,	application.
e.	Consumption and conservation of water and steam, norms	11
	1	
Unit	V Mercerization	07 Hours
a.	Overview of mercerizing process	1
b.	Yarn mercerization machine	
c.	Features of pad chain, pad chainless and padless chainless mercerization mach	ines
d.	Knit goods mercerization machine in tubular and open width form	
e.	Mercerization of cotton fabric, P/C blend fabric	
f.	Wet on wet mercerization,	
g.	Hot mercerization and liquid ammonia mercerization	
h.	Caustic recovery plant - design and working	
Unit	VI Preparatory Processes machinery	07 Hours
a.	Batch operation machines: Kier – low pressure and high pressure,	
b.	Rope washing machine,	
c.	Variety of Jigger machines,	
d.	Soft flow machines.	
e.	Semi-continuous machine: pad-batch technique	
f.	Continuous bleaching range	
g.	Wool and silk processing machinery	
h.	Preparatory processes and machinery for knitted and terry material.	
i.	Merit and demerit of these machinery.	
Refere	<b>Ices Books:</b>	) Kamaalaan Elaarian
1.	chemical technology in the pre-treatment processes of textiles by S is	K Karmakar, Elsevier
2	Chemical processing of sills and weed by M.L. Culmieni	
2.	Chemical processing of Silk and wool by M L Guirajani	ivadi
5. 4	Chemical processing of synthetic & blands by K.W. Datus A.A. Voidus	Iveui
4.	Meroperizing by LT. March	
5.	Ducing & Chamical Tashnalagy of Taytila Eibnes by E. D. Tratman	
0. 7	Dycing & Chemical Technology of Textile Flores by E.K. Trouman Textile preparation and dycing Asim Kumar Day Cheudhari published by SDC	C (I) C
v /.	Chemical processing machinery by R S Phagwat	- (1)
0.	Tractile Chamical Dragonian (Val. 1) h. Tital. V	
9.	1 extile Chemical Processing (Vol. 1) by Jitendra Kumar	

#### **DKTES Textile and Engineering Institute, Ichalkaranji** Second Year B. Tech. Textile Chemistry (Semester – IV) **TCL255: CHEMISTRY OF DYES AND PIGMENTS** Teaching Scheme: **Evaluation Scheme:** Credits Lectures: 03 Hrs / Week SE-I: 25 Marks 03 SE-II: 25 Marks SEE: 50 Marks **Course Objectives:** Describe light, colour – chemical constitution and classification of dyes-pigments. Describe dye intermediates and its manufacturing; nomenclature and colour index Describe elements of dyeing, its mechanism and dye fibre interactions □ Describe salient features of dyes and application principle **Course Outcomes:** At the end of the course, students will be able to □ Illustrate light, colour – chemical constitution and classification □ Understand dye intermediates and its manufacturing, nomenclature and colour index □ Illustrate elements of dyeing, its mechanism and dye fibre interactions Demonstrate salient features of dyes and application principle **Course Contents Unit** I **Colour and Chemical Constitution 07 Hours** Properties of electromagnetic radiation, its interactions with matter a. Visible spectrum, viewing of colour, b. Additive and subtractive theories of colour; c. d. Relationship between colour and chemical constitution – Witt's Theory, Relationship between colour and chemical constitution valence bond and molecular orbital theory e. Unit II **Dyes and Pigments 08 Hours** Concept of dye, colour and pigment; a. Classification of dyes according to the method of application and chemical structure h Classification of pigments c. d. Dye-fibre interactions Relationship between - chemical structure and substantivity as well as fastness properties e. f. Concept of colour index and its significance. Nomenclature of dyestuffs **Unit III Manufacturing of Synthetic Dyes 08 Hours** Destructive distillation of coal tar and its products as primaries a. b. Intermediates, their importance and basic reactions of involved in dye manufacturing Preparation of dyes based on Azo, Nitro, Stilbene, DPM, TPM and Anthraquinone chromophores c. Concept of fluorescent dyes, thermo-chromic dyes, photo-chromic dyes. d. **Unit IV Elements of Dyeing 05 Hours** Concept of substantivity and affinity of dyes, a. b. Concept of percentage shade, liquor ratio, exhaustion, expression. c. Solubility and dissolution of dyes, aggregates of dyes d. Dyeing assistants like water softeners, exhausting agents, levelling and retarding agents e. Effect of temperature on dyeing. Compatibility of dyes in combination shades f.

Unit	V Dyes for Natural fibres	07 Hours
a.	Natural dyes: sources, extraction, mordants and application of natural dyes	
b.	Mechanism of dyeing of cotton with direct dyes	
c.	Properties, classification and dyeing of Direct, Reactive, Vat, Sulphur dyes	
d.	Properties, classification and dyeing of Acid and Basic dyes	
e.	Dyeing of cotton with ingrain dyes - azoics	
Unit	VI Dyes for Synthetic fibres	04 Hours
a.	Introduction to dyeing of polyester with disperse dyes, its mechanism	
b.	Introduction to dyeing of nylon with acid dyes	
c.	Introduction to dyeing of acrylic with basic dyes	
Refere	ences Books:	
1.	Synthetic organic chemistry by G. R. Chatwal	
2.	Synthetic dyes by K. Venkatraman	
3.	Chemical processing of textile - preparatory and dyeing C V Kaushik, A I	Josico, NCUTE
4.	Principles of dye chemistry by Paul Vittum	
5.	Synthetics Dyes by K. M. Shah	
6.	Dyeing & chemical technology of textile fibres by E. R. Trotman	
7.	The dyeing of cellulose fibres by Clifford Preston.	
8.	Chemical technology of fibrous material by F. Sadov	
9.	. Basic Principles of Textile Colouration by Arthur D Broadbent, SDC	
10.	. Chemical processing of synthetic fibres by Dr. K. V. Datye & A. A. Vaidya	l

### DKTES Textile and Engineering Institute, Ichalkaranji Second Year B. Tech. Textile Chemistry (Semester – IV) TCL256: WEAVING AND KNITTING TECHNOLOGY

Teaching Scheme:	Credits	Evaluation Scheme:
Lectures: 03 Hrs/ Week	03	SE-I: 25 Marks
	05	SE-II: 25 Marks
		SEE: 50 Marks

#### **Course Objectives:**

 $\Box$  To define basics of fabric forming.

- □ To explain functions, working and calculations of various weaving processes such as winding, pirn winding, warping, sizing, drawing in, and weaving machines (plain, auto and shuttleless)
- □ To explain the method of fabric forming by warp knitting and weft knitting, fabric structure and calculations
- □ To explain the method of interlacement for warp and weft for different weaves such as plain, twill, satin, honeycomb, huck-a-back and mock-leno

#### **Course Outcomes:**

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

- □ Explain basics of fabric forming
- □ Describe the functions, working and to do calculations of various weaving processes such as winding, pirn winding, warping, sizing, drawing in, and weaving machines (plain, auto and shuttleless)
- □ Classify the method of fabric forming by warp knitting and weft knitting, fabric structure and calculations
- □ Analyse the method of interlacement for warp and weft for different weaves such as plain, twill, satin, honeycomb, huck-a-back and mock-leno

<b>Course Contents</b>			
Unit I	Introduction	03 Hours	

Methods of fabric forming such on weaving, knitting and non-woven. Brief general discussion about processes involved in these methods. Basic terminologies like Warp, Weft, End, Pick, Selvedge etc., Flow chart for grey, stripped and checks fabrics

Unit II	Weaving Preparatory	07 Hours
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#### a. Winding:

Object and passage of yarn through Winding machine, Functions of various important parts like creel, tensioner, clearer, winding drum. Features of automatic winding machine.

b. **Warping:** Objects and passage of yarn through Beam Warping Machine. Objects and need of Sectional Warping Machine. Process of sectional warping and Beaming.

c. **Sizing:** Objects and need of Sizing, Passage of warp through Sizing machine, Functions of various important parts like creel, sow box, drying system, and head stock.

d. Drawing in and Denting: Objects of drawing in and denting process.

e. **Pirn Winding:** Objects of pirn winding machine and passage of yarn through machine

Unit III	Weaving	15 Hours

Classification of looms. Concept of weaving. Passage of warp through the plain loom. Driving arrangement of plain loom and speed relation of crankshaft, bottom shaft and picks introduced. Various motions used on loom like -

a. **Shedding:** Different types of shedding mechanisms like tappet, dobby and jacquard. Concept of negative and positive shedding, working of tappet shedding mechanism. Limitations of tappet shedding

b.	Picking: Objects, types and working of Over-pick & Under- pick mechanism.			
c.	<b>Beat Up:</b> Objects, construction and working of beat-up motion. Eccentricity of sley. Functions of reed Reed count			
d.	Secondary Motions: Objects, construction and working of Negative Let off,	Seven Wheel Take		
	Up motion			
e.	Auxiliary Motions: Objects, construction and working of Weft Stop Motion,	Warp protecting		
	motion, Temple, Brake, backrest.			
At	tachments on the loom like –			
a	<b>Dobby Shedding:</b> Functions and applications of Climax Dobby			
b	Jacquard Shedding: Principle of Jacquard shedding.			
c.	<b>Drop Box:</b> Functions and applications of 4x1 Drop box			
Īı	production to Shuttleless looms - Limitations of Shuttle Loom. Features of Auto	matic Loom.		
Р	rinciples of picking of Projectile, Rapier, Air Jet and Water Jet.	,		
Unit	IV Knitting Technology	04 Hours		
Comm	wiscon of Knitting with Waaving Knitting avala for waft knitting. Types of stitch	as and their functions		
Compa Renres	entation of structure on point paper. Structure of single jersey Rib & Interlock f	abrics Warn Knitting		
proces	s its fabric applications	aones. Warp Kinting		
Unit	V   Fabric Structure	07 Hours		
Metho	ds of representation of warp and weft interlacement on graph paper. Design, draf	t, peg plan and		
dentin	2 order	, p • 8 p · · · · · ·		
a.	Plain Weave: Features and structure of weave, Derivatives of plain weave and its	structure.		
b.	Twill Weave: Features, Types of twill weave and its structure			
c.	Satin/Sateen weave: Features, Types of weave and structure of satin/sateen weave			
d.	Towel weave: Features, Types of towel weave and its structure Honey comb, Huch	k a back & Mock leno		
Unit	VI Calculations	03 Hours		
a. We	aving and its preparatory: Production calculation for winding, warping, loom			
b. Kni	tting: Production calculation of single jersey circular weft knitting machine			
c. Fab	ric weight: woven and knitted fabrics			
Refere	ences Books:			
1.	Plain loom motions by K.T. Aswani			
2.	Winding & Warping by Dr. M.K. Talukdar			
3.	Fancy Weaving by K.T. Aswani.			
4.	Textile Design & Colour by Watson			
5.	Knitting Technology by Ambumani.			
6.	Woven Fabric production – L and IL NCUTE publication			
7.	woven rubite production - i, and ii, we or it publication.			
	Knitting Technology by Prof. D.B. Ajgaonkar.			
8.	Knitting Technology by Prof. D.B. Ajgaonkar. Sizing by D. B. Ajgaokar			
8. 9.	Knitting Technology by Prof. D.B. Ajgaonkar. Sizing by D. B. Ajgaokar Principles of weaving by Marks and Robbinson			
8. 9. 10	<ul> <li>Knitting Technology by Prof. D.B. Ajgaonkar.</li> <li>Sizing by D. B. Ajgaokar</li> <li>Principles of weaving by Marks and Robbinson</li> <li>Weaving machines, mechanism, management by Talukdar, Srimalu and Ajga</li> </ul>	onkar		

11. Fundamentals of Yarn Winding by Milind Korane

#### DKTES Textile and Engineering Institute, Ichalkaranji Second Year B. Tech. Textile Chemistry (Semester – IV) TCP257: TEXTILE ELECTRONICS LAB

Lab Scheme	:	Credits	Evaluation Scheme:
Practicals: 02 Hrs/ Week		01	CIE: 50 Marks
			See: 50 Marks
List of Expe	eriments		
1	VI characteristics of	semiconductor diode.	
2	Half wave rectifier- without filter and with filter.		
3	Full wave rectifier- without filter and with filter.		
4	Reverse characteristics of zener diode.		
5	Closed loop inverting amplifier using Op-amp 741.		
6	Closed loop non-inverting amplifier using Op-amp 741.		•
7	AC power control using triac.		
8	LDR characteristics.		
9	Displacement measurement using LVDT.		
10	Speed measurement using magnetic and photo-electric pickup.		
11	Realization of digital gates.		
12	Realization of flip-flops/ decoder.		

#### DKTES Textile and Engineering Institute, Ichalkaranji Second Year B. Tech. Textile Chemistry (Semester – IV) TCP258: CHEMISTRY OF FIBRE -II LAB

Lab Scheme:		Credits	Evaluation Scheme:
Practicals: 02 Hrs/ Week		01	CIE: 50 Marks
		UT UT	SEE: 50 Marks
List of Exper	iments		
1	Identification of fibres from binary blend by chemical method – I.		l method – I.
2	Identification of fibres from binary blend by chemical method – II.		l method – II.
3	Identification of fibres from binary blend by chemical method – III.		l method – III.
4	Quantitative analysis of given known blend – I.		
5	Quantitative analysis of given known blend – II.		
6	Quantitative analysis of given known blend – III.		
7	Determination of degree of heat setting of polyester by Iodine absorption method.		
8	Demonstration of laboratory melt spinning unit and production of filament yarn.		
9	Demonstration of laboratory filament yarn drawing machine and drawing & heat setting of		
	polyester POY.		
10	Detection of damage of synthetic fibres.		
11	Fibre characterization by FTIR method.		
12	Determination of number average molecular weight of polyamide fibres by using end grou		of polyamide fibres by using end group
	analysis.		
13	Visit to fibre manufacturing plant.		

#### DKTES Textile and Engineering Institute, Ichalkaranji Second Year B. Tech. Textile Chemistry (Semester – IV) TCP259: CHEMISTRY OF DYES AND PIGMENTS LAB

Lab Scheme		Credits	Evaluation Scheme:
Practical: 02 Hrs / Week		01	CIE: 50 Marks
List of Expe	riments		
1	Natural dyes: extract	ion and application on cotton	
2	Estimation of aniline	by diazotization method	
3	Estimation of Sulpha	nilic acid by diazotization method	
4	Dyeing of cotton azoic colours		
5	Identification of dyes on fibres		
6	Identification of dyes on fibres		
7	Identification of dyestuffs in powder form		
8	Identification of dyestuffs in powder form		
9	Dyeing of cotton with direct dyes with differential MLR		2
10	Dyeing of cotton with reactive dyes with differential concentration of salt		
11	Comparative estimation of strength of the given dye by Optical method		
12	Comparative estimation of strength of the given dye by dyeing method		dyeing method
13	Dyeing of cotton wit	h vat dye	
14	Preparation of combination / compound shades		

### DKTES Textile and Engineering Institute, Ichalkaranji Second Year B. Tech. Textile Chemistry (Semester– IV) TCP260: WEAVING AND KNITTING TECHNOLOGY LAB

Lab Scheme:		Credits	Evaluation Scheme:	
Practical: 02 Hrs. / Week		01	CIE: 50 Marks	
			SEE: 50 Marks	
List of Expe	eriments			
1	General study of Automatic drum winding and Pirn winding m/cs.			
2	General study of warping & sizing m/c (Visit)			
3	Passage of warp through the ordinary & automatic looms.			
4	Study of the primary motions and secondary motions on loom			
5	Study of auxiliary motions.			
6	Study of dobby (climax).			
7	Study of Jacquard shedding mechanism			
8	Study of Drop box motion			
9	General study of features of Automatic looms			
10	General study of shuttleless looms- projectile, rapier & air jet looms.			
11	General study of circular weft knitting machine.			
12	Fabric Analysis: - V	Voven fabrics samples of Plain, 7	Twill, Satin, Sateen and Towelweaves	
	(Mock leno, Huck a back and Ordinary Honey comb)			

#### DKTES Textile and Engineering Institute, Ichalkaranji Second Year B. Tech. Textile Chemistry (Semester – IV) ADL201: ENVIRONMENTAL STUDIES

 Teaching Scheme:
 Evaluation Scheme:

 Tutorial: 02 Hrs / Week
 SEE-: 70 Marks

 CIE (Project work) -: 30 Marks
 (Based on syllabus of Sem. III and Sem. IV)

#### **Course Objectives:**

- □ To recall fundamental physical and biological principles those govern natural processes.
- $\Box$  To state the importance of ecological balance for sustainable development.
- □ To describe the impacts of developmental activities and mitigation measures and to further understand the environmental policies and regulations.
- □ To identify the complex relationships between scientific approaches to environmental issues and political, social, economic, and ethical perspectives on the environment.

#### **Course Outcomes:**

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

- □ Develop an understanding of different natural resources including renewable resources.
- $\Box$  Realize the importance of ecosystem and biodiversity for maintaining ecological balance.
- $\Box$  Aware of important acts and laws in respect of environment.
- Demonstrate critical thinking skills in relation to environmental affairs

Course Contents			
Unit IV	Environmental Pollution	08 Hours	
De po • S • F • F • F	finition: Causes, effects and control measures of: a) Air pollut llution, d) Marine pollution, e) Noise pollution, f) Thermal pollution colid waste Management: Causes, effects and control measures of u cole of an individual in prevention of pollution. Pollution case studies Disaster management: Floods, earthquake, cyclone and landslides.	ion, b) Water pollution, c) Soil on, g) Nuclear hazards urban and industrial wastes. Fsunami.	
Unit V	Social Issues and the Environment	09 Hours	
conservation, rain water harvesting, watershed management; Resettlement and rehabilitation of people; its problems and concerns; Environmental ethics: Issue and possible solutions; Climate change, Global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust; Wasteland reclamation; Consumerism and waste products.			
Unit VI	Environmental Protection	10 Hours	
En co Hu riv or	vironment Protection Act.; Air (Prevention and Control of Polluti ntrol of Pollution) Act; Wildlife Protection Act; Forest Conservat uman Health, Human Rights. ; Field WorkVisit to a local area to er/forest/grassland/hill/mountain or Visit to a local polluted site-um Study of common plants, insects, birds or Study of simple ecosyste	on) Act.; Water (Prevention and ion Act; Population Growth and o document environmental assets rban/rural/Industrial/Agricultural ems-ponds, river, hill slopes, etc.	
Reference	s Books:		
1. Cl 2. Cu En	ark R. S., Marine Pollution, Clanderson Press Oxford (TB) Pg No. nningham, W. P. Cooper, T. H. Gorhani, E. & Hepworth cyclopedia, Jaico Publ. House, Mumbai, 1196p.	6. , M. T. 2001, Environmental	

3. De A. K., Environmental Chemistry, Wiley Eastern Ltd.

- 4. Down to Earth, Centre for Science and Environment ®
- 5. Gleick, H., 1993, Water in crisis, Pacific Institute for Studies in Dev., Environment & security. Stockholm Env. Institute. Oxford Univ. Press 473p.
- 6. Hawkins R. e., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay