



**ewANNA UNIVERSITY, CHENNAI**  
**UNDERGRADUATE CURRICULUM (UNIVERSITY DEPARTMENTS)**

**Campus** : Alagappa College of Technology Campus

**Department** : Textile Technology

**Programme** : B.Tech. Apparel Technology

**Regulations** : 2023 (Revised 2024), with effect from the AY 2024 – 25 to all the students of UG Programme.

**OVERVIEW OF CREDITS**

Name of the Programme: Apparel Technology											
S.No.	Subject Area	Credits per Semester								Total Credits	%
		I	II	III	IV	V	VI	VII	VIII		
1.	HSMC	14	14	7	-	-	-	3	-	38	21.8
2.	ESC	7	-	-	-	-	-	-	-	6	4
3.	PCC	-	-	15.5	19.5	17	-	8	-	60	34.5
4.	PEC	-	-	-	-	-	12	6	-	18	10.3
5.	OEC	-	-	-	-	-	3	3	-	6	3.4
6.	SDC	-	7	2	3	5	1	2	8	28	16.1
7.	UC	1	1	2	3	-	3	-	-	10	5.7
8.	SLC	-	-	-	-	-	1	-	-	1	0.6
9.	ETC	-	-	-	-	-	3	3	-	6	3.4
<b>Total</b>		<b>22</b>	<b>22</b>	<b>26.5</b>	<b>25.5</b>	<b>22</b>	<b>23</b>	<b>25</b>	<b>8</b>	<b>174</b>	

SEMESTER – I									
S. NO.	COURSE CODE	COURSE NAME	COURSE TYPE#	PERIODS / WEEK				CREDITS	CATEGORY
				L-T-P			TCP*		
1.	EN23C01	Foundation English	LIT	2	0	2	4	3	HSMC
2.	MA23C01	Matrices and Calculus	T	3	1	0	4	4	HSMC
3.	CY23C01	Engineering Chemistry	LIT	3	0	2	5	4	HSMC
4.	CS23C02	Computer Programming in Python	LIT	3	0	2	5	4	ESC
5.	EE23C03	Basics of Electrical and Electronics Engineering	LIT	2	0	2	4	3	ESC
6.	AT23101	Design Thinking	LIT	2	0	2	4	3	HSMC
7.	UC23H01	தமிழர் மரபு /Heritage of Tamils	T	1	0	0	1	1	UC
8.	-	NCC/NSS/NSO/YRC		-	-	-	-	-	UC
<b>TOTAL CREDITS</b>								<b>22</b>	

SEMESTER – II									
S. NO.	COURSE CODE	COURSE NAME	COURSE TYPE#	PERIODS / WEEK				CREDITS	CATEGORY
				L-T-P			TCP*		
1.	EN23C02	Professional Communication	LIT	2	0	2	4	3	HSMC
2.	MA23C02	Ordinary Differential Equations and Transform Techniques	T	3	1	0	4	4	HSMC
3.	PH23C01	Engineering Physics	LIT	3	0	2	5	4	HSMC
4.	ME23C01	Engineering Drawing & 3D Modelling	LIT	2	0	4	6	4	SDC
5.	ME23C04	Maker Space	LIT	1	0	4	5	3	SDC
6.	CY23C03	Chemistry for Technologists	T	3	0	0	3	3	HSMC
7.	UC23H02	தமிழரும் தொழில் நுட்பமும் / Tamils and Technology	T	1	0	0	1	1	UC
<b>TOTAL CREDITS</b>								<b>22</b>	

SEMESTER – III									
S. NO.	COURSE CODE	COURSE NAME	COURSE TYPE#	PERIODS / WEEK			CREDITS	CATEGORY	
				L	T	P			TCP*
1.	MA23C05	Probability and Statistics	T	3	1	0	4	4	HSMC
2.	TT23C01	Fundamentals of Economics and Management	T	3	0	0	3	3	HSMC
3.	AT23301	Fibre Science	T	3	0	0	3	3	PCC
4.	AT23302	Textile Manufacturing	LIT	3	0	1	4	3.5	PCC
5.	TT23C02	Fabric Structure	LIT	3	0	2	5	4	PCC
6.	AT23303	Concepts and Evolution of Fashion and Design	LIT	2	0	2	4	3	PCC
7.	AT23304	Basic Sewing Machinery Practice Laboratory	L	0	0	4	4	2	PCC
8.	-	Skill Development Course I		-	-	-	-	2	SDC
9.	UC23U01	Universal Human Values	LIT	1	0	2	3	2	UC
10.	-	Audit Course – I	-	-	-	-	-	-	UC
<b>TOTAL CREDITS</b>							<b>26.5</b>		

SEMESTER – IV									
S. NO.	COURSE CODE	COURSE NAME	COURSE TYPE#	PERIODS / WEEK			CREDITS	CATEGORY	
				L	T	P			TCP*
1.	AT23401	Pattern Making	LIT	2	0	6	8	5	PCC
2.	AT23402	Garment Construction	LIT	3	0	4	7	5	PCC
3.	TT23C06	Garment Production Machinery	LIT	2	0	2	4	3	PCC
4.	AT23403	Textile Chemical Processing	LIT	3	0	3	6	4.5	PCC
5.	AT23U02	Perspectives of Sustainable Development – Apparel Technology	T	2	0	0	2	2	UC
6.	AT23404	Computer Aided Pattern Laboratory	L	0	0	4	4	2	PCC
7.	AT23U01	Standards – Apparel Technology	T	1	0	0	1	1	UC
8.	-	Industry Oriented Course I	-	-	-	-	-	1	SDC
9.	-	Skill Development Course II	-	-	-	-	-	2	SDC
<b>TOTAL CREDITS</b>							<b>25.5</b>		

SEMESTER – V									
S. NO.	COURSE CODE	COURSE NAME	COURSE TYPE <sup>#</sup>	PERIODS / WEEK				CREDITS	CATEGORY
				L-T-P		TCP*			
1.	TT23C05	Fabric and Garment Quality Evaluation	LIT	2	0	2	4	3	PCC
2.	AT23C04	Industrial Engineering in Apparel Industry	T	2	1	0	3	3	PCC
3.	AT23C01	Apparel Production and Planning	T	2	1	0	3	3	PCC
4.	TT23C08	Technology of Knitting and Nonwoven	T	3	0	0	4	3	PCC
5.	TT23C18	Financial Management for Textile Industry	T	2	1	0	3	3	PCC
6.	AT23501	Advanced Garment Construction Laboratory	L	0	0	4	4	2	PCC
7.	-	Industry Oriented Course- II	T	1	0	0	1	1	SDC
8.	-	Skill Development Course III	-	-	-	--	-	2	SDC
9.	AT23502	Internship I/Training I*		0	0	0	0	2	SDC
<b>TOTAL CREDITS</b>								<b>22</b>	
COURSES FOR HONOURS DEGREE									
S. NO.	COURSE CODE	COURSE NAME	COURSE TYPE <sup>#</sup>	PERIODS / WEEK				CREDITS	CATEGORY
				L-T-P		TCP*			
1.	AT23D01	Capstone Design Project – Level I	CDP	0	0	12	12	6	SDC
<b>(OR)</b>									
1.	-	Honours Elective – I	-	-	-	-	-	3	PEC
2.	-	Honours Elective – II	-	-	-	-	-	3	PEC
COURSES FOR MINOR DEGREE									
S. NO.	COURSE CODE	COURSE NAME	COURSE TYPE <sup>#</sup>	PERIODS / WEEK				CREDITS	CATEGORY
				L-T-P		TCP*			
1.	-	Minor Elective – I	-	-	-	-	-	3	PEC
2.	-	Minor Elective – II	-	-	-	-	-	3	PEC

<b>SEMESTER – VI (PREFERENCE FOR FOREIGN EXCHANGE)</b>									
<b>S. NO.</b>	<b>COURSE CODE</b>	<b>COURSE NAME</b>	<b>COURSE TYPE#</b>	<b>PERIODS / WEEK</b>				<b>CREDITS</b>	<b>CATEGORY</b>
				<b>L-T-P</b>			<b>TCP*</b>		
1.	UC23E01	Engineering Entrepreneurship Development	LIT	2	0	2	4	3	UC
2.	-	Emerging Technology Course I	T	3	0	0	3	3	ETC
3.	-	Professional Elective I	-	-	-	-	-	3	PEC
4.	-	Professional Elective II	-	-	-	-	-	3	PEC
5.	-	Professional Elective III	-	-	-	-	-	3	PEC
6.	-	Professional Elective IV	-	-	-	-	-	3	PEC
7.	-	Open Elective I	T	3	0	0	3	3	OEC
8.	-	Industry Oriented Course III	T	-	-	-	-	1	SDC
9.	-	Audit Course II	-	-	-	-	-	-	UC
10.	AT23L01	Self-Learning Course	T	1	0	0	1	1	SLC
<b>TOTAL CREDITS</b>								<b>23</b>	
<b>COURSES FOR HONOURS DEGREE</b>									
<b>S. NO.</b>	<b>COURSE CODE</b>	<b>COURSE NAME</b>	<b>COURSE TYPE#</b>	<b>PERIODS / WEEK</b>				<b>CREDITS</b>	<b>CATEGORY</b>
				<b>L-T-P</b>			<b>TCP*</b>		
1.	AT23D02	Capstone Design Project – Level II	CDP	0-012			12	6	SDC
<b>(OR)</b>									
1.	-	Honours Elective – III	-	-	-	-	-	3	PEC
2.	-	Honours Elective – IV	-	-	-	-	-	3	PEC
<b>COURSES FOR MINOR DEGREE</b>									
<b>S. NO.</b>	<b>COURSE CODE</b>	<b>COURSE NAME</b>	<b>COURSE TYPE#</b>	<b>PERIODS / WEEK</b>				<b>CREDITS</b>	<b>CATEGORY</b>
				<b>L-T-P</b>			<b>TCP*</b>		
1.	-	Minor Elective – III	-	-	-	-	-	3	PEC
2.	-	Minor Elective – IV	-	-	-	-	-	3	PEC

<b>SEMESTER – VII</b>									
<b>S. NO.</b>	<b>COURSE CODE</b>	<b>COURSE NAME</b>	<b>COURSE TYPE#</b>	<b>PERIODS / WEEK</b>				<b>CREDITS</b>	<b>CATEGORY</b>
				<b>L-T-P</b>			<b>TCP*</b>		
1.	TT23C04	Compliances in Textile Industry	T	3	0	0	3	3	PCC
2.	AT23C02	Apparel Marketing and Merchandising	T	3	0	0	3	3	PCC
3.	TT23C11	Total Quality Management for Textile Industry	T	3	0	0	3	3	HSMC
4.	-	Professional Elective V	-	-	-	-	-	3	PEC
5.	-	Professional Elective VI	-	-	-	-	-	3	PEC
6.	-	Emerging Technology Course II	T	3	0	0	3	3	ETC
7.	-	Open Elective - II	T	3	0	0	3	3	OEC
8.	AT23701	Fashion Portfolio development	L	0	0	4	4	2	PCC
9.	AT23702	Internship II/ Training II		0	0	0	0	2	SDC
<b>TOTAL CREDITS</b>								<b>25</b>	
<b>COURSES FOR HONOURS DEGREE</b>									
<b>S. No.</b>	<b>COURSE CODE</b>	<b>COURSE NAME</b>	<b>COURSE TYPE#</b>	<b>PERIODS / WEEK</b>			<b>CREDITS</b>	<b>CATEGORY</b>	
				<b>L-T-P</b>		<b>TCP*</b>			
1.	AT23D03	Capstone Design Project – Level III	CDP	0-0-12		12	6	SDC	
<b>(OR)</b>									
1.	-	Honours Elective – V	-	-	-	-	3	PEC	
2.	-	Honours Elective – VI	-	-	-	-	3	PEC	
<b>COURSES FOR MINOR DEGREE</b>									
<b>S. NO.</b>	<b>COURSE CODE</b>	<b>COURSE NAME</b>	<b>COURSE TYPE#</b>	<b>PERIODS / WEEK</b>			<b>CREDITS</b>	<b>CATEGORY</b>	
				<b>L-T-P</b>		<b>TCP*</b>			
1.	-	Minor Elective – V	-	-	-	-	3	PEC	
2.	-	Minor Elective – VI	-	-	-	-	3	PEC	

SEMESTER – VIII									
S. NO.	COURSE CODE	COURSE NAME	COURSE TYPE#	PERIODS / WEEK				CREDITS	CATEGORY
				L-T-P			TCP*		
1.	AT23801	Project Work / Internship cum Project Work	L	0	0	16	16	8	SDC
<b>TOTAL CREDITS</b>								<b>8</b>	

**PROFESSIONAL ELECTIVE COURSES: VERTICALS**

<b>VERTICAL I</b>	<b>VERTICAL II</b>	<b>VERTICAL III</b>	<b>VERTICAL IV</b>	<b>VERTICAL V</b>	<b>VERTICAL VI</b>	<b>MINORS OFFERED FOR OTHER BRANCHES</b>
<b>TEXTILE MANUFACTURING</b>	<b>APPAREL BUSINESS MANAGEMENT</b>	<b>INDUSTRIAL ENGINEERING</b>	<b>MARKETING</b>	<b>FASHION</b>	<b>FUNCTIONAL TEXTILES</b>	<b>APPAREL MANUFACTURING</b>
Production and Application of Sewing Threads	Sustainable Apparel Business Management	Project Management	Digital marketing and e-business	Fashion Journalism	Protective Garments	Garment Technology
Technology of Nonwoven	Logistics and Supply chain management for Apparel Industry	Production and Operations Management	Visual Merchandising	Introduction to Artificial Intelligence Application in Fashion	Intimate Apparels	Garment Production Machinery
Technology of Manufactured Fibre Production	Human Resource Management	Business Analytics	Apparel Retail Management	Sustainable Apparels	Smart Textiles and garments	Apparel Brand Management
Technology of Woven Fabric Manufacture	Statistics for textile industry	Ergonomics And Human Factors Engineering	Apparel Brand Management	Fashion Draping Lab	Sports Textiles and Garments	Apparel Production and Planning
Technology of Yarn Spinning	Enterprise Resource Planning for Apparel Industry	Quality Assurance And Auditing	Apparel Costing	Traditional Indian Textiles	Medical Textiles	Industrial Engineering in Apparel Industry
Special Textile Structures	Operations Research for Textile Industry	Industrial Relations and Labour Legislations	Fashion Forecasting	Introduction to Leather Garments	Home Textiles	Computer Aided Garment Designing
Advances in Textile Finishing				Garment Sizing and Fit		



VERTICAL I: TEXTILE MANUFACTURING						
S. NO.	COURSE CODE	COURSE NAME	COURSE TYPE <sup>#</sup>	PERIODS / WEEK		CREDITS
				L-T-P	TCP*	
1	AT23001	Production and Application of Sewing Threads	T	3-0-0	3	3
2	AT23002	Technology of Nonwoven	T	3-0-0	3	3
3	TT23C09	Technology of Manufactured Fibre Production	T	3-0-0	3	3
4	AT23003	Technology of Woven Fabric Manufacture	T	3-0-0	3	3
5	AT23004	Technology of Yarn Spinning	T	3-0-0	3	3
6	TT23C17	Special Textile Structures	T	3-0-0	3	3
7	TT23C03	Advances in Textile Finishing	T	3-0-0	3	3

VERTICAL II: APPAREL BUSINESS MANAGEMENT						
S. NO.	COURSE CODE	COURSE NAME	COURSE TYPE <sup>#</sup>	PERIODS / WEEK		CREDITS
				L-T-P	TCP*	
1	AT23005	Sustainable Apparel Business Management	T	3-0-0	3	3
2	AT23C03	Logistics and Supply chain management for Apparel Industry	T	3-0-0	3	3
3	AT23006	Human Resource Management	T	3-0-0	3	3
4	TT23C10	Statistics for Textile Industry	T	2-1-0	3	3
5	AT23007	Enterprise Resource Planning for Apparel Industry	T	0-0-6	6	3
7	TT23C07	Operations Research for Textile Industry	T	3-0-0	3	3

VERTICAL III : INDUSTRIAL ENGINEERING						
S. NO.	COURSE CODE	COURSE NAME	COURSE TYPE#	PERIODS / WEEK		CREDITS
				L-T-P	TCP*	
1	AT23008	Project Management	T	3-0-0	3	3
2	AT23009	Production and Operations Management	T	3-0-0	3	3
3	TT23C12	Business Analytics	T	3-0-0	3	3
4	AT23010	Ergonomics and Human Factors Engineering	T	3-0-0	3	3
5	AT23011	Quality Assurance and Auditing	T	3-0-0	3	3
6	AT23012	Industrial Relations and Labour Legislations	T	3-0-0	3	3

VERTICAL IV: MARKETING						
S. NO.	COURSE CODE	COURSE NAME	COURSE TYPE#	PERIODS / WEEK		CREDITS
				L-T-P	TCP*	
1	TT23C13	Digital Marketing and e-business	T	3-0-0	3	3
2	AT23013	Visual Merchandising	T	3-0-0	3	3
3	AT23014	Apparel Retail Management	T	3-0-0	3	3
4	AT23015	Apparel Brand Management	T	3-0-0	3	3
5.	AT23016	Apparel Costing	T	3-0-0	3	3
6	AT23017	Fashion Forecasting	T	3-0-0	3	3

VERTICAL V: FASHION						
S. NO.	COURSE CODE	COURSE NAME	COURSE TYPE#	PERIODS / WEEK		CREDITS
				L-T-P	TCP*	
1	AT23018	Fashion Journalism	T	3-0-0	3	3
2	AT23019	Introduction to Artificial Intelligence Application in Fashion	T	3-0-0	3	3
3	AT23020	Sustainable Apparels	T	3-0-0	3	3
4	AT23021	Fashion Draping Lab	T	0-0-6	3	3
5	AT23022	Traditional Indian Textiles	T	3-0-0	3	3
6	AT23023	Introduction to leather Garments	T	3-0-0	3	3
7	AT23024	Garment Sizing and Fit	T	3-0-0	3	3

VERTICAL VI: FUNCTIONAL TEXTILES						
S. NO.	COURSE CODE	COURSE NAME	COURSE TYPE#	PERIODS / WEEK		CREDITS
				L-T-P	TCP*	
1	AT23025	Protective Garments	T	3-0-0	3	3
2	AT23026	Intimate Apparels	T	3-0-0	3	3
3	TT23C16	Smart Textiles and Garments	T	2-1-0	3	3
4	AT23027	Sports Textiles and Garments	T	3-0-0	3	3
5	TT23C19	Medical Textiles	T	3-0-0	3	3
6	TT23C14	Home Textiles	T	3-0-0	3	3

MINORS OFFERED FOR OTHER BRANCHES: APPAREL MANUFACTURING						
S. NO.	COURSE CODE	COURSE NAME	COURSE TYPE#	PERIODS / WEEK		CREDITS
				L-T-P	TCP*	
1	TT23C15	Garment Technology	T	2-0-2	4	3
2	TT23C06	Garment Production Machinery	T	2-0-2	4	3
3	AT23015	Apparel Brand Management	T	3-0-0	3	3
4	AT23C01	Apparel Production and Planning	T	2-1-0	3	3
5	AT23C04	Industrial Engineering in Apparel Industry	T	2-1-0	3	3
6	AT23028	Computer Aided Garment Designing	T	0-0-6	6	3

#### LIST OF EMERGING TECHNOLOGY COURSES

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	AT23E01	Web designing for Textiles	ETC	3	0	0	3	3
2.	AT23E02	UX & UI Designing for Textiles	ETC	3	0	0	3	3
3.	AT23E03	Digital printing	ETC	2	0	2	4	3
4.	AT23E04	3D Weaving	ETC	3	0	0	3	3
5.	AT23E05	Artificial Intelligence and Machine Learning Fundamentals	ETC	2	0	2	4	3
6.	AT23E06	IoT Concepts and Applications	ETC	2	0	2	4	3
7.	AT23E07	Data Science Fundamentals	ETC	2	0	2	4	3
8.	AT23E08	Augmented Reality /Virtual Reality	ETC	2	0	2	4	3

**LIST OF SKILL BASED COURSES**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	AT23S01	Computer Aided Fabric Designing	SDC	0	0	4	4	2
2.	AT23S02	Professional Development	SDC	0	0	4	4	2
3.	AT23S03	Fashion Photography	SDC	0	0	4	4	2
4.	AT23S04	Surface Ornamentation of Apparels	SDC	0	0	4	4	2
5.	AT23S05	Composite Making and Testing	SDC	0	0	4	4	2
6.	AT23S06	Repurposing of Textile Materials	SDC	0	0	4	4	2

**COURSES TO BE OFFERED AS OPEN ELECTIVE**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	TT23C15	Garment Technology	OEC	2	0	2	4	3

**COURSES OFFERED FOR LATERAL ENTRY/B.Sc. STUDENTS**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	EE23C03	Basics of Electrical and Electronics Engineering	ESC	2	0	2	4	3
2.	ME23C01	Engineering Drawing & 3D Modelling	SDC	2	0	4	6	4

**COURSES OFFERED FOR LATERAL ENTRY/DIPLOMA STUDENTS**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	AT23101	Design Thinking	HSMC	2	0	2	4	3
2.	CY23C03	Chemistry for Technologists	HSMC	3	0	0	3	3



**UNIT V          EXPRESSION OF VIEWS****6**

Reading – Formal letters, Letters to Editor ; Writing – Letter writing/ Email writing (Enquiry / Permission, Letter to Editor); Grammar – Compound nouns, Vocabulary – Synonyms, Antonyms

**LAB ACTIVITY:****6**

Listening – Short speeches; Speaking – Making short presentations (JAM)

**TOTAL: 60 PERIODS****TEACHING METHODOLOGY**

Interactive lectures, role plays, group discussions, listening and speaking labs, technology enabled language teaching, flipped classroom.

**EVALUATION PATTERN**

Internal Assessment

Written assessments

Assignment

Lab assessment

Listening

Speaking

External Assessment

End Semester Examination

**LEARNING OUTCOMES**

By the end of the courses, students will be able to

- Use appropriate grammar and vocabulary to read different types of text and converse appropriately.
- Write coherent and engaging descriptive and comparative essay writing.
- Comprehend and interpret different kinds of texts and audio visual materials
- Critically evaluate reviews and articulate similarities and differences
- Write formal letters and emails using appropriate language structure and format

**TEXT BOOKS:**

1. "English for Engineers and Technologists" Volume I by Orient Blackswan, 2022
2. "English for Science & Technology - I" by Cambridge University Press, 2023

**REFERENCES**

1. "Interchange" by Jack C.Richards, Fifth Edition, Cambridge University Press, 2017.
2. "English for Academic Correspondence and Socializing" by Adrian Wallwork, Springer, 2011.
3. "The Study Skills Handbook" by Stella Cortrell, Red Globe Press, 2019
4. www.uefap.com

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1										√		√
CO2										√		
CO3										√		√
CO4										√		
CO5										√		√

**OBJECTIVES:**

- To develop the use of matrix algebra techniques in solving practical problems.
- To familiarize the student with functions of several variables.
- To solve integrals by using Beta and Gamma functions.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals.
- To acquaint the students with the concepts of vector calculus which naturally arise in many engineering problems.

**UNIT I      MATRICES      9+3**

Eigenvalues and Eigenvectors of a real matrix – Properties of Eigenvalues and Eigenvectors- Cayley-Hamilton theorem (excluding proof) – Diagonalization of matrices - Reduction of Quadratic form to canonical form by using orthogonal transformation - Nature of a Quadratic form.

**UNIT II      FUNCTIONS OF SEVERAL VARIABLES      9+3**

Limit, continuity, partial derivatives – Homogeneous functions and Euler's theorem - Total derivative – Differentiation of implicit functions – Jacobians -Taylor's formula for two variables - Errors and approximations – Maxima and Minima of functions of two variables – Lagrange's method of undetermined multipliers.

**UNIT III      INTEGRAL CALCULUS      9+3**

Improper integrals of the first and second kind and their convergence – Differentiation under integrals - Evaluation of integrals involving a parameter by Leibnitz rule – Beta and Gamma functions-Properties – Evaluation of single integrals by using Beta and Gamma functions..

**UNIT IV      MULTIPLE INTEGRALS      9+3**

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of Solids – Change of variables in double and triple integrals- Evaluation of double and triple integrals by using Beta and Gamma functions.

**UNIT V      VECTOR CALCULUS      9+3**

Gradient of a scalar field, directional derivative – Divergence and Curl – Solenoidal and Irrotational vector fields - Line integrals over a plane curve - Surface integrals – Area of a curved surface – Volume Integral - Green's theorem, Stoke's and Gauss divergence theorems (without proofs)– Verification and applications in evaluating line, surface and volume integrals.

**TOTAL: 60 PERIODS**

Laboratory based exercises / assignments / assessments will be given to students wherever applicable from the content of the course.

General engineering applications / branch specific applications from the content of each units wherever possible will be introduced to students.



Suggested Laboratory based exercises / assignments / assessments :

#### Matrices

1. Finding eigenvalues and eigenvectors
2. Verification of Cayley-Hamilton theorem
3. Eigenvalues and Eigenvectors of similar matrices
4. Eigenvalues and Eigenvectors of a symmetric matrix
5. Finding the powers of a matrix
6. Quadratic forms

#### Functions of Several Variables

1. Plotting of curves and surfaces
2. Symbolic computation of partial and total derivatives of functions

#### Integral Calculus

1. Evaluation of beta and gamma functions
2. Computation of error function and its complement

#### Multiple Integrals

1. Plotting of 3D surfaces in Cartesian and Polar forms

#### Vector Calculus

1. Computation of Directional derivatives
2. Computation of normal and tangent to the given surface

#### **OUTCOMES:**

CO 1 :Use the matrix algebra methods for solving practical problems.

CO 2 :Use differential calculus ideas on several variable functions.

CO 3 :Apply different methods of integration in solving practical problems by using Beta and Gamma functions.

CO 4 :Apply multiple integral ideas in solving areas and volumes problems.

CO 5 :Apply the concept of vectors in solving practical problems.

#### **TEXT BOOKS:**

1. Joel Hass, Christopher Heil, Maurice D.Weir "'Thomas' Calculus", Pearson Education., New Delhi, 2018.
2. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 45th Edition, New Delhi, 2020.
3. James Stewart, Daniel K Clegg & Saleem Watson "Calculus with Early Transcendental Functions", Cengage Learning, 6th Edition, New Delhi,2023.

#### **REFERENCES:**

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 10<sup>th</sup> Edition, Wiley India Pvt Ltd., New Delhi, 2018.
2. Greenberg M.D., "Advanced Engineering Mathematics", Pearson Education 2<sup>nd</sup> Edition, 5<sup>th</sup> Reprint, Delhi, 2009.
3. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, 5<sup>th</sup> Edition, New Delhi, 2017.
4. Narayanan S. and Manicavachagom Pillai T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.
5. Peter V.O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, 7<sup>th</sup> Edition, New Delhi, 2012.
6. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., 11<sup>th</sup> Reprint, New Delhi, 2010.

**CO – PO Mapping:**

<b>Course Outcomes</b>	<b>PROGRAMME OUTCOMES</b>											
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>P10</b>	<b>P11</b>	<b>P12</b>
CO1 :	3	3	2	3	1	2	1	1	1	1	1	3
CO2 :	3	3	2	3	1	2	1	1	1	1	1	3
CO3 :	3	3	2	3	1	2	1	1	1	1	1	3
CO4 :	3	3	2	3	1	2	1	1	1	1	1	3
CO5 :	3	3	2	3	1	2	1	1	1	1	1	3

**UNIT I WATER TECHNOLOGY**

Water – sources and impurities – water quality parameters: colour, odour, pH, hardness, alkalinity, TDS, COD, BOD, and heavy metals. Boiler feed water – requirement – troubles (scale & sludge, caustic embrittlement, boiler corrosion and priming & foaming. Internal conditioning – phosphate, Calgon, and carbonate treatment. External conditioning – demineralization. Municipal water treatment (screening, sedimentation, coagulation, filtration, disinfection-ozonolysis, UV treatment, chlorination), Reverse Osmosis – desalination.

**PRACTICAL:**

- Estimation of HCl using  $\text{Na}_2\text{CO}_3$  as the primary standard
- Determination of alkalinity in the water sample.
- Determination of hardness of water by EDTA method.
- Determination of DO content of water sample by Winkler's method.

**UNIT II NANOCHEMISTRY**

Basics-distinction between molecules, nanomaterials and bulk materials; size-dependent properties (optical, electrical, mechanical, magnetic and catalytic). Types –nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro-spinning. Characterization - Scanning Electron Microscope and Transmission Electron Microscope - Principle and instrumentation (block diagram). Applications of nanomaterials – medicine including AYUSH, automobiles, electronics, and cosmetics.

**PRACTICAL:**

- Preparation of nanoparticles by Sol-Gel method/sonication method.
- Preparation of nanowire by Electrospinning.
- Study of morphology of nanomaterials by scanning electron microscopy

**UNIT III CORROSION SCIENCE**

Introduction to corrosion – chemical and electrochemical corrosions – mechanism of electrochemical and galvanic corrosions – concentration cell corrosion-soil, pitting, inter-granular, water line, stress and microbiological corrosions-galvanic series-factors influencing corrosion- measurement of corrosion rate. Electrochemical protection – sacrificial anodic protection and impressed current cathodic protection. Protective coatings-metallic coatings (galvanizing, tinning), organic coatings (paints). Paints: Constituents and functions.

**PRACTICAL:**

- Corrosion experiment-weight loss method.
- Salt spray test for corrosion study.
- Corrosion prevention by electroplating.
- Estimation of corroded Iron by Potentiometry/UV-visible spectrophotometer

**UNIT IV ENERGY SOURCES**

Electrochemical cell, redox reaction, electrode potential – oxidation and reduction potential. Batteries – Characteristics; types of batteries; primary battery (dry cell), secondary battery (lead acid, lithium-ion battery) and their applications. Emerging energy sources – metal hydride battery, hydrogen energy, Fuel cells –  $\text{H}_2\text{-O}_2$  fuel cell. Supercapacitors –Types and Applications, Renewable Energy:

solar heating and solar cells. Recycling and disposal of batteries.

**PRACTICAL:**

- Study of components of Lead acid battery.
- Measurement of voltage in a photovoltaic cell.
- Working of H<sub>2</sub> – O<sub>2</sub> fuel cell

**UNIT V POLYMER CHEMISTRY**

Introduction: Functionality-degree of polymerization. Classification of polymers (Source, Structure, Synthesis and Intermolecular forces). Mechanism of free radical addition polymerization. Properties of polymers: T<sub>g</sub>, tacticity, molecular weight-number average, weight average, viscosity average and polydispersity index (Problems). Techniques of polymerization: Bulk, emulsion, solution and suspension. Compounding and Fabrication Techniques: Injection, Extrusion, Blow and Calendaring. Polyamides, Polycarbonates and Polyurethanes – structure and applications. Recycling of polymers.

**PRACTICAL:**

- Determination of molecular weight of a polymer using Ostwald viscometer.
- Preparation of a polymer.
- Determination of molecular weight by Gel Permeation Chromatography.

**TOTAL: 75 PERIODS**

**COURSE OUTCOMES:**

**CO1:** To demonstrate knowledge of water quality in various industries and develop skills in analyzing water quality parameters for both domestic and industrial purposes.

**CO2:** To identify and apply fundamental concepts of nanoscience and nanotechnology for engineering and technology applications, and to develop skills in synthesizing nanomaterials and studying their morphology.

**CO3:** To apply fundamental knowledge of corrosion protection techniques and develop skills to conduct experiments for measuring and preventing corrosion.

**CO4:** To study the fundamentals of energy storage devices and develop skills in constructing and experimenting with batteries.

**CO5:** To recognize and apply basic knowledge of different types of polymeric materials and develop skills in preparing and determining their applications for futuristic material fabrication needs.

**TEXT BOOKS:**

1. Jain P. C. & Monica Jain., "Engineering Chemistry", 17th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2015.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2012.
3. Dara S.S., "A Textbook of Engineering Chemistry", Chand Publications, 2004.
4. Laboratory Manual - Department of Chemistry, CEGC, Anna University (2023).

**REFERENCES:**

1. Schdeva M.V., "Basics of Nano Chemistry", Anmol Publications Pvt Ltd, 2011.
2. Friedrich Emich, "Engineering Chemistry", Medtech, 2014.
3. Gowariker V.R., Viswanathan N.V. and Jayadev Sreedhar, "Polymer Science" New AGE International Publishers, 2009.
4. Vogel's Textbook of Quantitative Chemical Analysis (8th edition, 2014).

**CO - PO Mapping**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
<b>CO1</b>	3	3	-	-	-	-	3	-	-	-	-	-
<b>CO2</b>	3	-	2	-	2	-	3	-	-	-	-	-
<b>CO3</b>	3	3	2	-	2	-	3	-	-	-	-	-
<b>CO4</b>	3	3	-	-	-	-	3	-	-	-	-	-
<b>CO5</b>	3	-	-	-	-	-	3	-	-	-	-	-
<b>Avg</b>	3	3	-	-	-	-	3	-	-	-	-	-

1' = Low; '2' = Medium; '3' = High

**COURSE OBJECTIVES:**

- To understand fundamental structural programming concepts and problem-solving process.
- To solve problems using modular programming and decomposition techniques.
- To solve problems using data structures and abstraction techniques.
- To create programming solutions using libraries and packages.
- To design solutions to domain problems using programming problem-solving techniques.

**UNIT I – STRUCTURED PROGRAMMING****9+6**

Problem-Solving Strategies. Basic Problem-Solving Tools: Flowcharts, Pseudocode. Introduction to Programming Languages and Development Environments. Programming. Basic Concepts and Syntax: Variables, Identifiers, Data Types: Primitive Types and Strings, Statements, Operators, Expressions and its evaluation, Operator Precedence, Basic Arithmetic Operations. Principles of Structured Programming – Control Structures: Sequence, Selection, Iteration and Branching.

**PRACTICALS:**

- Design algorithms for simple computational problems
- Create Pseudo-code and Flow charts for simple computational problems
- Create Python programs using simple and nested selective control statements
- Create Python programs using simple and nested sequence & iterative control statements
- Create Python programs to generate series/patterns using control statements

**UNIT II – MODULARITY AND DECOMPOSITION****9+6**

Principles of Modular and Decomposition. Functions: Defining functions –Argument types – Function Name-spaces – Scoping: Global and Non-local. Principles of Recursion: Base case and Recursive cases – Develop and Analyze Recursive functions: Factorial, Fibonacci. Principles of First-Class and Higher-Order functions: Lambda functions – Functions as arguments.

**PRACTICALS:**

- Create Python programs using functions
- Create python program using recursion
- Create Python programs using lambda functions
- Create Python programs using first-class functions
- Create Python programs using higher-order functions

### **UNIT III – DATA STRUCTURES AND ABSTRACTIONS**

**9+6**

Principles of Data Structures and Abstractions. String Methods and Manipulations,.Lists: List Operations and Methods, List comprehensions, Nested List comprehensions, Matrix operations using Lists. Tuples and sequences. Sets and Operations. Dictionaries: Dictionary operations, Dictionary comprehensions, Nested Dictionary comprehensions. Comparing Data Structures. Search and Sort Data Structures. Principle of Functional Programming and Tools : map, filter, and reduce.

#### **PRACTICALS:**

- Create Python programs for strings manipulations.
- Design Python programs using Lists, Nested Lists and Lists comprehensions
- Create Python programs using Tuples, Nested Tuples, and Tuple comprehensions
- Create Python programs creating Sets and performing set operations
- Create Python programs using Dictionary, Nested Dictionary and comprehensions
- Create Python programs by applying functional programming concepts

### **UNIT IV – LIBRARIES AND MODULES**

**9+6**

Exceptions: Syntax errors, Exceptions, Exception types, Handling exceptions, Raising exceptions. Files: File Path, Type of files, opening modes, Reading and Writing text files, Handling other format Data files. Modules: Creating Modules, import and from statements, Executing modules as scripts, Standard modules. Packages and Importing from packages

#### **PRACTICALS:**

- Design Python programs to handle errors and exceptions
- Create, import, and use pre-defined modules and packages
- Create, import, and use user-defined modules and packages
- Create Python programs to perform various operations on text files
- Create Python programs to perform various operations on other data file formats.

### **UNIT V – SIMPLE PROBLEM SOLVING TECHNIQUES IN PROGRAMMING**

**9+6**

Data Structures for Problem Solving: Stack, Queue. Principles of Divide and Conquer: Binary Search. Principles of Greedy Algorithms: Minimum Coin Change Problem. Case studies on programming application of problem-solving techniques in different fields of engineering.

#### **PRACTICALS:**

- Create python programs to implement stack and queue.
- Create python programs to implement binary search.
- Create python programs to solve minimum coin change problem.

- Case study on developing python solution to a domain specific problems.

**TOTAL = 45 + 30 = 75 PERIODS**

### **COURSE OUTCOMES**

1. Understand fundamental structural programming concepts and problem-solving process.
2. Solve problems using modular programming and decomposition techniques.
3. Solve problems using data structures and abstraction techniques.
4. Create programming solutions using libraries and packages.
5. Design solutions to domain problems using programming problem-solving techniques.

### **TEXT BOOKS**

1. Reema Thareja, Python Programming using Problem Solving Approach, Oxford University Press, First Edition, 2017.
2. S. Sridhar, J. Indumathi, V. M. Hariharan, Python Programming, Pearson Education, First Edition, 2023

### **REFERENCE BOOKS**

1. Paul Deitel, Harvey Deitel, Python for Programmers, Pearson Education, 2020.
2. John V Guttag. Introduction to Computation and Programming Using Python, With Application to Computational Modeling and Understanding Data. Third Edition, The MIT Press, 2021
3. Mark Lutz, Learning Python, 5th Edition, O'Reilly Media, Inc.
4. Python official documentation and tutorial, <https://docs.python.org/3/>
5. Numerical Python official documentation and tutorial, <https://numpy.org/>

### **CO's-PO's & PSO's MAPPING**

CO	PO1	PO2	PO3	PO4	POS	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>1</b>	2		2		1								1	1	
<b>2</b>	2		2		1								1	1	
<b>3</b>	2	1	2		1								1	1	
<b>4</b>	2	1	2	1	1								1	1	
<b>5</b>	2	1	2	1	1								1	1	
<b>Avg</b>	2	1	2	1	1								1	1	

**1 - low, 2 - medium, 3 - high, '-' - no correlation**



<b>EE23C03</b>	<b>BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>2</b>	<b>3</b>

**UNIT-I BASIC ELECTRICAL CIRCUITS 6**

Basic Elements: R,L,C- DC Circuits: Ohm's Law - Kirchhoff's Laws –Mesh and Nodal Analysis(Only Independent Sources). AC Circuits: Average Value, RMS Value, Impedance Instantaneous Power, Real Power, Reactive Power and Apparent Power, Power Factor-Steady state Analysis of RL,RC and RLC circuits.

**UNIT II AC AND DC MACHINES 6**

Magnetic Circuit Fundamentals -DC Machines - Construction and Working Principle, Types and Application of DC generator and Motor, EMF and Torque Equation.

AC Machines: Principle, Construction, Working and Applications of Transformer -Three phase Alternator - Three Phase Induction Motor.

**UNIT III ANALOG AND DIGITAL ELECTRONICS 6**

Operation and Characteristics of electronic devices: PN Junction Diodes, Zener Diode and BJT Applications: Diode Bridge Rectifier and Shunt Regulator.

Introduction to Digital Electronics: Basics Logic Gates-Flip Flops.

**UNIT IV SENSORS AND TRANSDUCERS 6**

Solenoids, electro-pneumatic systems, proximity sensors, limit switches, Strain gauge, LVDT, Piezo electric transducer, optical and digital transducers, Smart sensors, Thermal Imagers.

**UNIT V MEASUREMENTS AND INSTRUMENTATION 6**

Functional Elements of an Instrument, Operating Principle of Moving Coil and Moving Iron Instruments, Power Measurement, Energy Meter, Instrument Transformers - CT and PT, Multimeter- DSO - Block Diagram Approach.

**TOTAL:30 PERIODS**

**LAB COMPONENT:**

1. Verification of ohms and Kirchhoff's Laws.
2. Load test on DC Shunt Motor.
3. Load test on Single Phase Transformer.
4. Load test on 3 Phase Induction Motor.
5. Uncontrolled diode bridge Rectifiers.
6. Application of Zener diode as shunt regulator.
7. Verification of truth table of logic gates and flip flops.
8. Characteristics of LVDT.
9. Three phase power measurement using two wattmeter method.
10. Study of DSO.

**COURSE OUTCOMES:**

Students will be able to

- CO1** Compute the electric circuit parameters for simple circuits.
- CO2** Understand the working principles and characteristics of electrical machines.
- CO3** Understand the basic electronic devices.
- CO4** Understand the basic operating principles of sensors and transducer.

**CO5** Understand the operating principles measuring devices

**TEXT BOOKS:**

1. Kotharai DP and Nagarath IJ, “Basic Electrical and Electronics Enigneering”, McGraw Hill Education, Second Edition, 2020.
2. Bhattacharya SK, “Basic Electrical and Electronics Engineering”, Pearson Education, Second Edition, 2017.

**REFERENCES:**

1. Mehta V.K. & Mehta Rohit, “Principles of Electrical Engineering and Electronics”, McGraw Hill Education, Second Edition, 2020.
2. Mehta V.K. & Mehta Rohit, “Principles of Electrical Machines”, S. Chand Publishing, second edition 2006.
3. Albert Malvino & David Bates, “Electronic principles”, McGraw Hill Education, Seventh Edition, 2017.

Mapping COs and POs:																
COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	1														
CO2	2	1														
CO3	2	1														
CO4	2	1														
CO5	2	1														
Avg	2	1														

**Course Objectives**

To enable the students to use design thinking approaches for solving problems

**UNIT I INTRODUCTION TO DESIGN THINKING 6+6**

Understanding design thinking, design thinking as problem solving tools, design Thinking for need identification and product specification; basic rules of design thinking; double diamond and abstract tangible cycle

**Practicals:**

1. Conduct survey on the product/system of interest for problem identification
2. Identify the problem and frame the problem statement

**UNIT II DESIGN THINKING APPROACHES 6+3**

Empathy, ethnography, divergent thinking, convergent thinking, visual thinking, assumption thinking, prototyping

**Practicals:**

1. Identify the possible solutions for the identified problem using different approaches

**UNIT III RESEARCH AND IDEA GENERATION 6+9**

Design thinking process stages – define, research, ideate, prototype, select, implement, learn. Research and idea generation: Research – identifying drivers, information gathering, target groups; Idea Generation: Basic design directions, themes of thinking, inspiration and references, brainstorming, value, inclusion, sketching, presentation ideas.

**Practicals:**

1. Identify the target customer for the identified problem statement and create persona
2. Build a customer journey map and identify the touch points
3. Story boarding design about user needs into design concepts

**UNIT IV REFINEMENT, PROTOTYPING AND IMPLEMENTATION 6+12**

Thinking in images, thinking in signs, appropriation, humor, personification, visual metaphors, modification, thinking in words, words and language, type 'faces', thinking in shapes, thinking in proportions, thinking in colour; Prototyping - Developing designs, types of prototype. Implementation – format, materials, finishing, media, scale, series, continuity.

**Practicals:**

1. Draw product/system using the appropriate design thinking tools
2. Develop a function map for the persona designed
3. Identify the components to establish the product/system
4. Create a prototype for the product/system

**UNIT V DESIGN THINKING TOOLS AND METHODS 6**

Visualization, journey mapping, value chain analysis, mind mapping, brainstorming, concept development, assumption testing, rapid prototyping, design thinking application

**TOTAL: 30 PERIODS+30 PERIODS**

**OUTCOMES:**

Upon completion of this course, the student shall be able to understand

- CO 1 –understand the need for the design thinking and implement the rules of design thinking in problem solving process
- CO 2 –analyse and implement the design thinking approaches
- CO 3 –identify an idea and analyse the various information related to that idea for design development
- CO 4 –Analyse the problem and develop a prototype by analysing the implications in implementation
- CO 5 –comprehend and implement the design thinking tools in problem solving process

**TEXTBOOKS:**

1. Walter Brenner, Falk Uebernickel, Design Thinking for Innovation Research and Practice by Walter Brenner, Falk Uebernickel , Springer, 2016
2. Gavin Ambrose and Paul Harris, “Design Thinking”, AVA publishing, Singapore, 2010.

**REFERENCES:**

1. Gerard H.Gaynor, “Innovation by Design”, American Management Association, USA, 2002.
2. Roger Martin, “The Design of Business: Why design thinking is the next competitive advantage”, Harvard Business Press, 2009.
3. Tracy Jennings, “Creativity in Fashion Design – An Inspiration Workbook”, Fairchild books, Newyork, 2011.
4. Product Design and Development byUlrich, Karl T., Eppinger,SteveD.,and Yang, Maria C.,7th ed., McGraw-Hill Education, 2020
5. FrédéricDarbellay, Zoe Moodyand Todd Lubart, Creativity, Design Thinking and Interdisciplinarity, Springer, 2017

Course Outcomes	Program Outcome												Program Specific Outcome		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	2	2	3	3	-	-	2	3	2	-	-	3	1	2	3
2	2	2	3	3	-	-	2	3	2	-	-	3	1	2	3
3	2	2	3	3	-	-	2	3	2	-	-	3	1	2	3
4	2	2	3	3	-	-	2	3	2	-	-	3	1	2	3
5	2	2	3	3	-	-	2	3	2	-	-	3	1	2	3
Overall CO	2	2	3	3	-	-	2	3	2	-	-	3	1	2	3

**அலகு I மொழி மற்றும் இலக்கியம்**

3

இந்திய மொழிக் குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி – தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் – திருக்குறளில் மேலாண்மைக் கருத்துக்கள் – தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் – சிற்றிலக்கியங்கள் – தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

**அலகு II மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை**

3

நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள்– பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் – தேர் செய்யும் கலை – சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரிமுனையில் திருவள்ளூர் சிலை – இசைக் கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

**அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:**

3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஓயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

**அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள்:**

3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடு – சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் – சங்ககால நகரங்களும் துறை முகங்களும் – சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

**அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு:**

3

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிக்கள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

**TOTAL : 15 PERIODS**

## TEXT-CUM-REFERENCEBOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சந்திரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருறை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

**UNIT I LANGUAGE AND LITERATURE****3**

Language Families in India-Dravidian Languages–Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural – Tamil Epics and Impact of Buddhism & Jainism in Tamil Land-Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

**UNIT II HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE****3**

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts-Art of temple car making - Massive Terracotta sculptures, Villagedeities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments-Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

**UNIT III FOLK AND MARTIAL ARTS****3**

Therukoothu, Karagattam, VilluPattu, KaniyanKoothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

**UNIT IV THINAICONCEPTOFTAMILS****3**

Flora and Fauna of Tamils&AhamandPuramConceptfromTholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import duringSangamAge -Overseas Conquestof Cholas.

**UNIT V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE****3**

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

**TOTAL : 15 PERIODS****TEXT-CUM-REFERENCE BOOKS**

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருறை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)

9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.



**NCC Credit Course Level 1\***

<b>UC23P01 (ARMY WING) NCC Credit Course Level - I</b>		<b>L T P C</b>
		<b>2 0 0 2</b>
<b>NCC GENERAL</b>		<b>6</b>
NCC 1	Aims, Objectives & Organization of NCC	1
NCC 2	Incentives	2
NCC 3	Duties of NCC Cadet	1
NCC 4	NCC Camps: Types & Conduct	2
<b>NATIONAL INTEGRATION AND AWARENESS</b>		<b>4</b>
NI 1	National Integration: Importance & Necessity	1
NI 2	Factors Affecting National Integration	1
NI 3	Unity in Diversity & Role of NCC in Nation Building	1
NI 4	Threats to National Security	1
<b>PERSONALITY DEVELOPMENT</b>		<b>7</b>
PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving	2
PD 2	Communication Skills	3
PD 3	Group Discussion: Stress & Emotions	2
<b>LEADERSHIP</b>		<b>5</b>
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour 'Code	3
L 2	Case Studies: Shivaji, Jhasi Ki Rani	2
<b>SOCIAL SERVICE AND COMMUNITY DEVELOPMENT</b>		<b>8</b>
SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth	3
SS 4	Protection of Children and Women Safety	1
SS 5	Road / Rail Travel Safety	1
SS 6	New Initiatives	2
SS 7	Cyber and Mobile Security Awareness	1

**TOTAL : 30 PERIODS**

<b>NCC Credit Course Level 1*</b>		<b>L T P C</b>
<b>UC23P02</b>	<b>(NAVAL WING) NCC Credit Course Level – I</b>	<b>2 0 0 2</b>
<b>NCC GENERAL</b>		<b>6</b>
NCC 1	Aims, Objectives & Organization of NCC	1
NCC 2	Incentives	2
NCC 3	Duties of NCC Cadet	1
NCC 4	NCC Camps: Types & Conduct	2
<b>NATIONAL INTEGRATION AND AWARENESS</b>		<b>4</b>
NI 1	National Integration: Importance & Necessity	1
NI 2	Factors Affecting National Integration	1
NI 3	Unity in Diversity & Role of NCC in Nation Building	1
NI 4	Threats to National Security	1
<b>PERSONALITY DEVELOPMENT</b>		<b>7</b>
PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving	2
PD 2	Communication Skills	3
PD 3	Group Discussion: Stress & Emotions	2
<b>LEADERSHIP</b>		<b>5</b>
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code	3
L 2	Case Studies: Shivaji, Jhasi Ki Rani	2
<b>SOCIAL SERVICE AND COMMUNITY DEVELOPMENT</b>		<b>8</b>
SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth	3
SS 4	Protection of Children and Women Safety	1
SS 5	Road / Rail Travel Safety	1
SS 6	New Initiatives	2
SS 7	Cyber and Mobile Security Awareness	1

**TOTAL : 30 PERIODS**

<b>UC23P03</b>	<b>NCC Credit Course Level 1*</b> <b>(AIR FORCE WING) NCC Credit Course Level – I</b>	<b>L T P C</b> <b>2 0 0 2</b>
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<b>NCC GENERAL</b>		<b>6</b>
NCC 1	Aims, Objectives & Organization of NCC	1
NCC 2	Incentives	2
NCC 3	Duties of NCC Cadet	1
NCC 4	NCC Camps: Types & Conduct	2
<b>NATIONAL INTEGRATION AND AWARENESS</b>		<b>4</b>
NI 1	National Integration: Importance & Necessity	1
NI 2	Factors Affecting National Integration	1
NI 3	Unity in Diversity & Role of NCC in Nation Building	1
NI 4	Threats to National Security	1
<b>PERSONALITY DEVELOPMENT</b>		<b>7</b>
PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving	2
PD 2	Communication Skills	3
PD 3	Group Discussion: Stress & Emotions	2
<b>LEADERSHIP</b>		<b>5</b>
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code	3
L 2	Case Studies: Shivaji, Jhasi Ki Rani	2
<b>SOCIAL SERVICE AND COMMUNITY DEVELOPMENT</b>		<b>8</b>
SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth	3
SS 4	Protection of Children and Women Safety	1
SS 5	Road / Rail Travel Safety	1
SS 6	New Initiatives	2
SS 7	Cyber and Mobile Security Awareness	1

**TOTAL : 30 PERIODS**

**COURSE OBJECTIVES:**

- To read and comprehend different forms of official texts.
- To develop students' writing skills in professional context.
- To actively listen, read and understand written and oral communication in a professional context.
- To comprehend and analyse the visual content in authentic context.
- To write professional documents with clarity and precision

**UNIT I CAUSE AND EFFECT 6**

Reading – Newspaper articles on Social and Environmental issues; Writing – Instructions, Cause and effect essay; Grammar - Modal verbs; Vocabulary – Cause and effect, Idioms

**LAB ACTIVITY: 6**

Listening and Speaking – Listen to news reports and summarise in oral form.

**UNIT II CLASSIFICATION 6**

Reading – An article, social media posts and classifying based on the content; Writing – Definition, Note making, Note taking (Cornell notes etc.) and Summarising; Grammar – Connectives; Vocabulary – Phrasal verbs

**LAB ACTIVITY: 6**

Listening and speaking: Social interaction (Conversation including small talk)

**UNIT III PROBLEM AND SOLUTION 6**

Reading – Visual content (Tables/charts/graphs) for comprehension; Writing - Problem and Solution Essay; Grammar – If conditionals; Vocabulary – Sequential words.

**LAB ACTIVITY: 6**

Listening – Group discussion; Speaking – Participating in a group discussion

**UNIT IV REPORT 6**

Reading – Formal report on accidents (industrial/engineering); Writing – Industrial Accident report; Grammar – Active and passive voice, Direct and Indirect speech; Vocabulary – Numerical adjectives.

**LAB ACTIVITY: 6**

Listening / watching – Television documentary and discussing its content, purpose etc.

**UNIT V JOB APPLICATION AND INTERVIEW 6**

Reading - Job advertisement and company profile; Writing – Job application (cover letter and CV) Grammar – Mixed Tenses; Vocabulary – Collocations related to work environment

**LAB ACTIVITY: 6**

Listening – Job interview; Speaking – Mock interviews

**TOTAL: 60 PERIODS**

## TEACHING METHODOLOGY

Interactive lectures, role plays, group discussions, listening and speaking labs, technology enabled language teaching, flipped classroom.

## EVALUATION PATTERN

Internal Assessment

Written assessments

Assignment

Lab Assessment

Group discussion (Peer assessment)

Listening

External Assessment

End Semester Examination

## LEARNING OUTCOMES

By the end of the courses, students will be able to

- To apply appropriate language structure and vocabulary to enhance both spoken and written communication in formal contexts.
- Comprehend different forms of official documents
- Write professional documents coherently and cohesively.
- Interpret verbal and graphic content in authentic context
- Analyse and evaluate verbal and audio visual materials.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1										√		√
CO2										√		√
CO3										√		√
CO4										√		√
CO5										√		√

## TEXT BOOKS:

1. "English for Engineers and Technologists" Volume 2 by Orient Blackswan, 2022
2. "English for Science & Technology - II" by Cambridge University Press, 2023.

## REFERENCES:

1. "Communicative English for Engineers and Professionals" by Bhatnagar Nitin, Pearson India, 2010.
2. "Take Off – Technical English for Engineering" by David Morgan, Garnet Education, 2008.
3. "Advanced Communication Skills" by Mathew Richardson, Charlie Creative Lab, 2020.
4. [www.uefap.com](http://www.uefap.com)

<b>MA23C02</b>	<b>ORDINARY DIFFERENTIAL EQUATIONS AND TRANSFORM TECHNIQUES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**OBJECTIVES:**

- To acquaint the students with Differential Equations which are significantly used in engineering problems.
- To make the students to understand the Laplace transforms techniques.
- To develop the analytic solutions for partial differential equations used in engineering by Fourier series.
- To acquaint the student with Fourier transform techniques used in wide variety of situations in which the functions used are not periodic.
- To develop Z- transform techniques in solving difference equations.

**UNIT I      ORDINARY DIFFERENTIAL EQUATIONS      9+3**

Homogeneous linear ordinary differential equations of second order -superposition principle - general solution- Particular integral - Operator method - Solution by variation of parameters - Method of undetermined coefficients - Homogeneous equations of Euler–Cauchy and Legendre’s type – System of simultaneous linear differential equations with constant coefficients.

**UNIT II      LAPLACE TRANSFORMS      9+3**

Existence theorem - Transform of standard functions – Transform of Unit step function and Dirac delta function – Basic properties - Shifting theorems - Transforms of derivatives and integrals – Transform of periodic functions - Initial and Final value theorem - Inverse Laplace transforms- Convolution theorem (without proof) – Solving Initial value problems by using Laplace Transform techniques.

**UNIT III      FOURIER SERIES      9+3**

Dirichlet’s conditions – General Fourier series – Odd and even functions – Half-range Sine and Cosine series – Complex form of Fourier series – Parseval’s identity – Computation of harmonics.

**UNIT IV      FOURIER TRANSFORMS      9+3**

Fourier integral theorem – Fourier transform pair - Fourier sine and cosine transforms – Properties – Transform of elementary functions – Inverse Fourier Transforms - Convolution theorem (without proof) – Parseval’s identity.

**UNIT V      Z – TRANSFORM AND DIFFERENCE EQUATIONS      9+3**

Z-transform – Properties of Z-transform – Inverse Z-transform – Convolution theorem – Evaluation of Inverse Z transform using partial fraction method and convolution theorem - Initial and final value theorems – Formation of difference equations – Solution of difference equations using Z - transform.

**TOTAL: 60 PERIODS**

Laboratory based exercises / assignments / assessments will be given to students from the content of the course wherever applicable.

Branch specific / General Engineering applications based on the content of each units will be introduced to students wherever possible.

Suggested Laboratory based exercises / assignments / assessments :

Ordinary differential equations

1. Symbolic computation of linear ordinary differential equations

2. Solving System of simultaneous linear differential equations using ODE SOLVER

Laplace transforms

1. Symbolic computation of Laplace transform and Inverse Laplace transform
2. Plotting Laplace transforms

Fourier Series

1. Symbolic computation of Fourier Coefficients
2. Computation of harmonics
3. Plotting truncated Fourier Series

Fourier Transform

1. Symbolic computation of Fourier Transforms
2. Plotting truncated Fourier Transforms

Z – transform

1. Symbolic computation of Z-Transforms

**OUTCOMES:**

- CO1 :Solve higher order ordinary differential equations which arise in engineering applications.  
 CO2 :Apply Laplace transform techniques in solving linear differential equations.  
 CO3 :Apply Fourier series techniques in engineering applications.  
 CO4 :Understand the Fourier transforms techniques in solving engineering problems.  
 CO5 :Understand the Z-transforms techniques in solving difference equations.

**TEXT BOOKS:**

1. Grewal B.S., “Higher Engineering Mathematics”, Khanna Publishers, 45th Edition, New Delhi, 2020.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 10<sup>th</sup> Edition, Wiley India Pvt Ltd., New Delhi, 2018.

**REFERENCES:**

1. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008
2. Greenberg M.D., “Advanced Engineering Mathematics”, Pearson Education 2nd Edition, 5th Reprint, Delhi, 2009.
3. Jain R.K. and Iyengar S.R.K., “Advanced Engineering Mathematics”, Narosa Publications, 5 th Edition, New Delhi, 2017.
4. Peter V.O’Neil, “Advanced Engineering Mathematics”, Cengage Learning India Pvt., Ltd, 7 th Edition, New Delhi , 2012.
5. Ramana B.V., “Higher Engineering Mathematics”, Tata McGraw Hill Co. Ltd., 11th Reprint, New Delhi, 2010.

**CO – PO Mapping:**

Course Outcomes	PROGRAMME OUTCOMES											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO 1 :	3	3	2	3	1	2	1	1	1	1	1	3
CO 2 :	3	3	2	3	1	2	1	1	1	1	1	3
CO 3 :	3	3	2	3	1	2	1	1	1	1	1	3
CO 4 :	3	3	2	3	1	2	1	1	1	1	1	3
CO 5 :	3	3	2	3	1	2	1	1	1	1	1	3

**COURSE OBJECTIVES**

- To familiarize with crystal structure, bonding and crystal growth.
- To impart knowledge on Mechanics of Materials.
- To impart knowledge of oscillations, sound and Thermal Physics
- To facilitate understanding of optics and its applications, different types of Lasers and fiber optics.
- To introduce the basics of Quantum Mechanics and its importance.

**UNIT I CRYSTAL PHYSICS****9+6**

Crystal Bonding – Ionic – covalent – metallic and van der Waals's/ molecular bonding. Crystal systems - unit cell, Bravais lattices, Miller indices - Crystal structures - atomic packing density of BCC, FCC and HCP structures. NaCl, Diamond, Graphite, Graphene, Zincblende and Wurtzite structures - crystal imperfections- point defects - edge and screw dislocations – grain boundaries. Crystal Growth – Czochralski method – vapor phase epitaxy – Molecular beam epitaxy- Introduction to X-Ray Diffractometer.

1. Determination of Lattice parameters for crystal systems.
2. Crystal Growth – Slow Evaporation method
3. Crystal Growth Sol – Gel Method

**UNIT II MECHANICS OF MATERIALS****9+6**

Rigid Body – Centre of mass – Rotational Energy - Moment of inertia (M.I)- Moment of Inertia for uniform objects with various geometrical shapes. Elasticity –Hooke's law - Poisson's ratio - stress-strain diagram for ductile and brittle materials – uses- Bending of beams – Cantilever - Simply supported beams - uniform and non-uniform bending - Young's modulus determination - I shaped girders –Twisting couple – Shafts. Viscosity – Viscous drag – Surface Tension.

1. Non-uniform bending -Determination of Young's modulus of the material of the beam.
2. Uniform bending -Determination of Young's modulus of the material of the beam
3. Viscosity – Determination of Viscosity of liquids.

**UNIT III OSCILLATIONS, SOUND AND THERMAL PHYSICS****9+6**

Simple harmonic motion - Torsional pendulum -- Damped oscillations –Shock Absorber -Forced oscillations and Resonance –Applications of resonance.- Waves and Energy Transport –Sound waves – Intensity level – Standing Waves - Doppler effect and its applications - Speed of blood flow. Ultrasound – applications - Echolocation and Medical Imaging. Thermal Expansion – Expansion joints – Bimetallic strip – Seebeck effect – thermocouple -Heat Transfer Rate – Conduction – Convection and Radiation.

1. Torsional pendulum-Determination of rigidity modulus of wire and moment of inertia of the disc
2. Melde's string experiment - Standing waves.
3. Ultrasonic interferometer – determination of sound velocity and liquids compressibility

**UNIT IV OPTICS AND LASERS****9+6**

Interference - Thin film interference - Air wedge- Applications -Interferometers–Michelson Interferometer -- Diffraction - CD as diffraction grating – Diffraction by crystals -Polarization - polarizers



-- Laser – characteristics – Spontaneous and Stimulated emission- population – inversion - Metastable states - optical feedback - Nd-YAG laser, CO<sub>2</sub> laser, Semiconductor laser - Industrial and medical applications - Optical Fibers – Total internal reflection – Numerical aperture and acceptance angle – Fiber optic communication – Fiber sensors – Fiber lasers.

1. Laser - Determination of the width of the groove of the compact disc using laser.  
Laser Parameters  
Determination of the wavelength of the laser using grating
2. Air wedge -Determination of the thickness of a thin sheet/wire
3. Optical fibre - Determination of Numerical Aperture and acceptance angle  
-Determination of bending loss of fibre.
4. Michelson Interferometer (Demonstration)

## **UNIT V QUANTUM MECHANICS**

**9+6**

Black body radiation (Qualitative) – Planck’s hypothesis – Einstein’s theory of Radiation - Matter waves– de Broglie hypothesis - Electron microscope – Uncertainty Principle – The Schrodinger Wave equation (time-independent and time-dependent) – Meaning and Physical significance of wave function - Normalization - Particle in an infinite potential well-particle in a three-dimensional box - Degenerate energy states - Barrier penetration and quantum tunneling - Tunneling microscope.

1. Photoelectric effect – Determination of Planck’s constant.
2. Black Body Radiation (Demonstration)
3. Electron Microscope (Demonstration)

**TOTAL: 75 PERIODS**

### **COURSE OUTCOMES:**

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

- CO1:** Understand the significance of crystal structure and bonding. Learn to grow crystals.
- CO2:** Obtain knowledge on important mechanical and thermal properties of materials and determine them through experiments.
- CO3:** Conceptualize and visualize the oscillations and sound.
- CO4:** Grasp optical phenomenon and their applications in real life.
- CO5:** Appreciate and evaluate the quantum phenomenon.
- CO6** Develop skill set to solve engineering problems and design experiments.

### **TEXT BOOKS:**

1. Raymond A. Serway, John W. Jewett, Physics for Scientists and Engineers, Thomson Brooks/Cole, 2013.
2. D. Halliday, R. Resnick and J. Walker, Principles of Physics. John Wiley & Sons, 10<sup>th</sup> Edition, 2015.
3. N. Garcia, A. Damask and S. Schwarz, Physics for Computer Science Students, Springer-Verlag, 2012.
4. Alan Giambattista, Betty McCarthy Richardson and Robert C. Richardson, College Physics, McGraw-Hill Higher Education, 2012.

### **REFERENCES:**

1. R. Wolfson, Essential University Physics. Volume 1 & 2. Pearson, 2016.
2. D. Kleppner and R. Kolenkow. An Introduction to Mechanics, McGraw Hill Education, 2017.

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
<b>CO1</b>	3	2	1		1							
<b>CO2</b>	3	2	1	1								
<b>CO3</b>	3	2	1	1								
<b>CO4</b>	3	2	1	1	1							
<b>CO5</b>	3	2	1	1	1							
<b>CO6</b>	3	2	1	2								

**INTRODUCTION**

Manual drawing tools (Mini Drafter, Set Squares, Protractor, Compass, and different grades of pencil). 'BIS' specifications and rules of Engineering Drawing – Arrows (2H thin line body, HB Filled head and L:W = 3:1 ratio), lettering (Digital fonts, font sizes pertaining to usage and representation), types of line and their syntax (Drawing based – Continuous thin & thick, dashed, dashed dotted and Application based – extension, dimensioning, construction, projection, reference, axis, section, hatching, and break lines), scaling (up, down and equal), and dimensioning. Placing and positioning the 'A3' size drawing sheet over the drawing table. Principal planes and projection, Division of line and circle in to equal parts, and construction of polygons

**UNIT 1: ENGINEERING CURVES, PROJECTION OF POINTS AND LINES**

Construction of conic curves with their tangent and normal – ellipse, parabola, and hyperbola by eccentricity method

Construction of special curves with their tangent and normal – cycloid, epicycloid, and involute  
Projection of points and I angle projection of lines inclined to both principal planes by rotating line method and trapezoidal rule – marking their traces.

**Lab exercises:** Study exercise – Introduction to Sketching (or) Drawing, and modification tools in CAD software (AutoCAD, CREO, CATIA, Solid Works, Inventor, Fusion 360)

**(6+12 = 18 Hours)**

**Activities based learning:** Identification of the curves used in the application given in the flash card, demonstration of the instantaneous centre of rotation of governors with respect to angle of inclination of the arms of the governors

**UNIT 2: PROJECTION OF SURFACES & SOLIDS, AND 2D MODELING**

Projection of surfaces inclined to both the principal planes – polygonal, trapezoidal, rhomboidal and circular

Projection of solids – prisms, pyramids, and axisymmetric solids when the axis inclined to both the principal planes – freely hanging – contour resting condition on either of the planes by rotating object method

**Lab exercises:** Construction of basic sketches – lines, circle, polygon, spline curves, coils, along with dimensioning. Familiarizing with geometric constraints and their types

**(6+12 = 18 Hours)**

**Activities based learning:** Making the solids using cardboards, shadow mapping and contour drawing at different orientation of the solids using torches

**UNIT 3: 3D PROJECTION OF SOLIDS AND 3D MODELING OF SIMPLE PARTS**

Free hand sketching – I & III angle projections of engineering parts and components

Isometric projection of combination of solids – prisms, pyramids, axisymmetric solids, frustum

Perspective projection of prisms, pyramids and axisymmetric solids by visual ray method

**Lab exercises:** 3D Modeling and 2D drafting of machine parts

**(6+12 = 18 Hours)**

**Activities based learning:** Flipped classroom for Free hand sketching, Jig saw activity for Isometric projection, arts and crafts for perspective view

**UNIT 4: SECTION OF SOLIDS AND SECTIONED DRAFTING OF ASSEMBLED COMPONENTS**

Section of simple and hollow solids – prisms, pyramids and axisymmetric solids, solids with holes/ slots when the section plane perpendicular to one principal plane and inclined to other principal plane ('On the axis' and 'from the axis' conditions)

Application based – section of beams (I, T, L, and C), section of pipe bracket, wood joints, composite walls, shells, flange of a coupling and other similar applications

**Lab exercises:** Assembly of parts with respect to engineering constraints, and sectioned drafting of assembled components

**(6+12 = 18 Hours)**

**Activities based learning:** Making of mitered joint in wood, sectioning the beams in different angles of orientation and identifying the true shape

### **UNIT 5: LATERAL SURFACE DEVELOPMENT AND SHEET METAL DESIGN**

Lateral surface development of sectioned solids when the section plane perpendicular to VP and inclined to HP.

Application based – construction of funnel, chimney, dish antenna, door latch, trays, AC vents, lamp shade, commercial packaging boxes with respect to sectioning conditions and other similar applications

**Lab exercises:** Sheet metal design and drafting, drafting of coils, springs and screw threads

**(6+12 = 18 Hours)**

**Activities based learning:** Fabrication of funnels, chimney, lamp shade, boxes using card boards, ply woods, acrylics

**Total: 90 Hours**

**Note:** Activities based learning should not be covered in the regular class hours. It should be given as assignments to the group of maximum 3 members

### **COURSE OBJECTIVES**

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

1. Understand and use the engineering curves in engineering applications and projection techniques to construct conic curves, points and lines.
2. Develop skills in projecting surfaces and solids and create 2D models using CAD software.
3. Develop skills in 3D projection and 3D modeling of simple parts manually as well as using CAD software.
4. Understand and apply sectioning techniques to solids and assemble components.
5. Develop skills in lateral surface development and sheet metal design.

### **COURSE OUTCOMES**

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

**CO1:** Construct and identify different types of conic curves and special curves, and project the points and lines pertaining to engineering applications

**CO2:** Project and visualize surfaces and solids in different orientations and utilize the CAD tools for designing.

**CO3:** Create and draft accurate 3D models and 2D drawings of machine parts manually as well as using CAD software

**CO4:** Determine the true shape of a sectioned solid and draft the assembled parts accordingly

**CO5:** Develop lateral surfaces of sectioned solids and design sheet metal components

### **TEXT BOOK**

1. "Engineering Drawing" by N S Parthasarathy and Vela Murali, Oxford University Press; UK ed. Edition, 2015.
2. "Engineering Drawing + Auto CAD" by Venugopal K, V. Prabhu Raja, New Age International Publishers, Sixth edition (1 January 2022).

### **REFERENCES**

1. "Basic Engineering Drawing: Mechanical Semester Pattern" by Mehta and Gupta, Charotar Publishing House, 2<sup>nd</sup> edition, 2018.
2. "Engineering Drawing" by Basant Agrawal and C M Agrawal, Vikas Publishing House, 3<sup>rd</sup> edition, 2020.
3. "Engineering Drawing With Auto CAD" by B V R Gupta, McGraw Hill Education, 4<sup>th</sup> edition, 2019.
4. "Engineering Drawing" by P S Gill, Tata McGraw Hill Education, 5<sup>th</sup> edition, 2018.
5. "Engineering Drawing with an Introduction to AutoCAD" by Dhananjay Jolhe, Cengage Learning,

2<sup>nd</sup> edition, 2020.

6. "Engineering Drawing" by M B Shah, Charotar Publishing House, 3<sup>rd</sup> edition, 2019
7. "Fundamentals of Engineering Drawing" by Imtiaz Hashmi, Pearson Education, 2<sup>nd</sup> edition, 2018.
8. "Computer Aided Engineering Drawing" by S Trymbaka Murthy, Scitech Publications, 3<sup>rd</sup> edition, 2020.
9. "CAED: Computer Aided Engineering Drawing for I/II Semester BE/Btech Courses" by Reddy K B, CBS Publishers & Distributors, 2<sup>nd</sup>, 2019.
10. "Computer-Aided Engineering Drawing" by Subrata Pal, Oxford University Press, 2<sup>nd</sup>, 2020.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	2		1				3	1		3	3	3	2
2	3	3	2		2				3	2		3	3	3	2
3	3	3	3	1	2				3	3		3	3	3	2
4	3	3	3	1	3				3	3		3	3	3	2
5	3	3	3	1	3				3	3		3	3	3	2

**COURSE OBJECTIVES:**

1. To practice the usage of various tools towards assembly and dis-assembly of different items / equipment.
2. To make simple part / component using welding processes.
3. To train on the basic wiring practices of boards, machines, etc.
4. To provide a hands-on experience on the use of electronic components, equipment, sensors and actuators.
5. To expose to modern computer tools and advanced manufacturing / fabrication processes.

**LIST OF ACTIVITIES****1L,4P****(A). Dis-assembly & Assembly Practices**

- i. Tools and its handling techniques.
- ii. Dis-assembly and assembly of home appliances – Grinder Mixer Grinder, Ceiling Fan, Table Fan & Washing Machine.
- iii. Dis-assembly and assembly of Air-Conditioners & Refrigerators.
- iv. Dis-assembly and assembly of a Bicycle.

**(B). Welding Practices**

- i. Welding Procedure, Selection & Safety Measures.
- ii. Power source of Arc Welding – Gas Metal Arc Welding & Gas Tungsten Arc Welding processes.
- iii. Hands-on session of preparing base material & Joint groove for welding.
- iv. Hands-on session of MAW, GMAW, GTAW, on Carbon Steel & Stainless Steel plates / pipes, for fabrication of a simple part.

**(C). Electrical Wiring Practices**

- i. Electrical Installation tools, equipment & safety measures.
- ii. Hands-on session of basic electrical connections for Fuses, Miniature Circuit Breakers and Distribution Box,
- iii. Hands-on session of electrical connections for Lightings, Fans, Calling Bells.
- iv. Hands-on session of electrical connections for Motors & Uninterruptible Power Supply.

**(D). Electronics Components / Equipment Practices**

- i. Electronic components, equipment & safety measures.
- ii. Dis-assembly and assembly of Computers.
- iii. Hands-on session of Soldering Practices in a Printed Circuit Breaker.
- iv. Hands-on session of Bridge Rectifier, Op-Amp and Transimpedance amplifier.
- v. Hands-on session of integration of sensors and actuators with a Microcontroller.
- vi. Demonstration of Programmable Logic Control Circuit.

**(E).Contemporary Systems**

- i. Demonstration of Solid Modelling of components.
- ii. Demonstration of Assembly Modelling of components.
- iii. Fabrication of simple components / parts using 3D Printers.
- iv. Demonstration of cutting of wood / metal in different complex shapes using Laser Cutting Machine.

**TOTAL: 75 Periods (15 Lecture + 60 Practical)**

**COURSE OUTCOMES:**

Upon the successful completion of the course, students will be able to:

- CO1: Assemble and dis-assemble various items / equipment.
- CO2: Make simple parts using suitable welding processes.
- CO3: Setup wiring of distribution boards, machines, etc.
- CO4: Utilise the electronic components to fabricate a simple equipment, aided with sensors and actuators.
- CO5: Take advantage of modern manufacturing practices.

**REFERENCES:**

1. Stephen Christena, Learn to Weld: Beginning MIG Welding and Metal Fabrication Basics, Crestline Books, 2014.
2. H. Lipson, Fabricated - The New World of 3D Printing, Wiley, 1<sup>st</sup> edition, 2013.
3. Code of Practice for Electrical Wiring Installations (IS 732:2019)
4. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Oxford University Press, 7th ed. (Indian edition), 2017.
5. Mazidi, Naimi, Naimi, AVR Microcontroller and Embedded Systems: Using Assembly and C, Pearson India, 1<sup>st</sup> edition 2013.
6. Visualization, Modeling, and Graphics for Engineering Design, D.K. Lieu, S.A. Sorby, Cengage Learning; 2nd edition.

**COURSE OBJECTIVE**

- The students will be imparted the knowledge on Boiler feed water requirements, water treatment techniques, Applications of oil and its properties, principles of different chemical analysis and students also be provided with the knowledge on important dyes and their applications, they will be taught to prepare bleaching powder, sodium hypochlorite and hydrogen peroxide for the bleaching of fabrics in industries.

**UNIT I WATER TECHNOLOGY 9**

Water quality parameters- hardness -definition - units of hardness - determination of hardness (EDTA method).Alkalinity - definition - determination of alkalinity. TDS, BOD, COD and iron and their significance. Softening – zeolite and demineralization processes. Boiler troubles (scale, sludge, boiler corrosion, caustic embrittlement and carry over) and remedies – removal of oils and silica, internal conditioning.Desalination by electro-dialysis and reverse osmosis.

**UNIT II OILS, FATS, SOAPS & LUBRICANTS 9**

Chemical constitution, chemical analysis of oils and fats – free acid, saponification and iodine values, definitions, determinations and significance.Soaps and detergents – cleaning action of soap. Lubricants - definition, characteristics, types and properties – viscosity,viscosity index, carbon residue, oxidation stability, flash and fire points, cloud and pour points, aniline point. Solid lubricants – graphite and molybdenum disulphide.

**UNIT III CHEMICAL ANALYSIS – AN ANALYTICAL INSIGHT 9**

Gravimetric analysis – principles – method – applications. redox titrations – principle – method – applications. Thin layer chromatography – principles – techniques – applications. Principles underlying the estimations of nitrogen in nitrogenous fertilizers, phenol and aniline.

**UNIT IV DYE CHEMISTRY 9**

Witt's theory and modern theory of colors – synthesis of methyl red, methyl orange, congo red, malachite green, p-rosaniline, phenolphthalein, fluorescence, eosin dyes.

**UNIT V CHEMICALS AND AUXILIARIES 9**

Preparations of bleaching powder, sodium hypochlorite, hydrogen peroxide, chlorine dioxide – estimation of available chlorine in hypochlorite – determination of strength of hydrogen peroxide.

**TOTAL: 45 PERIODS****COURSE OUTCOME**

After completion of this course, the student is expected to

- CO1. Analyze the boiler feed water and assess the method of purification techniques.
- CO2 Classify oil, fat and soap and its properties and gain the knowledge about lubricants
- CO3. Understand the principles of different chemical analysis and to estimate the amount of nitrogen and aniline
- CO4. Classify the dyes and to prepare various dyes used in textile industries.
- CO5. Explain and prepare the chemical auxiliaries required for dyeing



### **TEXT BOOKS**

1. Jain & Jain, "Engineering Chemistry", 16th Edition, 2014, Dhanpat Rai Publishing Company, New Delhi.
2. Sharma B.K, "Industrial Chemistry", 16th Edition, 2014, GOEL Publishing House, n Meerut.

### **REFERENCE BOOKS**

1. Dara SS, Umare SS, "A Textbook of Engineering Chemistry", S. Chand & Company Ltd., New Delhi, 2010.
2. Puri BR, Sharma LR, Pathania S, "Principles of Physical Chemistry", 42nd Edition, 2008, Vishal Publishing Co., Jalandhar.
3. Morrison RT, Boyd RN, Bhattacharjee SK, "Organic Chemistry", 7th Edition, Pearson India, 2011.

**அலகு I நெசவு மற்றும் பானைத் தொழில்நுட்பம்: 3**

சங்க காலத்தில் நெசவுத் தொழில் – பானைத் தொழில்நுட்பம் – கருப்பு சிவப்பு பாண்டங்கள் – பாண்டங்களில் கீறல் குறியீடுகள்.

**அலகு II வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்: 3**

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு- சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் – மாமல்லபுரச் சிற்பங்களும், கோவில்களும் – சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் – நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் – செட்டிநாட்டு வீடுகள் – பிரிட்டிஷ் காலத்தில் சென்னையில் இந்நோ-சாரோசெனிக் கட்டிடக் கலை.

**அலகு III உற்பத்தித் தொழில் நுட்பம்: 3**

கப்பல் கட்டும் கலை – உலோகவியல் – இரும்புத் தொழிற்சாலை – இரும்பை உருக்குதல், எஃகு – வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல்மணிகள், கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் – எலும்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

**அலகு IV வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்: 3**

அணை, ஏரி, குளங்கள், மதகு – சோழர்காலக் குழுவித் தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் முத்துக்குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகம்.

**அலகு V அறிவியல் தமிழ் மற்றும் கணித்தமிழ்: 3**

அறிவியல் தமிழின் வளர்ச்சி – கணித்தமிழ் வளர்ச்சி – தமிழ் நூல்களை மின்பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் – தமிழ் மின் நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.

**TOTAL : 15 PERIODS****TEXT-CUM-REFERENCE BOOKS**

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல்

துறை வெளியீடு)

4. பொருறை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils – The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi – ‘Sangam City Civilization on the banks of river Vaigai’ (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

**UC23H02**

**TAMILS AND TECHNOLOGY**

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**1 0 0 1**

**UNIT I WEAVING AND CERAMIC TECHNOLOGY 3**

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

**UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY 3**

Designing and Structural construction House & Designs in household materials during Sangam Age -Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period -Type study (Madurai Meenakshi Temple)- Thirumalai NayakarMahal -ChettiNadu Houses, Indo-Saracenic architecture at Madras during British Period.

**UNIT III MANUFACTURING TECHNOLOGY 3**

Art of Ship Building - Metallurgical studies -Iron industry - Iron smelting, steel -Copper and gold-Coins as source of history - Minting of Coins – Beads making-industries Stonebeads -Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.

**UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY 3**

Dam, Tank, ponds, Sluice, Significance of KumizhiThoompuof Chola Period,Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing -KnowledgeofSea -Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean -KnowledgeSpecificSociety.

**UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING****3**

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

**TOTAL : 15 PERIODS****TEXT-CUM-REFERENCEBOOKS**

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருறை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils – The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi – ‘Sangam City Civilization on the banks of river Vaigai’ (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

**OBJECTIVES:**

- To understand the basics of random variables with emphasis on the standard discrete and continuous distributions.
- To understand the basic probability concepts with respect to two dimensional random variables along with the relationship between the random variables and the significance of the Central Limit theorem.
- To understand the basic concepts of sampling distributions and statistical properties of point and interval estimators.
- To apply the small/ large sample tests through Tests of hypothesis.
- To understand the concept of analysis of variance and use it to investigate factorial dependence.

**UNIT I ONE-DIMENSIONAL RANDOM VARIABLES 9+3**

Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Functions of a random variable.

**UNIT II TWO-DIMENSIONAL RANDOM VARIABLES 9+3**

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

**UNIT III ESTIMATION THEORY 9+3**

Sampling distributions – Characteristics of good estimators – Method of Moments – Maximum Likelihood Estimation – Interval estimates for mean, variance and proportions.

**UNIT IV TESTS OF SIGNIFICANCE 9+3**

Type I and Type II errors – Tests for single mean, proportion, Difference of means (large and small samples) – Tests for single variance and equality of variances –  $\chi^2$  test for goodness of fit – Independence of attributes.

**UNIT V DESIGN OF EXPERIMENTS 9+3**

Completely Randomized Design – Randomized Block Design – Latin Square Design –  $2^2$  factorial design.

**TOTAL: 60 PERIODS**

Laboratory based exercises / assignments / assessments will be given to students from the content of the course wherever applicable.

Branch specific / General Engineering applications based on the content of each units will be introduced to students wherever possible.

## SUGGESTED LAB EXERCISES

1. Data exploration using R
2. Visualizing Probability distributions graphically
3. Evaluation of correlation coefficient
4. Creating a Linear regression model in R
5. Maximum Likelihood Estimation in R
6. Hypothesis testing in R programming
7. Chi square goodness of fit test in R
8. Design and Analysis of experiments with R

## OUTCOMES:

- CO1: Can analyze the performance in terms of probabilities and distributions achieved by the determined solutions.
- CO2: Will be familiar with some of the commonly encountered two dimensional random variables and be equipped for a possible extension to multivariate analysis.
- CO3: Provides an estimate or a range of values for the population parameter from random samples of population.
- CO4: Helps to evaluate the strength of the claim/assumption on a sample data using hypothesis testing.
- CO5: Equips to study the influence of several input variables on the key output variable.

## TEXT BOOKS:

1. Irwin Miller and Marylees Miller, "John E. Freund's Mathematical Statistics with applications", Pearson India Education, Asia, 8<sup>th</sup> Edition, 2014.
2. Walpole, R.E., Myers R.H., Myres S.L., and Ye, K. "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 9<sup>th</sup> Edition, 2024.

## REFERENCES:

1. Richard A. Johnson, Irwin Miller, John Freund "Miller & Freund's Probability and Statistics for Engineers", Person Education, 8<sup>th</sup> Edition, 2015.
2. Ross, S.M. "Introduction to Probability and Statistics for Engineers and Scientists", Elsevier, New Delhi, 5<sup>th</sup> Edition, 2014.
3. Spiegel, M.R., Schiller, J., Srinivasan, R.A. and Goswami, D. "Schaum's Outline of Theory and Problems for Probability and Statistics", McGraw Hill Education, 3<sup>rd</sup> Edition, Reprint, 2017.
4. Devore, J.L. "Probability and Statistics for Engineering and the Sciences", Cengage Learning, 9<sup>th</sup> Edition, 2016.

## CO – PO Mapping:

COURSE OUTCOMES	PROGRAMME OUTCOMES											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1 :	3	3	2	3	1	2	1	1	1	1	1	3
CO2 :	3	3	2	3	1	2	1	1	1	1	1	3
CO3 :	3	3	2	3	1	2	1	1	1	1	1	3
CO4 :	3	3	2	3	1	2	1	1	1	1	1	3
CO5 :	3	3	2	3	1	2	1	1	1	1	1	3

**OBJECTIVES :**

1. To explain principles of economics relevant to managing an organization, to describe principles of economics to have the understanding of economic environment of business.
2. To study the Evolution, Functions and Principles of Management.

**UNIT I : BASIC CONCEPTS OF ECONOMICS AND MARKET 9**

Definition, scope of economics; fundamental concepts; demand, supply, equilibrium; theory of production, cost; forms of market; concepts of revenue; pricing in perfect and imperfect competition.

**UNIT II : NATIONAL INCOME AND MONEY 9**

National income - concept, measurement, economic welfare; concept of consumption, saving and investment; economic growth - measurement, fluctuation, control; Money-theory, exchange - Demand and supply of money.

**UNIT III : INFLATION AND GOVERNMENT POLICY 9**

Inflation - causes, effect, control; Inflation VS Unemployment, Philips curve; Government policies, Fiscal and Monitoring Policy, planning - economic growth and public welfare.

**UNIT IV : MANAGEMENT PRINCIPLES AND ORGANIZATIONS 9**

Definition of Management - Science or Art - Manager vs. Entrepreneur - Types of Managers - Managerial Roles and Skills - Evolution of Management - Scientific, Approaches of Management - Types of Business Organization - Sole Proprietorship, Partnership, Company - Public and Private Sector Enterprises - Organization Culture and Environment.

**UNIT V : FUNCTIONS OF MANAGEMENT 9**

Planning - Nature and Purpose- Objectives - Strategies - Policies and Planning Premises - Decision Making - Organizing - Nature and Process - Premises - Departmentalization - Line and Staff - Decentralization - Organizational culture, Staffing - Selection and training - Placement - Performance appraisal - Career Strategy - Leadership - Communication, Controlling - Process of Controlling - Controlling techniques, productivity and operations management - Preventive control, Industrial Safety.

**TOTAL : 45 PERIODS****OUTCOMES :**

Upon completion of the course, Students are expected to become familiar with

CO1: Principles of economics and market

CO2: Concepts of consumption and national income

CO3: Government policy and economic growth

CO4: Management principles and business organisation

CO5: Performing managerial functions like planning, organizing, staffing, leading & controlling

**REFERENCES :**

1. Stephen P. Robbins & Mary Coulter, "Management", Prentice Hall of India, 10th Edition, 2009.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", Pearson Education, 6th Edition 2004.

3. Stephen A. Robbins, David A. Decenzo and Mary Coulter, "Fundamentals of Management" Pearson Education, 7<sup>th</sup> Edition, 2011.
4. Pau. A. Samuelson, William D., Nordhaus, Sudip Chaudhuri and Anindya Sen, Economics, 19<sup>th</sup> edition, Tata McGraw Hill, New Delhi, 2010.
5. Richard Lipsey & Alec Charystal, Economics, 12<sup>th</sup> ed., Oxford University Press, New Delhi, 2011.
6. Kari E. Case and Ray C.Fair, "Principles of Economics", 6<sup>th</sup> edition, Pearson, Education Asia, ND, 2002.

Course Outcomes	Program Outcome												Program Specific Outcome		
	PO 1	PO2	PO3	PO4	PO5	PO 6	PO7	PO 8	PO 9	PO10	PO11	PO1 2	PSO 1	PSO 2	PSO 3
<b>1</b>	2	2	2	2	1	1	1	1	-	-	1	1	3	3	2
<b>2</b>	2	2	2	2	1	1	1	1	-	-	1	1	3	3	2
<b>3</b>	2	2	2	2	1	1	1	1	-	-	1	1	3	3	2
<b>4</b>	2	2	2	2	1	1	1	1	-	-	1	1	3	3	2
<b>5</b>	2	2	2	2	1	1	1	1	-	-	1	1	3	3	2
<b>Overall CO</b>	2	2	2	2	1	1	1	1	-	-	1	1	3	3	2





## REFERENCES

1. Mukhopadhyay S. K., "Advances in Fibre Science", The Textile Institute,1992, ISBN:1870812379
2. Meredith R. , "Mechanical Properties of Textile Fibres", North Holland, Amsterdam,1986, ISBN:1114790699,ISBN-13:9781114790698
3. RaheelM.(ed.),"Modern Textile Characterization Methods", Marcel Dekker, 1995, ISBN:0824794737
4. Mukhopadhyay.S.K.,"TheStructureandPropertiesofTypicalMeltSpunFibres",TextileProgress,Vol.18,No.4,TextileInstitute,1989,ISBN:1870812115
5. Hearle J. W. S., and Peters. R. H., "Fibre structure", Elsevier Ltd, 1963, ISBN:1483212211|ISBN-13:9781483212210

Course Outcomes	Program Outcome												Program Specific Outcome		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	3	1	0	1	1	1	2	1	2	1	3	3	2	2	3
2	2	3	2	2	2	1	2	1	2	1	2	2	2	1	3
3	2	3	3	3	2	2	2	2	2	1	2	2	2	2	3
4	2	2	3	3	3	2	2	1	2	1	2	2	2	1	2
5	2	3	3	3	3	1	1	1	1	1	2	2	1	1	3
<b>Overall CO</b>	2.3	2.4	2.2	2.4	2.2	1.4	1.8	1.2	1.8	1	2.2	2.2	1.8	1.4	2.8



**Practicals:**

1. Study of rapier loom
2. Study of air jet loom

**TOTAL: 45 PERIODS +15 PERIODS****OUTCOMES:**

On completion of this course, the students shall be able to

CO1: analyze and describe the various process and machines required for converting fibre to yarn, calculate the count of fibre strand

CO2: explain the formation of yarn in different spinning system and analyze the structure and faults of yarn

CO3: prepare yarn for weaving and describe the working of weaving preparatory machines

CO4: demonstrate the functioning of weaving and explain the different types of motions involved in production of fabric in conventional weaving machine

CO5: explain the different types of motions involved in production of fabric in modern weaving machines and analyze the fabric defects

**TEXT BOOKS**

1. Klein W., "The Technology of Short-staple Spinning", The Textile Institute, Manchester, 1998.
2. Oxtoby E., "Spun Yarn Technology", Butterworth, London, 1987, ISBN: 0408014644/ISBN-13: 9780408014649.
3. Talukdar M.K., Sriramulu P.K. and Ajgaonkar D.B., "Weaving: Machines, Mechanisms, Management", Mahajan Publishers, Ahmedabad, 1998, ISBN: 81-85401-16-0
4. Marks R. and Robinson T.C., "Principles of Weaving", The Textile Institute, Manchester, 1989, ISBN: 0 900739 258

**REFERENCES**

1. Lord P. R., "Yarn Production: Science, Technology and Economics", The Textile Institute, Manchester, 2003, ISBN: 1855736969 | ISBN-13: 9781855736962
2. PR. Lord and Mohammed, "Weaving: Conversion of yarn to fabric", M.H.Merrine Publishing Co. Ltd., VK, 1998.

Course Outcomes	Program Outcome												Program Specific Outcome		
	PO 1	PO2	PO3	PO4	PO 5	PO 6	PO7	PO8	PO 9	PO10	PO11	PO12	PSO1	PSO 2	PSO3
1	2	2	2	2	1	1	1	1	-	-	1	1	3	3	2
2	2	2	2	2	1	1	1	1	-	-	1	1	3	3	2
3	2	2	2	2	1	1	1	1	-	-	1	1	3	3	2
4	2	2	2	2	1	1	1	1	-	-	1	1	3	3	2
5	2	2	2	2	1	1	1	1	-	-	1	1	3	3	2
Overall CO	2	2	2	2	1	1	1	1	-	-	1	1	3	3	2

**OBJECTIVES:**

To enable the students to learn about different structures of woven fabric and design the structure for different applications

**UNIT I ELEMENTARY WEAVES****9+10**

Introduction — methods of representing weave in point paper, construction of design, draft and lifting plan, types of draft, heald calculation, order of denting; elementary weaves – plain, twill, satin, sateen and their derivatives – loom requirements

**Practicals**

- 1) Identification of commercially available woven fabrics
- 2) Plain and its derivatives
- 3) Twill and its derivatives
- 4) Satin (regular and irregular)
- 5) Sateen (regular and irregular)

**UNIT II SPECIAL WEAVES I****9+10**

Ordinary and brighten honey comb; huck-a-back and its modifications; mock-Leno; crepe weaves; colour and weave effects; Bedford cords - plain and twill faced, wadded; welts and piques, wadded piques; loom requirements

**Practicals**

1. Honeycomb (ordinary and brighton)
2. Huck-a-back
3. Crepe
4. Mock-leno
5. Bedford cord

**UNIT III SPECIAL WEAVES II****9+4**

Backed fabrics-warp and weft, reversible and non-reversible fabrics; extra warp and extra weft figuring - single and double colour — loom requirements

**Practicals**

1. Extra warp and extra weft figuring
2. Backed fabrics

**UNIT IV PILE FABRICS AND VELVETEENS****9+2**

Pile fabrics; warp pile - wire pile, terry pile, loose backed; weft pile – plain back and twill back velveteen, lashed pile, corduroy, and weft plush – loom requirements

**Practicals**

- 1) Pile fabrics (warp and weft)

**UNIT V SPECIAL FABRICS****9+4**

Double cloth, types of stitches; Damasks; Gauze and Leno principles – loom requirements; trade name of popular structures

### Practicals

- 1) Gauze and Leno
- 2) Double cloth
- 3) Tapestry

**TOTAL: 45 PERIODS + 30 PERIODS**

### OUTCOMES:

Upon the completion of this course the student will be able to construct design, draft and peg plan and loom requirements for producing fabrics with

CO1: Plain, twill, satin and derivatives structures

CO2: Honey comb, crepe structures

CO3: Bedford cords, piques, backed fabrics, extra warp/weft figuring fabrics

CO4: Warp and weft pile structures

CO5: Double, damask, gauze and leno structures

### TEXT BOOKS

1. Grosicki Z. J., "Watson's Textile Design and Colour", Vol.1, Wood head Publications, Cambridge England, 2004, ISBN: 1 85573 7701 24.
2. Grosicki Z. J., "Watson's Advanced Textile Design and Colour", Vol. II, Butterworths, London, 1989, ISBN-9781855739963

### REFERENCES

1. Wilson J., "Handbook of Textile Design", Textile Institute, Manchester, 2001, ISBN: 185573 5733.
2. Horne C.E., "Geometric Symmetry in Patterns and Tilings", Textile Institute, Manchester, 2000, ISBN: 1 85573 4923.
3. Seyam A. M., "Structural Design of Woven Fabrics, Theory and Practice", Textile Institute, Manchester, 2002, ISBN: 1 87037 2395.
4. GeornerD., "Woven Structure and Design, part 1: Single Cloth Construction", WIRA,U.K., 1986, ISBN: 0900820179 | ISBN-13: 9780900820175
5. GeornerD., "Woven Structure and Design, Part 2: Compound Structures", WIRA, U.K., 1989, ISBN: 090366951X | ISBN-13: 9780903669511
6. Jan Shenton., "Woven Textile Design", Laurence King Publishing, 2014, ISBN: 178067337X | ISBN-13: 9781780673370.

Course Outcomes	Program Outcome												Program Specific Outcome		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	3	3	3	3	2	1	2	2	1	1	2	2	3	3	3
2	3	3	3	3	2	1	2	2	1	1	2	2	3	3	3
3	3	3	3	3	2	1	2	2	1	1	2	2	3	3	3
4	3	3	3	3	2	1	2	2	1	1	2	2	3	3	3
5	3	3	3	3	2	1	2	2	1	1	2	2	3	3	3
Overall CO	3	3	3	3	2	1	2	2	1	1	2	2	3	3	3

**OBJECTIVES:**

- To introduce briefly the basic concepts of fashion and design to the students.
- To acquaint the student with the history and evolution of fashion, its elements, traditional costumes of various cultures of the world

**UNIT I FASHION DESIGN 6 + 3**

Fashion – definition; terminologies – high end fashion, ready to wear, boutique, street fashion, recurring fashion, mass fashion, style, chic, classic, fad, trend, motif -forms, bases, arrangement and principles, silhouettes, fashion cycle; fashion adoption theories – trickle down, trickle up and trickle across; fabric design – traditional, geometrical, abstract, naturalistic and folk; garment design – classification, structural, decorative and functional.

**Practicals:**

1. Illustration of different types of fabric designs using lines, strokes, gradation and perspective shading techniques

**UNIT II ELEMENTS AND PRINCIPLES OF DESIGN 6 + 9**

Elements of design –definition, perception and visual effects - line, shape, form, size, texture and pattern, colour – dimensions, physical and psychological effects; principles of design – Harmony, balance, rhythm, emphasis and proportion; introducing elements and principles of design in apparels.

**Practicals:**

1. Illustration and rendering of flat sketches of women's garment applying elements and principles of design
2. Illustration and rendering of flat sketches of men's garment applying elements and principles of design
3. Illustration and rendering of flat sketches of kid's garment applying elements and principles of design

**UNIT III HISTORY AND EVOLUTION OF WORLD COSTUMES 6 + 3**

History and evolution of motifs, designs, colour and costumes of Egypt, Greece, Rome, English, America, France, Africa, Thailand, Myanmar, China, Japan, Srilanka, Pakistan

**Practicals:**

1. Illustration and rendering of different styles of World costumes on flesh figure

**UNIT IV HISTORY AND EVOLUTION OF INDIAN COSTUMES 6 +12**

History and evolution of motifs, designs, colour and costumes of India – ancient garments during the Mauryan and Guptha period; traditional Indian costumes – northern, eastern, western and southern part of India

**Practicals:**

1. Illustration and rendering of different styles of costumes of Northern part of India
2. Illustration and rendering of different styles of costumes of Southern part of India
3. Illustration and rendering of different styles of costumes of Eastern part of India
4. Illustration and rendering of different styles of costumes of Western part of India

## **UNIT V TRADITIONAL TEXTILES OF INDIA**

**6 + 3**

Motifs, colour combinations and designs of Hand-woven textiles -Banaras brocades, Jamdani saris, Paithani saris, Kanchipuram saris, Chanderi saris; printed textiles - Bagru prints from Rajasthan, Kalamkari from Andhra Pradesh; embroidered textiles -Kashida, Phulkari, Chamba, Rumal, Chikankari, phoolpak, zardozi, kasuti, kantha, pipliaplique; resist dyed textiles - Bandhani, Bandhej & Lehariya of Rajasthan, Ikat and Patola of Gujarat.

### **Practicals:**

1. Study on drapes and practice on rendering of traditional saris

**TOTAL: 30 PERIODS +30 PERIODS**

### **OUTCOMES:**

Upon the completion of this course, the students can able to

- CO1 Understand the fashion terminologies and development of textile & garment designs
- CO2 Apply the elements & principles of design in Textiles and Apparels
- CO3 Understand the History and evolution of costumes of different parts of the World and apply it on to the garments for the current trend
- CO4 Understand the History and evolution of costumes of different parts of India and apply it on to the garments for the current trend
- CO5 Understand the motifs, colour and design used in the traditional Indian textiles, embroideries and printing and apply it on to the textiles for the current trend

### **TEXT BOOKS:**

1. John Hopkins , "Fashion Design: The Complete Guide", Fairchild Books, USA, 2012.
2. Vandana Bhenderi, "Costume, Textiles and Jewellery of India – Traditions in Rajasthan", 78 Prakash Books, New Delhi, 2004.
3. Fillow J and Bernard N Thomas and Hudson, "Traditional Indian Textiles", Prentice Hall, India, 1993.
4. Alkazi, Roshen. Ancient Indian Costume. [New Delhi]: Art Heritage, 1983.

### **REFERENCES:**

1. Hart A North S V and A Museum, "Historical Fashion in detail the 17th and 18th Centuries", McMillan, India, 1998.
2. Kathy Alert, "Traditional folk costumes of Europe paper dolls in full color", Dover publications, Inc., Newyork, 1984.
3. Diane T. and Cassidy T., "Colour forecasting", Blackwell Publishing, 2005, ISBN: 1405121203 / ISBN: 978-1405121200.
4. Elaine Stone and Jean A. Samples, "Fashion Merchandising", McGraw-Hill Book Company, 1985, ISBN: 0070617422.
5. Marian L. Davis, "Visual Design and Dress", Prentice Hall, New Jersey, 1996, ISBN: 0131121294 / ISBN: 978-0131121294.
6. Naik, S. D., Traditional embroideries of India. 1996, APH Publishing



### COURSE ARTICULATION MATRIX

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
<b>CO1</b>	2	2	3	-	-	2	2	2	-	-	-	2	3	3	2
<b>CO2</b>	2	2	3	-	-	2	2	2	-	-	-	2	3	3	2
<b>CO3</b>	2	2	3	-	-	2	2	2	-	-	-	2	3	3	2
<b>CO4</b>	2	2	3	-	-	2	2	2	-	-	-	2	3	3	2
<b>CO5</b>	2	2	3	-	-	2	2	2	-	-	-	2	3	3	2
<b>Overall</b>	2	2	3	-	-	2	2	2	-	-	-	2	3	3	2

**OBJECTIVES:**

To practically train the students in sewing using SNLS machine

**LIST OF EXPERIMENTS:**

1. Identification of single needle lockstitch machine (SNLS) components and understanding their functions.
2. Needle fixing and threading in single needle, double needle, over-lock, flat lock and feed-of the-arm machine.
3. Practice for pedal and knee lifter operations and winding the bobbin thread.
4. Study on Needle bar working, hook /looper mechanism, feeding mechanism, threading and tensioning for the following machines
  - i. SNLS machine
  - ii. Chain stitch machine
  - iii. Overlock machine
  - iv. Flatlock machine
  - v. Feed off arm machine
5. Sewing exercise on paper in SNLS
  - i. Exercise 1 - Parallel line
  - ii. Exercise 2 - Square
  - iii. Exercise 3 - Curves
  - iv. Exercise 4 - Concentric curves
6. Stitching exercise on fabric panels in SNLS
  - i. Exercise 1 - Parallel line
  - ii. Exercise 2 - Square
  - iii. Exercise 3 – Curves

**OUTCOMES**

Upon completion of this practical course, the student shall be able to

CO 1: Identify and understand the functions of machine components

CO 2: Execute the threading and settings of the sewing machine

CO 3: Prepare fabric panels with different sewing patterns

**TOTAL:60 PERIODS**

**Course Articulation Matrix**

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	3	3	-	-	2	-	2	-	-	3	2	3	2
CO2	2	2	3	3	-	-	2	-	2	-	-	3	2	3	2
CO3	2	2	3	3	-	-	2	-	2	-	-	3	2	3	2
Overall	2	2	3	3	-	-	2	-	2	-	-	3	2	3	2

**COURSE OBJECTIVE:**

The objective of the course is four-fold:

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

**Module I: Introduction****(3L,6P)**

Purpose and motivation for the course, recapitulation from Universal Human Values-I, Self-Exploration– Its content and process; ‘Natural acceptance’ and Experiential Validation- as the process for self-exploration Continuous Happiness and Prosperity- A look at basic Human Aspirations Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

**Practical Session:** *Include sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking*

**Module II: Harmony in the Human Being****(3L,6P)**

Understanding human being as a co-existence of the sentient ‘I’ and the material ‘Body’, Understanding the needs of Self (‘I’) and ‘Body’ - happiness and physical facility, Understanding the Body as an instrument of ‘I’ (I being the doer, seer and enjoyer), Understanding the characteristics and activities of ‘I’ and harmony in ‘I’, Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Health.

**Practical Session:** *Include sessions to discuss the role others have played in making material goods available to me. Identifying from one’s own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.*

**Module III: Harmony in the Family and Society****(3L,6P)**

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship, Understanding the meaning of Trust; Difference between intention and competence, Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society, Universal Order-

from family to world family.

**Practical Session:** Include sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

#### **Module IV: Harmony in the Nature and Existence (3L,6P)**

Understanding the harmony in the Nature, Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self regulation in nature, Understanding Existence as Co-existence of mutually interacting units in all- pervasive space, Holistic perception of harmony at all levels of existence.

**Practical Session:** Include sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

#### **Module V: Implications of Harmony on Professional Ethics (3L,6P)**

Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations, Sum up.

**Practical Session:** Include Exercises and Case Studies will be taken up in Sessions E.g. To discuss the conduct as an engineer or scientist etc.

**TOTAL: 45 (15 Lectures + 30 Practicals) PERIODS**

#### **COURSE OUTCOME:**

**By the end of the course, the students will be able to:**

1. Become more aware of themselves, and their surroundings (family, society, nature);
2. Have more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
3. Have better critical ability.
4. Become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
5. Apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

#### **REFERENCES:**

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 3<sup>rd</sup> revised edition, 2023.

2. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
3. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
4. The Story of Stuff (Book).
5. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
6. Small is Beautiful - E. F Schumacher.
7. Slow is Beautiful - Cecile Andrews.
8. Economy of Permanence - J C Kumarappa
9. Bharat Mein Angreji Raj - PanditSunderlal
10. Rediscovering India - by Dharampal
11. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
12. India Wins Freedom - Maulana Abdul Kalam Azad
13. Vivekananda - Romain Rolland (English)
14. Gandhi - Romain Rolland (English)

**Web URLs:**

1. Class preparations: <https://fdp-si.aicte-india.org/UHV-II%20Class%20Note.php>
2. Lecture presentations: [https://fdp-si.aicte-india.org/UHV-II\\_Lectures\\_PPTs.php](https://fdp-si.aicte-india.org/UHV-II_Lectures_PPTs.php)
3. Practice and Tutorial Sessions: <https://fdp-si.aicte-india.org/UHV-II%20Practice%20Sessions.php>

**Articulation Matrix:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>						1	1	1	3			3
<b>CO2</b>						1	1	1	3			3
<b>CO3</b>						3	3	2	3		1	3
<b>CO4</b>						3	3	2	3		1	3
<b>CO5</b>						3	3	3	3		2	3

**OBJECTIVES:**

To enable students

- To understand the various landmark of the body and measurement taking process.
- To understand the pattern making principles and draft the pattern for various components of the garments

**UNIT I BODY MEASUREMENTS****6+12**

Anthropometry measurements, Body measurements- measuring body dimensions, landmark terms 3D body scanning; standard measurement chart, designation and control dimensions; body appearance, its relation to clothing, illusions created by clothing; body ideals- eight head theory, body proportions, height and weight distribution

**Practicals:**

1. Measuring the Dress Form – male, female and child
2. Formulation of the size charts

**UNIT II PATTERN TERMINOLOGIES****6+18**

Block Pattern, working pattern & Commercial patterns allowances; functions of pattern making tools and pattern terminologies- grain line, balance line, style line, notches, jog seam, dart points, pleats, flares, gather and true bias; truing and blending in pattern

**Practicals:**

1. Drafting patterns of sleeve variations
2. Drafting patterns of collar and yoke variations
3. Drafting patterns of pocket and cuff variations

**UNIT III PATTERN MAKING PRINCIPLES****6+18**

Methods of patternmaking- drafting and draping; basic Men's and Women's bodice block- top and bottom; contouring pattern making principles, grading techniques

**Practicals:**

1. Drafting the basic blocks of male
2. Drafting the basic blocks of female
3. Grading of basic block

**UNIT IV DART MANIPULATION AND COMPONENT PATTERNS****6+24**

Dart manipulation, added fullness; dart variations- graduated and radiating darts, parallel, asymmetric and intersecting darts; terminologies, pattern drafting- collar, neck lines- binding and facing, yoke, pocket, sleeve, cuff and plackets

**Practicals:**

1. Single Dart manipulation using slash spread and pivotal techniques
2. Double Dart manipulation using slash spread and pivotal techniques
3. Drafting Graduated and radiating darts
4. Drafting Asymmetric dart variations

**UNIT V GARMENT PATTERNS****6+18**

Shirt and trousers for men, women and children; skirt foundations and its variation; salwar kameez and Indian blouse, bias styled dresses and dresses without waist lines; children wear- basic pattern set, dresses and jumpers

**Practicals:**

1. Drafting patterns of skirt
2. Drafting patterns of salwar kameez

**TOTAL: 30 PERIODS+90 PERIODS****OUTCOMES:**

On completion of the course students are expected to

- CO1. Discuss the significance of anthropometric and the clothing sizing systems
- CO2. Explain pattern terminologies and methods of taking body measurements
- CO3. Illustrate pattern construction techniques
- CO4. Practice pattern making principles and develop garment components
- CO5: Develop patterns for men, women and children wear

**TEXT BOOKS:**

1. Fan J., Yu W., and Hunter L., "Clothing Appearance and Fit: Science and Technology", Wood head Publishing Limited, 2004, ISBN: 1855737450 | ISBN-13: 9781855737457
2. Ashdown S., "Sizing in Clothing", Wood head Publishing Limited, 2007, ISBN: 1845690346 ISBN-13: 9781845690342

**REFERENCES:**

1. Helen Joseph Armstrong., "Patternmaking for Fashion Design", Pearson Education Pvt Ltd., 2005,ISBN: 067398026X | ISBN-13: 9780673980267
2. Winifred Aldrich., "Metric Pattern Cutting for Children's Wear and Baby Wear", Blackwell Publishing, 2009, ISBN: 140518292X | ISBN-13: 9781405182

**COURSE ARTICULATION MATRIX**

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	3	1	1	3	1	1	3	3	2	3	3	2	1
CO2	3	3	3	1	1	2	1	2	3	2	2	2	3	2	1
CO3	3	2	3	2	3	2	1	2	3	2	2	2	3	2	1
CO4	2	2	3	2	2	2	1	2	2	2	3	3	3	2	1
CO5	3	3	3	2	2	2	1	2	2	2	2	2	3	2	1
Overall	2.8	2.4	3	1.6	1.8	2.2	1	1.8	2.6	2.2	2.2	2.4	3	2	1

**COURSE OBJECTIVES**

- To impart knowledge on laying, cutting and sewing of garment
- To enable students to understand the construction of Men's, Women's and Children's wear

**UNIT I LAYING AND CUTTING 9+4**

Different fabric packages and unwinding methods, fabric spreading modes, marker planning, Requirements of cutting and safety procedures; bundling and numbering.

**Practicals:**

1. Fabric laying using pin table for understanding symmetry and matching

**UNIT II SEAMS AND STITCHES 9+12**

Seam types and classes, stitch types and classes – characteristics and applications; sewing threads- types, numbering system, ticket number calculation, sewing thread consumption, selection of sewing thread, common sewing defects – causes and remedies

**Practicals:**

1. Sewing practice of different stitch classes
2. Sewing practice of seam types – superimposed seam, lapped seam, bound seam and flat seam

**UNIT III GARMENT COMPONENTS AND ITS STYLINGS 9+32**

Selection and construction- fullness, yoke, neckline finishes, collars, pocket, placket, sleeves, hems and cuffs; Balance and symmetry in garments. Fastenings - Types of zippers, Buttonholes and buttons, Hooks, eyes, and snaps

**Practicals:**

1. Sewing of different types of neckline finishes
2. Sewing of different types of darts, pleats, tucks and gathers
3. Sewing of different types of plackets
4. Sewing of different types of pockets
5. Sewing of different types of sleeves
6. Sewing of different types of collars
7. Sewing of different types of yokes

**UNIT IV MEN'S WEAR 9**

Material flow, assembly of garments and machinery used for Men's wear – T-Shirt, shirt, trousers, denim pants, skirt and jackets.

**UNIT V WOMEN'S AND CHILDREN'S WEAR 9 +12**

Material flow, assembly of garments and machinery used for women's wear – ladies blouses, shirts, pants, trousers, and jeans, casual wear, party wear; children's wear – jump suits, rompers, frocks and dungaree

**Practicals:**

1. Sewing of button hole and button attachments
2. Construction of zipper placket
3. Attachment of trims with fabric with different presser foot.



**TOTAL: 45 PERIODS +60 PERIODS**

**COURSE OUTCOMES**

Upon completion of this course, the student would be able to

- CO1 Comprehend the laying and cutting process for garment construction
- CO2 Analyse the characteristics and applications of seams and stitches used for construction
- CO3 Identify the factors influencing the selection and construction of different garment components
- CO4 Illustrate the construction of Men’s wear
- CO5 Illustrate the construction of Women’s and children’s wear

**TEXT BOOKS:**

1. Helen Joseph, Armstrong, “Patternmaking for Fashion Design”, Pearson Education Pte.Ltd.,2005.
2. Winifred Aldrich, “Metric Pattern Cutting for Children’s Wear and Baby Wear”, BlackwellPublishing,2004.
3. JacobSolinger,“ApparelProductionHandbook”,ReinholdPublications,1998
4. Carr H and Latham B., “The Technology of Clothing Manufacturing”, Blackwell Science,U.K.,1994

**REFERENCES**

1. Ruth E. Glock, Grace I. Kunz, “Apparel Manufacturing, Sewn Product Analysis”, fourth edition, Pearson Education, ISBN:81775807601594
2. Laing R.M.,Webster J, “Stitches & Seams”,The Textile Institute, India,1998
3. Shaeffer Claire, “Sewing for the Apparel Industry”, Prentice Hall, New Jersey,2001
4. Singer, “SewingLingerie”, CyDeCosselIncorporated,1991.

**Course Articulation Matrix**

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
<b>CO1</b>	3	3	3	2	3	1	1	2	3	3	1	3	3	2	1
<b>CO2</b>	2	2	3	2	3	1	1	2	1	3	1	3	3	2	1
<b>CO3</b>	1	2	3	3	2	2	2	1	2	2	2	3	3	2	1
<b>CO4</b>	3	3	3	2	1	1	1	2	3	3	1	3	3	2	1
<b>CO5</b>	3	3	3	2	1	1	1	2	3	3	1	3	3	2	1
<b>Overall</b>	2.4	2.6	3	2.2	2	1.2	1.2	1.8	2.4	2.8	1.2	3	3	2	1

**OBJECTIVE:**

To enable the students to recognize the garment production machines and its working mechanisms

**UNIT I SPREADING AND CUTTING MACHINES 6+9**

Spreading machines, cutting machines, Fusing machines; working mechanism- straight knife, round knife, rotary shears, band knife, die cutting, computer controlled cutting machine, laser cutting, notches and drills; automations and advancements.

**Practicals:**

1. Study on the working principle of spreading machine
2. Study on the working mechanism of different cutting machines

**UNIT II SEWING MACHINES 6+15**

Types of sewing machines and mechanism- lockstitch, chainstitch, overlock, coverstitch, button hole, button attachment, feed off arm; machine components and functions, basic operation and maintenance

**Practicals:**

1. Study on the threading, tensioning and working principle of button hole machine
2. Evaluation of the strength and consistency of stitches produced by different settings on the SNLS machine.
3. Evaluation of the strength and consistency of stitches produced by different settings on the chain stitch machine.
4. Evaluation of the strength and consistency of stitches produced by different settings on the overlock machine.
5. Evaluation of the strength and consistency of stitches produced by different settings on the flatlock machine.

**UNIT III SPECIAL MACHINES AND WORK AIDS 6**

Special machines based on product category – shirt, pants, denim, knits, leather and functional garments. Work aids - folders, presser foot, guides and attachments.

**UNIT IV PRESSING AND FINISHING EQUIPMENT 6+6**

Ironing equipment- steam irons, vacuum tables; needle detectors, washing and finishing machines, pressing techniques and tools, folding machines, poly bagging machine.

**Practicals:**

1. Study on the working principle ironing equipments
2. Study on the working mechanism of form finishers

**UNIT V GARMENT MACHINERY MAINTENANCE 6**

Preventive, predictive, breakdown maintenance; safety standards in garment production, automation in garment production – sew bots.

**TOTAL: 30 PERIODS + 15 PERIODS**

**COURSE OUTCOMES:**

Upon completion of the course, the students will be able to

- CO 1 Comprehend the fundamental concepts on belts and drives
- CO 2 Explain the fundamental principle and working of machines used for spreading and cutting
- CO 3 Analyse the stitch formation and other mechanisms of SNLS machine
- CO 4 Explain the stitch formation and other mechanisms of chain stitch machine
- CO 5 Classify different types of feed mechanisms and attachments

**TEXT BOOKS:**

1. Harold Carr., and Barbara Iatham., "The Technology of Clothing Manufacture", 4th Edition, Wiley-Blackwell Sciences, 2008, ISBN: 1405161981 / ISBN: 978-1405161985
2. Jacob Solinger., "Apparel Manufacturing Handbook", 2nd Edition Bobbin Blenheim Media Corp, 1988, ISBN : 1879570009 / ISBN: 978-1879570009
3. Ruth E. Glock., and Grace I. Kunz., "Apparel Manufacturing Sewn Product Analysis", 4th Edition, Pearson Prentice Hall, 2005, ISBN: 0131119826 | ISBN-13: 9780131119826

**REFERENCES:**

1. Villumsone-Nemes I., "Industrial Cutting of Textiles material", Woodhead Publications Pvt. Ltd 2012, ISBN: 978-1-85709-134-5
2. Jelka Gersak., "Design of Clothing Manufacture Process - A Systematic Approach to Planning Scheduling and Control", Woodhead Publications Pvt. Ltd, 2013, ISBN: 978-1-85709-778-1

**Course Articulation Matrix**

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	3	2	2	2	1	3	1	2	2	1	1
CO2	3	2	2	2	2	2	1	2	1	2	2	1	2	1	1
CO3	2	1	3	1	2	1	2	1	1	3	1	3	2	1	1
CO4	2	1	3	1	2	1	2	1	1	3	1	3	2	1	1
CO5	3	3	1	1	1	2	2	2	2	3	1	2	2	1	1
Overall	2.6	2	2.4	1.6	2	1.6	1.8	1.6	1.2	2.8	1.2	2.2	2	1	1

**OBJECTIVES:**

To enable the students to learn about pre-treatments involved in the wet processing of textiles, dyeing and printing of textiles

**UNIT I PREPARATORY PROCESSES 9+9**

Identification of fibres; process sequence of wet processing for woven and knits; singeing; desizing; scouring; bleaching; optical whitening; mercerization

**Practicals:**

1. Identification of fibres
2. Determination of blend composition
3. Desizing, scouring, bleaching of cotton fabric

**UNIT II DYEING 9+18**

Classification of dyes; dyeing of cotton using direct, reactive, vat and sulphur dyes; dyeing of polyester and blends; garment dyeing, machineries used in dyeing. Color; electromagnetic spectrum - visible range, measurement of color strength – color matching- theory and applications; spectrophotometer and color matching systems; quality control using color matching systems, color difference - pass / fail system and shade sorting; assessment of fastness of dyed fabrics

**Practicals:**

1. Dyeing of cotton using reactive dyes
2. Dyeing of cotton using vat dyes
3. Dyeing of polyester using disperse dyes
4. Determination of wash, perspiration, light and rubbing fastness of dyed fabrics
5. Determination of whiteness and yellowness index
6. Determination of color parameters in fabric using spectrophotometer

**UNIT III PRINTING 9+6**

Styles of printing- direct, discharge, resist; ingredients of print paste; methods of printing; digital printing, garment printing,; special prints -flock, foam, foil, glitter, kadi, leather, pearl and rubber

**Practicals:**

1. Printing of cotton fabric by direct- block and screen
2. Printing of cotton fabric by discharge technique - block and screen

**UNIT IV FINISHING 9+6**

Mechanical finishing; chemical finishing - softening, crease resist, bio-polishing, flame retardant, water repellent, water proof, soil release, antimicrobial, UV protection finish; denim washing, types of garment washing

**Practicals:**

1. Assessment of water repellent fabric
2. Assessment of flame retardant fabric

## **UNIT V GARMENT CARE**

**9+6**

Garment care-types and characteristics of stains, identification of stains, selection of stain removers, methods of stain removal; laundering procedures and care instructions adopted for cellulosic, protein and synthetic materials, storage of household linen and apparel laundries, care labeling

### **Practicals:**

1. Determination of skew, bow and shrinkage of dyed/finished fabrics
2. Determination of residual formaldehyde on garments
3. Determination of PCP estimation on fabrics

**TOTAL:45 PERIODS + 45 PERIODS**

### **COURSE OUTCOMES**

Upon completion of this course, the student would be able to

- CO1 Comprehend the preparatory process in chemical processing
- CO2 Classify various types of dyes and distinguish the applications of the dyes based on the types of fibre
- CO3 Recognize about different styles of printing and the print paste composition
- CO4 Distinguish the various methods and application of finishing
- CO5 Analyze the strength of color and color difference of dyed samples

### **TEXT BOOKS:**

1. Trotman E. R., "Dyeing and Chemical Technology of Textile Fibres", B.I Publishing Pvt. Ltd., NewDelhi,1994, ISBN:0471809101|ISBN-13:9780471809104
2. Karmarkar S.R., "Chemical Technology in Pre-treatment processes of Textiles", Elsevier Publications, Newyork,1999, ISBN: 044450060X|ISBN-13:9780444500601.
3. Shenai V. A., "Chemistry of Dyes and Principles of Dyeing", Sevak Publications, Mumbai,1995, ISBN: B0007BFE9Y
4. Shenai V.A., "Technology of printing", Sevak Publications, Mumbai, 1996
5. Miles W. C., "Textile Printing" ,Wood head Publication, 2003, ISBN 0901956761.

### **REFERENCES:**

1. Hall A.J., "Textile Finishing", 2<sup>nd</sup>ed., McGrawHill, 1995.
2. Marsh J.T., "Introduction to Textile Finishing" Vol.II, NewAge, 1996.
3. HeywoodD., "Textile Finishing", WoodheadPublishingLtd., 2003 ISBN090195681
4. ShenaiV.A., "Technology of Finishing", Vol.X, Usha, 1998
5. Schindler.W.D and HauserP., "Chemical Finishing of Textiles", Woodhead Publications, ISBN:1855739054.
6. Yin-Ling Lam, Chi-Wai Kan & Chun-Wah Marcus Yuen, "Developments in functional finishing of cotton fibres— wrinkle-resistant, flame retardant and antimicrobial treatments", Textile Progress, Vol. 44, Nos. 3 - 4, September-December 2012, 175–249.
7. Shah H.S., and Gandhi R.S., "Instrumental Colour Measurement and Computer Aided Colour Matching for Textiles", Mahajan Book Publication, 1990, ISBN: 8185401004 / ISBN: 9788185401003
8. Choudhury A.K.R., "Modern concepts of colour and Appearance", Oxford and IBH publishing Ltd., 2000, ISBN: 1578080789 | ISBN-13: 9781578080786
9. Gulrajani M.L.(Ed.), "Colour Measurement - Principles, advances and industrial

applications", Wood head Publishing Ltd, 2010, ISBN: 1845695593 | ISBN-13:9781845695590

10. Reife A. and Freeman H.S., "Environmental Chemistry of Dyes and Pigments", Wiley,1996,ISBN:0471589276

### Course Articulation Matrix

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
<b>CO1</b>	3	3	3	2	0	0	3	3	3	2	0	2	3	1	3
<b>CO2</b>	3	3	3	2	0	0	3	3	3	2	0	2	3	1	3
<b>CO3</b>	3	3	3	2	0	0	3	3	3	2	0	2	3	1	3
<b>CO4</b>	3	3	3	2	0	0	3	3	3	2	0	2	3	1	3
<b>CO5</b>	3	3	3	2	0	0	3	3	3	2	0	2	3	1	3
<b>Overall</b>	3	3	3	2	0	0	3	3	3	2	0	2	3	1	3

**MODULE I – INTRODUCTION****6**

Principles & Historical perspectives, Importance and need for sustainability in engineering and technology, impact and implications. United Nations Sustainability Development Goals (SDG), UN summit – Rio & outcome, Sustainability and development indicators.

**MODULE II – ENVIRONMENTAL SUSTAINABILITY****6**

Climate change, Biodiversity loss, Pollution and waste management, Renewable vs. non-renewable resources, Water and energy conservation, Sustainable agriculture and forestry. National and international policies, Environmental regulations and compliance, Ecological Footprint Analysis

**MODULE III – SOCIAL & ECONOMIC SUSTAINABILITY****9**

Equity and justice, Community development, Smart cities and sustainable infrastructure, Cultural heritage and sustainability, Ethical considerations in sustainable development. Triple bottom line approach, Sustainable economic growth, Corporate social responsibility (CSR), Green marketing and sustainable product design, Circular economy and waste minimization, Green accounting and sustainability reporting.

**MODULE IV – SUSTAINABILITY IN TEXTILE & APPAREL****9**

SDGs, carbon and water footprints – fibre production, conversion from fibre to garment usage; recycling concepts

**TOTAL: 30 PERIODS****REFERENCES:**

1. Allen, D., & Shonnard, D. R. (2011). Sustainable engineering: Concepts, design and case studies. Prentice Hall.
2. Munier, N. (2005). Introduction to sustainability (pp. 3558-6). Amsterdam, The Netherlands: Springer.
3. Blackburn, W. R. (2012). The sustainability handbook: The complete management guide to achieving social, economic and environmental responsibility. Routledge.
4. Clini, C., Musu, I., & Gullino, M. L. (2008). Sustainable development and environmental management. Published by Springer, PO Box, 17, 3300.
5. Bennett, M., James, P., & Klinkers, L. (Eds.). (2017). Sustainable measures: Evaluation and reporting of environmental and social performance. Routledge.
6. Seliger, G. (2012). Sustainable manufacturing for global value creation (pp. 3-8). Springer Berlin Heidelberg.
7. Stark, R., Seliger, G., & Bonvoisin, J. (2017). Sustainable manufacturing: Challenges, solutions and implementation perspectives. Springer Nature.
8. Davim, J. P. (Ed.). (2013). Sustainable manufacturing. John Wiley & Sons.

**OBJECTIVE:**

To train the students in Computer aided pattern making software's for pattern making and marker planning

**LIST OF EXPERIMENTS**

- I. Use CAD software- I to train the basic tool and develop 2D patterns, grading and marker planning for
  1. Kid's frock
  2. Women's top
  3. Women's skirt
  4. Dungaree
  5. Ladies blouse
  6. Men's Formal shirt
  7. Men's Formal trouser
  
- II. To Use CAD software- II to train the basic tool and develop 2D patterns, grading and marker planning for
  1. Kid's romper
  2. Shirts and Trousers
  3. Blouses

**TOTAL: 60 PERIODS****OUTCOMES:**

Upon completion of the course, the student will able to

CO1: Develop a pattern for kids wear

CO2: Develop a pattern for women's wear

CO3: Develop a pattern for men's wear

CO4: Formulate grading of developed patterns

CO5: Experiment with the optimization of marker

**COURSE ARTICULATION MATRIX**

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	2	2	1	2	1	1	2	1	1	2	2	2
CO2	3	2	2	2	2	1	2	1	1	2	1	1	2	2	2
CO3	3	2	2	2	2	1	2	1	1	2	1	1	2	2	2
CO4	3	2	2	2	2	1	2	1	1	2	1	1	2	2	2
CO5	3	2	2	2	2	1	2	1	1	2	1	1	2	2	2
Overall	3	2	2	2	2	1	2	1	1	2	1	1	2	2	2



	<b>SEMESTER V</b>				
<b>AT23U01</b>	<b>STANDARDS – APPAREL TECHNOLOGY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>
<b>MODULE I – OVERVIEW OF STANDARDS</b>					<b>6</b>

Basic concepts of standardization; Purpose of Standardization, marking and certification of articles and processes; Importance of standards to industry, policy makers, trade, sustainability and innovation. Objectives, roles and functions of BIS, Bureau of Indian Standards Act, ISO/IEC Directives; WTO Good Practices for Standardization. Important Indian and International Standards.

**MODULE II – STANDARDS FOR APPAREL TECHNOLOGY** **9**

**1. FABRIC PROPERTIES**

- IS 1969 - Tensile Properties of Fabrics
- IS 6489 - Tear Properties of Fabrics
- IS 15891 - Determination of Bending Length
- IS 8357 - Method for Assessment of Fabric Drape
- IS 4681: Method for determination of recovery from creasing of textile fabrics by measuring the angle of recovery
- IS 10971 - Determination of fabric propensity to surface fuzzing and to pilling  
Part - 1 Pilling box method
- IS 11056 - Method for determination of air permeability of fabrics
- IS 1313 - Methods for Determination of Flammability and Flame Resistance of Textile Fabrics
- IS 686 - Methods for Determination of Colour Fastness of Textile Materials to Daylight
- IS 766- Method for Determination of colourfastness of Textile Materials to Rubbing
- IS 765 - Method for determination of colour fastness of textile materials to washing

**2. GARMENT PROPERTIES**

- IS 11161: Textiles - Seam Types - Classification and Terminology
- IS 9030 - Method for determination of seam strength of jute fabrics including their laminates
- IS 12675 - Guide to garment quality
- IS 15312 - Method of Test for Seam Puckering on Materials Sewn by Industrial Sewing Machines

**COURSE OUTCOMES**

**Upon the completion of the course students will be able to**

- CO 1: conduct and interpret tests on fabric properties, applying the relevant standards to assess the quality and performance of textiles
- CO 2: evaluate garment quality and performance by applying standard testing methods, ensuring that garments meet industry standards

### Course Articulation Matrix

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
<b>CO1</b>	3	2	2	2	2	1	2	1	1	2	1	1	2	2	2
<b>CO2</b>	3	2	2	2	2	1	2	1	1	2	1	1	2	2	2
<b>Overall</b>	3	2	2	2	2	1	2	1	1	2	1	1	2	2	2

<b>TT23C05</b>	<b>FABRIC AND GARMENT QUALITY EVALUATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>2</b>	<b>3</b>

**OBJECTIVES:**

- To enable the students to learn about the constructional details of fabrics, evaluation of fabric properties, their importance and garment quality

**UNIT I CONSTRUCTION CHARACTERISTICS 6**

Basic fabric particulars – Measurement of thread density, count of warp and weft, thickness, areal density (GSM), crimp, the cover factor and cover fraction calculations; fabric sampling techniques; standards and norms

**UNIT II STRENGTH CHARACTERISTICS 6+10**

Tensile strength measurement – principles and methods; seam strength, seam slippage; principles and measurement of tear strength, bursting strength; standards and norms

**Practicals:**

Determination of

1. Fabric tensile strength
2. Fabric tear strength
3. Fabric bursting strength
4. Seam strength
5. Seam slippage

**UNIT III SURFACE CHARACTERISTICS 6+14**

Principle and measurement of fabric stiffness, drapeability, crease recovery, wrinkle recovery, air permeability, water repellency, fabric shrinkage, fabric abrasion resistance, fabric pilling, soil resistance; standards and norms

**Practicals:**

Determination of

1. Fabric bending modulus and flexural rigidity
2. Fabric crease recovery
3. Fabric wrinkle recovery
4. Fabric drape
5. Fabric abrasion
6. Fabric pilling resistance
7. Air permeability of fabrics

**UNIT IV FABRIC HANDLE AND FUNCTIONAL CHARACTERISTICS 6**

Objective measurement by KES-F – tensile, shear, bending, compression, surface roughness and friction - hysteresis measurements; principles and measurement by FAST, principle and measurements of fabric flame resistance, moisture and thermal properties; standards and norms.

**UNIT V FABRIC INSPECTION AND GARMENT QUALITY 6+6**

Fabric defects – inspection and grading, acceptable quality level; quality assessment of garments - cutting, sewing, pressing, finishing and packaging defects; durability characteristics

of trims - zippers, buttons, snaps; buckles- abrasion, bursting and corrosiveness; standards and norms

**Practicals:**

Determination of

1. Button pulling test
2. Delamination test
3. Testing of sewing threads

**TOTAL: 30 PERIODS +30 PERIODS**

**OUTCOMES:**

Upon completion of this course, the students shall be able to

- CO1 Analyse and evaluate the construction characteristics of fabric
- CO2 Differentiate and explain measuring principles of strength characteristics of fabric
- CO3 Evaluate and explain the surface characteristics of fabrics
- CO4 Investigate and evaluate the low stress and functional characteristics of fabric
- CO5 Evaluate and explain the fabric inspection and quality assessment of garments

**TEXT BOOKS**

1. Booth J.E., "Principle of Textile Testing", Butterworth Publications, London, 1989
2. Saville B.P., "Physical Testing of Textiles", Textile Institute, Manchester, 1998
3. Kothari V. K., "Testing and Quality Management", Progress in Textile Technology Vol.1, IAFL Publications, New Delhi, 1999

**REFERENCES:**

1. Ruth clock and Grace Kunz., "Apparel Manufacture – Sewn Product Analysis", Upper Sadle River Publications, New York, 2000
2. Pradip V. Mehta., "Managing Quality in the Apparel Industry", NIFT Publication, India, 1998
3. Sara J. Kadolph, "Quality Assurance for Textiles and Apparels", Fair Child Publications, New York, 1998
4. Slater K., "Physical Testing and Quality Control", The Textile Institute, Vol.23, No.1/2/3 Manchester, 1993

**Course Articulation Matrix**

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	2	2	1	2	1	1	2	1	1	2	2	2
CO2	3	2	2	2	2	1	2	1	1	2	1	1	2	2	2
CO3	3	2	2	2	2	1	2	1	1	2	1	1	2	2	2
CO4	3	2	2	2	2	1	2	1	1	2	1	1	2	2	2
CO5	3	2	2	2	2	1	2	1	1	2	1	1	2	2	2
Overall	3	2	2	2	2	1	2	1	1	2	1	1	2	2	2

**OBJECTIVES:**

- To enable the students to learn about basics of industrial engineering and different tools of industrial engineering and its application in apparel industry

**UNIT I PLANT LOCATION AND LAYOUT****6+3**

Industrial engineering – concept and application; site selection for garment industry; plant layout – types and their suitability; line balancing concepts

**UNIT II METHOD STUDY****6+3**

Work study- introduction and procedure; methods study – introduction, approaches; techniques of recording and analysis; application of methods study in garment manufacture; principles of motion economy, motion analysis

**UNIT III WORK MEASUREMENT I****6+3**

Work content; time study – equipment and procedure, rating concepts; standard time; standard data- PMTS, GSD; wage incentive systems

**UNIT IV WORK MEASUREMENT II****6+3**

Work measurement applied to garment industry; calculation of standard allowed minutes (SAM); line balancing for garment construction

**UNIT V ERGONOMICS****6+3**

Production and productivity concepts; Ergonomics – importance, types, principles; materials handling tools; lighting, ventilation, climatic conditions; noise control; introduction to human anthropometry, designing of workplace; effects on operator's health and productivity; safety measures in garment industry

**TUTORIALS**

Solving the problems using computer spread sheet

**TOTAL: 30 PERIODS + 15 PERIODS****OUTCOMES:**

Upon the completion of the course the student shall be able to

CO1: Understand the productivity concepts

CO2: Carryout method study and Motion analysis

CO3: Execute work measurement in textile industry

CO4: Understand the importance of ergonomics in garment industry

CO5: Illustrate the types of layout

**TEXT BOOKS:**

- George Kanwaty, "Introduction to Work Study ", ILO, Geneva, 1996, ISBN: 9221071081 | ISBN-13: 9789221071082
- Enrick N. L., "Time study manual for Textile industry", Wiley Eastern (P) Ltd., 1989, ISBN: 0898740444 | ISBN-13: 9780898740448
- Khanna O. P., and Sarup A., "Industrial Engineering and Management", Dhanpat Rai Publications, New Delhi, 2010, ISBN: 818992835X / ISBN: 978-8189928353

**REFERENCES**

- Norberd Lloyd Enrick., "Industrial Engineering Manual for Textile Industry", Wiley Eastern (P) Ltd., New Delhi, 1988, ISBN: 0882756311 | ISBN-13: 9780882756318

2. Chuter A. J., "Introduction to Clothing Production Management", Wiley-Black well Science, U.S. A., 1995, ISBN: 0632039396 | ISBN-13: 9780632039395
3. David M. Levine., Timothy C. Krehbiel., and Mark L. Berenson., "Business Statistics: A First Course", 7th Edition, Pearson Education Asia, New Delhi, 2015, ISBN: 032197901X | ISBN-13: 9780321979018
4. Chase., Aquilano., and Jacobs., "Production and Operations Management", Tata McGraw-Hill, New Delhi, 8th Edition, 1999, ISBN: 0256225567 | ISBN-13: 9780256225563
5. Gavriel Salvendy., "Industrial Engineering – Technology and operations management", WileyInterscience Publications, USA, 2001, ISBN: 0471330574 | ISBN-13: 9780471330578
6. Gordana Colovic., "Ergonomics in the garment industry", Wood publishing India Pvt. Ltd., India, 2014, ISBN: 0857098225 | ISBN-13: 9780857098221

### Course Articulation Matrix

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	3	3	2	2	2	2	2	2	2	2	2	3
CO2	3	3	2	3	3	2	2	2	2	2	2	2	2	2	3
CO3	3	3	2	3	3	2	2	2	2	2	2	2	2	2	3
CO4	3	3	2	3	3	2	2	2	2	2	2	2	2	2	3
CO5	3	3	2	3	3	2	2	2	2	2	2	2	2	2	3
Overall	3	3	2	3	3	2	2	2	2	2	2	2	2	2	3

**OBJECTIVES**

- To enable the students to understand the production planning in garment industry
- To emphasis on the improved methods of material control in apparel production
- To acquaint students with quality concepts for implementing quality in apparel production

**UNIT I SAMPLING AND PRE - PRODUCTION ACTIVITIES 6+3**

Concepts of concurrent engineering and reverse engineering of standard garments; overview of pre-production functions, purpose and procedure of conducting pre-production meeting; sampling stages, steps between prototypes to production; product data management; cut order planning; bundle distributions and tracking

**UNIT II OPERATION BREAKDOWN 6+3**

Operation break down and production sequence, line balancing, identification of bottlenecks and critical operations, operation wise machinery allocation–basic shirts, trousers, skirts; production grid and flowchart.

**UNIT III PLANT LOADING AND CAPACITY PLANNING 6+3**

Determination of machinery requirements for a new factory, calculation of labour requirements; line balancing techniques – line and operator efficiency, balance control; establishing factory capacity, TAKT time, planning for multi style production – preparation of planning board; subcontracting – reasons.

**UNIT IV PRODUCTION SCHEDULING 6+3**

Principles of scheduling, scheduling charts - master schedule, GANTT chart, backlog graph for WIP control, scheduling control techniques; network representations - CPM and PERT; preparation of time and action calendar.

**UNIT V PRODUCTION SYSTEM AND CONTROL METHODS 6+3**

Production systems - full garment assembly, make through, batch production, progressive bundle, straight line assembly, unit production system, modular production system; material management - Manufacturing Resources Planning (MRP II), Just In Time production system (JIT), Optimised Production Technology (OPT), Economic Order Quantity (EOQ), ABC, VED analysis in inventory control; lean manufacturing and its performance measures, kanban system.

**TUTORIALS**

Solving the problems using computer spread sheet

**TOTAL:30 PERIODS + 15 PERIODS**

**COURSE OUTCOMES**

Upon completion of this course, the student will be able to

- CO1: Understand the aspects of production planning  
 CO2: Explain operations involved in cutting room  
 CO3: Illustrate operations and assembly planning  
 CO4: Understand the material management  
 CO5: Describe the significance of inspection and quality control

**TEXT BOOKS:**

1. JacobSolinger.,“ApparelProductionHandbook”,ReinholdPublications,1998,ISBN:1879570009/ISBN:978-1879570009(series1 &series 2)
2. CarrH and LathamB., “The Technology of Clothing Manufacturing”, Blackwell Science,U.K.,1994,ISBN:0632037482|ISBN-13:9780632037483
3. RuthE.Glock.,andGracel.Kunz.,“ApparelManufacturing,SewnProductAnalysis”,FourthEdition,PearsonEducation,2004, ISBN:0131119826|ISBN-13:9780131119826.
4. Vilumsoneland Nemes.,“Industrial cutting of textile materials”, Wood head Publishing Limited, 2012,ISBN:978-0081021224/ISBN :0081021224.

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1. Laing R.M., and WebsterJ., “Stitches & Seams”, The Textile Institute, India, 1999, ISBN:1870812735|ISBN-13:9781870812733
2. ShaefferClaire.,“Sewing for the Apparel Industry”, Prentice Hall, New Jersey, 2001, ISBN:0321062841 |ISBN-13:9780321062840
3. Singer., “Sewing Lingerie”, CyDeCosse Incorporated, 1991, ISBN:0865732604|ISBN-13:9780865732605
4. PattyBrown., andJanettRice.,“Ready-To Wear Apparel Analysis”,Third Edition, Prentice-HallInc.,NewJersey,2000,ISBN:0130254347| ISBN-13:9780130254344
5. Chuter A.J., “Introduction to Clothing Production Management”, Blackwell Scientific Publications, Oxford, 2001, ISBN: 0632039396 | ISBN-13:9780632039399

**Course Articulation Matrix**

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	3	3	2	2	2	2	2	2	2	2	2	3
CO2	3	3	2	3	3	2	2	2	2	2	2	2	2	2	3
CO3	3	3	2	3	3	2	2	2	2	2	2	2	2	2	3
CO4	3	3	2	3	3	2	2	2	2	2	2	2	2	2	3
CO5	3	3	2	3	3	2	2	2	2	2	2	2	2	2	3
Overall	3	3	2	3	3	2	2	2	2	2	2	2	2	2	3





## REFERENCES

1. Ajgaonkar D.B., "Knitting technology", Universal Publishing Corporation, Mumbai,1998, ISBN:0818502738/ISBN:9780818502736
2. Chandrasekhar Iyer, Bernd Mammel and Wolfgang Schach, "Circular Knitting", Meisenbach GmbH, Bamberg, 1995, ISBN:3-87525-066-4.
3. Dharmadhikary R. K., Gilmore T. F., Davis H. A. and Batra S. K., "Thermal Bonding of Nonwoven Fabrics", Textile Progress, Vol.26, No.2, Textile Institute Manchester, 1995, ISBN:1870812786.
4. Jirsak O. and Wadsworth L. C., "Nonwoven Textiles", Textile Institute, Manchester, 1999, ISBN: 0 89089 9788.
5. Russell S., "Hand Book of Nonwovens", Textile Institute, Manchester, 2004, ISBN: 1855736039

## Course Articulation Matrix

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	3	-	2	1	-	2	2	2	2	1	-	2	-
CO2	-	-	3	-	2	1	-	2	2	2	2	1	-	2	-
CO3	-	-	2	-	3	1	-	2	2	2	2	1	-	2	-
CO4	-	-	2	-	3	1	-	2	2	2	2	1	-	2	-
CO5	-	-	2	-	3	1	-	2	2	2	2	1	-	2	-
Overall	-	-	2.4	-	2.6	1	-	2	2	2	2	1	-	2	-



## REFERENCES

1. Bhave P.V. and Srinivasan V., "Costing Accounting to Textile Mills", ATIRA, Ahmadabad, 1976
2. Thukaram Rao M.E., "Cost Accounting and Financial Management" New Age International, Bangalore, 2004
3. Narang, G. B. S., and Kumar V., "Production and Costing", Khanna Publishers, New Delhi, 1988
4. Hrishikes Bhattacharya., "Working Capital Management, Strategies and Techniques", Prentice Hall of India Pvt. Ltd., New Delhi, 2014
5. Khan and Jain, "Basic Financial Management and Practice", Tata McGraw Hill, New Delhi, 7<sup>th</sup> Edition, 2014

Course Outcomes	Program Outcome												Program Specific Outcome		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	-	-	3	-	2	1	-	2	2	2	2	1	-	2	-
2	-	-	3	-	2	1	-	2	2	2	2	1	-	2	-
3	-	-	2	-	3	1	-	2	2	2	2	1	-	2	-
4	-	-	2	-	3	1	-	2	2	2	2	1	-	2	-
5	-	-	2	-	3	1	-	2	2	2	2	1	-	2	-
<b>Overall CO</b>	-	-	2.4	0	2.6	1	-	2	2	2	2	1	-	2	-

**OBJECTIVES**

- To enable the students to draft a pattern and construct the various styles of kids, women's and men's wear

**LIST OF EXPERIMENTS****Construction of**

- Children's romper
- Children's frock
- Women's skirt – any one variation
- T- Shirt
- Salwar kameez
- Saree blouse
- Men's formal shirt
- Men's formal trousers

**TOTAL : 60 PERIODS****OUTCOMES:**

Upon completion of this practical course, the students can be able to

CO1 develop the pattern and construct children's wear

CO2 develop the pattern and construct women's wear; analyse the fit of the developed garment with respect to fit standards

CO3 develop the pattern and construct men's wear; analyse the fit of the developed garment with respect to fit standards

**Course Articulation Matrix**

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
<b>CO1</b>	2	2	3	3	-	-	2	-	2	-	-	3	2	3	2
<b>CO2</b>	2	2	3	3	-	-	2	-	2	-	-	3	2	3	2
<b>CO3</b>	-	-	2	2	-	-	2	-	2	-	-	2	2	2	2
<b>Overall</b>	2	2	2.6	2.6	-	-	2	-	2	-	-	2.6	2	2.6	2

## SEMESTER VI

<b>UC23E01</b>	<b>ENGINEERING ENTREPRENEURSHIP DEVELOPMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>2</b>	<b>3</b>

### **COURSE OBJECTIVES:**

1. Learn basic concepts in entrepreneurship, develop mind-set and skills necessary to explore entrepreneurship
2. Apply process of problem - opportunity identification and validation through human centred approach to design thinking in building solutions as part of engineering projects
3. Analyse market types, conduct market estimation, identify customers, create customer persona, develop the skills to create a compelling value proposition and build a Minimum Viable Product
4. Explore business models, create business plan, conduct financial analysis and feasibility analysis to assess the financial viability of a venture ideas & solutions built with domain expertise
5. Prepare and present an investible pitch deck of their practice venture to attract stakeholders

### **MODULE – I: ENTREPRENEURIAL MINDSET 4L,8P**

Introduction to Entrepreneurship: Definition – Types of Entrepreneurs – Emerging Economies – Developing and Understanding an Entrepreneurial Mindset – Importance of Technology Entrepreneurship – Benefits to the Society.

Case Analysis: Study cases of successful & failed engineering entrepreneurs - Foster Creative Thinking: Engage in a series of Problem-Identification and Problem-Solving tasks

### **MODULE – II: OPPORTUNITIES 4L,8P**

Problems and Opportunities – Ideas and Opportunities – Identifying problems in society – Creation of opportunities – Exploring Market Types – Estimating the Market Size, - Knowing the Customer and Consumer - Customer Segmentation - Identifying niche markets – Customer discovery and validation; Market research techniques, tools for validation of ideas and opportunities

Activity Session: Identify emerging sectors / potential opportunities in existing markets - Customer Interviews: Conduct preliminary interviews with potential customers for Opportunity Validation - Analyse feedback to refine the opportunity.

### **MODULE – III: PROTOTYPING & ITERATION 4L,8P**

Prototyping – Importance in entrepreneurial process – Types of Prototypes - Different methods – Tools & Techniques.

Hands-on sessions on prototyping tools (3D printing, electronics, software), Develop a prototype based on identified opportunities; Receive feedback and iterate on the prototypes.

### **MODULE – IV: BUSINESS MODELS & PITCHING 4L,8P**

Business Model and Types - Lean Approach - 9 block Lean Canvas Model - Riskiest Assumptions in Business Model Design – Using Business Model Canvas as a Tool – Pitching Techniques:

Importance of pitching - Types of pitches - crafting a compelling pitch – pitch presentation skills - using storytelling to gain investor/customer attention.

Activity Session: Develop a business model canvas for the prototype; present and receive feedback from peers and mentors - Prepare and practice pitching the business ideas- Participate in a Pitching Competition and present to a panel of judges - receive & reflect feedback

## **MODULE – V: ENTREPRENEURIAL ECOSYSTEM**

**4L,8P**

Understanding the Entrepreneurial Ecosystem – Components: Angels, Venture Capitalists, Maker Spaces, Incubators, Accelerators, Investors. Financing models – equity, debt, crowdfunding, etc, Support from the government and corporates. Navigating Ecosystem Support: Searching & Identifying the Right Ecosystem Partner – Leveraging the Ecosystem - Building the right stakeholder network

Activity Session: Arrangement of Guest Speaker Sessions by successful entrepreneurs and entrepreneurial ecosystem leaders (incubation managers; angels; etc), Visit one or two entrepreneurial ecosystem players (Travel and visit a research park or incubator or makerspace or interact with startup founders).

**TOTAL: 60 PERIODS**

### **COURSE OUTCOMES:**

Upon the successful completion of the course, students will be able to:

- CO1: Develop an Entrepreneurial Mind-set and Understand the Entrepreneurial Ecosystem Components and Funding types
- CO2: Comprehend the process of opportunity identification through design thinking, identify market potential and customers
- CO3: Generate and develop creative ideas through ideation techniques
- CO4: Create prototypes to materialize design concepts and conduct testing to gather feedback and refine prototypes to build a validated MVP
- CO5: Analyse and refine business models to ensure sustainability and profitability Prepare and deliver an investible pitch deck of their practice venture to attract stakeholders

### **REFERENCES:**

- 1 Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha (2020). Entrepreneurship, McGrawHill, 11th Edition
2. Bill Aulet (2024). Disciplined Entrepreneurship: 24 Steps to a Successful Startup. John Wiley & Sons.
3. Bill Aulet (2017). Disciplined Entrepreneurship Workbook. John Wiley & Sons.
4. Ries, E. (2011). The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. Crown Business
5. Blank, S. G., & Dorf, B. (2012). The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company. K&S Ranch
6. Osterwalder, A., & Pigneur, Y. (2010). Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. John Wiley & Sons
7. Marc Gruber & Sharon Tal (2019). Where to Play: 3 Steps for Discovering Your Most Valuable Market Opportunities. Pearson.

## SEMESTER VII

<b>TT23C04</b>	<b>COMPLIANCE IN TEXTILE INDUSTRY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### COURSE OBJECTIVES:

- To impart knowledge on the concepts of social compliance and provide insight on eco process and ethical practices

#### **UNIT I SCOPE AND NEED OF SOCIAL COMPLIANCE 9**

Social Compliance - concept, need, benefits for industry, workers, society; SA 8000 Standard, Provisions and Certification Process, compliance in material procurement, production, supply chain management; social compliances applied to garment manufacturing and other textile industry; case studies

#### **UNIT II HEALTH AND SAFETY 9**

WRAP, FLA. Health and Safety Targets, Objectives, Standards, Practices and Performances. 12 key criteria and principles of WRAP; working hours-norms, code of conduct; remuneration-minimum wages, compensation - norms applicable in India; freedom of association, trade union, collective bargaining agreements, related laws in India; health and safety – norms and measures to be taken for safe working environment – Factories Act 1948 and amendments, Provisions of Health, Safety and Welfare

#### **UNIT III SUSTAINABILITY 9**

Circular economy, carbon and water foot print, carbon balance, Zero waste and 3R, SDGs - concept, significance, practices; RSL(Restricted Substance List) - definition, importance; Environment standards

#### **UNIT IV ENVIRONMENT COMPLIANCE AND ECO-FRIENDLY SOLUTIONS 9**

Environment and climate; Global Reporting Initiatives (GRI), sustainability reporting guide line; Organization for Economics Co-operation and Development (OECD) and provisions; Eco-friendly environment - ecofriendly dyes, ecofriendly process - bio scouring, biopolishing; recycling and up cycling concepts for fashion and accessories, ethical, standard practices for sourcing of sustainable fashion clothing and accessory. Eco-Mark – Standards, Benefits to customers and certifications; Eco-labels – Standards Benefits to customers and certifications; Organic Products – Standards Benefits to customers and certifications

#### **UNIT V ETHICAL TRADING AND INTERNATIONAL COMPLIANCE 9**

Ethical Trading Initiative (ETI). National and international regulating organizations – GOTS, OSHA The Higg Facility Environmental Module (Higg FEM) - sustainability assessment tool & Standards to measure the Social and Environmental Impacts of companies and their environmental performance – Sustainable Apparel Coalition and their practices; HIGG INDEX, OEKO TEX, BLUE SIGN AND REACH – Standards, certification and benefits to customers; Corporate Governance - Corporate Social Responsibility (CSR) – mandatory requirements – benefits to company, labour and society

**TOTAL:45 PERIODS**

### OUTCOMES:

Upon completion of the course, the students can

**CO1:** comprehend about the scope and need for social compliance



- CO2:** discuss about the need for labour and wage compliance  
**CO3:** apply the health and environmental compliance in relation to textile industry  
**CO4:** analyse the potential hazards caused by banned and hazardous substances  
**CO5:** explain the need for ethical trading and sustainability in the current business scenario

### TEXT BOOKS

1. Rajesh Chhabara, "Social Accountability", Avasoftech Pvt.Ltd.,2005
2. Claudia E. Henninger, Kirsi Niinimäki, Marta Blazquez, Celina Jones "Sustainable Fashion Management" routledge taylor and francis group first edition 2022

### REFERENCES

1. Venkatesh Selvaraj, "Handbook for social compliance audit: a step by step approach", Kindle Store, 2021
2. Muhammad Azizul Islam, "Social Compliance Accounting", Springer, 2015
3. Rebocak Leifziger, "SA 8000: The first decade", Greech Leaf Publishers, May2009.
4. Miraftab M and Horrocks A R, "Eco Textiles", The Textile Institute, Woodhead Publication Ltd., Cambridge, 2007.
5. Susanna Benny and Janakiraman K P, "Eco parameters: Present Status", Mill Control Report No.15, The South India, Textile Research Association, Coimbatore, 1998.
6. "Oko-tex Standard 100", International Association for Research and Testing in the field of Textile Ecology (Oko- tex), Zurich, Switzerland, January, 1997.

Course Outcomes	Program Outcome												Program Specific Outcome		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
<b>1</b>	2	2	1	1	-	3	3	3	-	2	1	1	3	3	1
<b>2</b>	2	2	1	1	-	3	3	3	-	2	1	1	3	3	1
<b>3</b>	2	2	1	1	-	3	3	3	-	2	1	1	3	3	1
<b>4</b>	2	2	1	1	-	3	3	3	-	2	1	1	3	3	1
<b>5</b>	2	2	1	1	-	3	3	3	-	2	1	1	3	3	1
<b>Overall CO</b>	2	2	1	1	-	3	3	3	-	2	1	1	3	3	1

**OBJECTIVE:**

To acquaint the students with the concepts of business, design merchandising, sourcing and export documentation

**UNIT I MARKET RESEARCH 9**

Core concepts and orientation towards market place, market research; forecast- data collection, research, forecasting methods- qualitative and quantitative techniques (time series, moving average, exponential smoothening, regression analysis, econometric analysis, input output), analysis and calculations; market segmentations

**UNIT II MARKETING FOR APPAREL 9**

Introduction to fashion marketing; types of fashion marketing; understanding fashion change; elements of fashion marketing; fashion marketing strategies- of the developed economies, developing economies, whole sale and retail; apparel business practices; AI lead apparel business for beyond generation alpha; fashion trends

**UNIT III MERCHANDISING 9**

Concepts of merchandising, apparel product lines, dimensions of product change, determination and development of product line and product range; creative design of garments and accessories, new product development and seasons of sale; role and responsibilities of merchandiser

**UNIT IV SOURCING 9**

Understanding the basics of sourcing, sourcing strategy and best sourcing practice in apparel and textile businesses, supply chain and demand chain, sourcing negotiations, global co-ordination in sourcing, identifying & qualifying new sourcing destinations; supplier partnership in sourcing; materials management and quality in sourcing, quick response, ERP.

**UNIT V EXPORT DOCUMENTATION AND POLICIES 9**

Government policies, guidelines for apparel export and domestic trade, tax structures and government incentives in apparel trade; export documents and its purposes, finance and banking activities, Letter of credit, logistics and shipping, foreign exchange regulation, export risk management and insurance; export finance, role of Special economic zones.

**TOTAL: 45 PERIODS****OUTCOMES:**

Upon completion of this course, the student shall be able to

CO1: Identify various apparel markets and create innovative forecasting strategies for apparel markets

CO2: Analyse various apparel and fashion markets and predict changing fashion

CO3: Analyse the apparel product dynamics in a market and relating it along the value chain.

CO4: Apply the concepts of sourcing in various apparel industries

CO5: Outline the documents involved in trade.

**TEXT BOOKS**

1. Elian stone, Jean A samples, “Fashion Merchandising”, McGraw Hill Book Company, New York, 1985, ISBN: 0-07-061742-2
2. Shivaramu S.,” Export Marketing” – A Practical Guide to Exporters”, Wheeler Publishing, Ohio, 1996, ISBN: 81-7544-166-6
3. Ruth E. Glock, Grace I. Kunz ” Apparel Manufacturing Sewn Product Analysis” Fourth Edition, Pearson Prentice Hall, NJ, 2005, ISBN: 81-7758-076-0

**REFERENCES:**

1. Dominic Kosorin., “Introduction To Programmatic Marketing”, Dominik Kosorin, 2016, ISBN 8026096118
2. Dimitris N. Chorafas., “Integrating Erp, Crm, Supply Chain Management and Smart Materials”, Auerbach, 2001, ID 54795
3. Michael Mc Tear, ZoraidaCallejas, David Griol., “The Conversational Interface- Talking to Smart Devices”, Springer Publishing, 2016, ISBN 3-319-32967-3

**COURSE ARTICULATION MATRIX**

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
<b>CO1</b>	2	3	2	3	3	2	2	2	3	2	2	3	3	3	3
<b>CO2</b>	2	3	2	3	3	2	2	2	3	2	2	3	3	3	3
<b>CO3</b>	2	3	2	3	3	2	2	2	3	2	2	3	3	3	3
<b>CO4</b>	2	3	2	3	3	2	2	2	3	2	2	3	3	3	3
<b>CO5</b>	2	3	2	3	3	2	2	2	3	2	2	3	3	3	3
<b>Overall</b>	2	3	2	3	3	2	2	2	3	2	2	3	3	3	3

**TT23C11 TOTAL QUALITY MANAGEMENT FOR TEXTILE INDUSTRY**      **L   T   P   C**  
**3   0   0   3**

**OBJECTIVES:**

- To enable the students to learn the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
- To acquire the TQM Principles for application.

**UNIT I                    TQM PHILOSOPHIES AND PRINCIPLES IN TEXTILE INDUSTRY                    9**

Definition, need, evolution of quality; Concept of total Quality; Attitude and involvement of top management; customer focus, perception and retention; dimensions of product and service quality; Cost of quality; Quality Gurus - Crosby, Deming, Masaaki Imai, Feigenbaum, Ishikawa, Juran, Oakland, Shigeo Shingo, and Taguchi.

**UNIT II                    PROCESS CONTROL IN TEXTILE INDUSTRY I                    9**

Concepts of Quality circle, Kaizan and 5S principles, PDSA and 8D methodology; TQM - culture, framework, benefits, awareness and obstacles; Employee involvement – Motivation, empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal; Supplier - Selection, Partnering, Supplier Rating.

**UNIT III                    PROCESS CONTROL IN TEXTILE INDUSTRY II                    9**

Statistical Process Control (SPC) – Meaning, Significance. construction of control charts for variables and attributes. Process capability – meaning, significance and measurement. Six sigma- concepts of process capability. Reliability concepts – definitions, reliability in series and parallel, product life characteristics curve. Total productive maintenance (TMP), Terotechnology. Business process Improvement (BPI) – principles, applications, reengineering process, benefits and limitations.

**UNIT IV                    TQM TOOLS & TECHNIQUES I                    9**

Quality Tools - the seven traditional tools of quality, new management tools. lean principles, Six-sigma, Poka-yoke, failure mode effect analysis (FMEA) – reliability, failure rate, FMEA stages, design, process and documentation.

**UNIT V                    TQM TOOLS & TECHNIQUES II                    9**

Quality Function Deployment (QFD) –benefits, house of quality. Taguchi - quality loss function, parameter and tolerance design,signal to noise ratio; Quality management systems –elements, documentation guidelines for performance improvements, Quality manuals, Quality Audits;

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

Upon completion of this course, the students shall be able to

CO1: Understand TQM concepts

CO2: Apply TQM principles in a textile enterprise.

CO3: understand the importance of statistical process control in textile firm

CO4: Implement TQM tool in textile industry

CO5: Discuss the quality management system

**TEXT BOOK:**

1. Dale H.Besterfield, Carol B.Michna,Glen H. Bester field,MaryB.Sacre, Hemant Urdhwareshe and Rashmi Urdhwareshe, “Total Quality Management”, Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression,2013

2. Tapan Bose “Total Quality Management”, Pearson Education, 2011

**REFERENCES:**

1. Joel.E. Ross, “Total Quality Management – Text and Cases”, Routledge., 2017.
2. Kiran.D.R, “Total Quality Management: Key concepts and case studies, Butterworth Heinemann Ltd, 2016.
3. Oakland, J.S. “TQM – Text with Cases”, Butterworth – Heinemann Ltd., Oxford, Third Edition,2003.
4. Suganthi,L and Anand Samuel, “Total Quality Management”, Prentice Hall (India) Pvt. Ltd.,2006

Course Outcomes	Program Outcome												Program Specific Outcome		
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>1</b>	1	2	2	-	2	1	1	2	2	2	2	2	2	2	-
<b>2</b>	1	2	2	-	2	1	1	2	2	2	2	2	2	2	-
<b>3</b>	1	3	2	-	2	1	1	2	2	3	2	2	2	2	-
<b>4</b>	2	2	2	-	2	1	2	2	3	3	3	2	2	2	-
<b>5</b>	1	2	2	-	2	1	1	2	2	2	2	2	2	2	-
<b>Overall CO</b>	1.2	2.2	2	-	2	1	1.2	2	2.2	2.4	2.2	2	2	2	-

**OBJECTIVE:**

To enable the students, to develop a portfolio and construct a garment for the identified theme.

**LIST OF EXPERIMENTS**

1. Inspiration, design research and conceptualization for the theme
2. Develop a story board and mood board for the theme
3. Develop the colour board and fabric board for the theme
4. Develop a collection for any category from the developed boards
5. Prepare a specification sheet for the selected 3 garments (men/women/children)
6. Construction of the garments
7. Portfolio preparation and presentation

**TOTAL: 60 PERIODS****COURSE OUTCOMES:**

Upon completion of this practical course, the student shall be able to,

CO1:Develop various boards and create designs based on the boards for the specified theme

CO2:Develop specification sheet for a particular design

CO3:Construct the garment as per the specification and analyse the fit of the developed garment

**Course Articulation Matrix**

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	-	2	-	2	2	-	2	-	2	-	2	3	2	1
CO2	2	-	2	-	2	2	-	2	-	2	-	2	3	2	1
CO3	2	-	2	-	2	2	1	2	-	2	-	2	3	2	1
Overall	2	-	2	-	2	2	1	2	-	2	-	2	3	2	1

**OBJECTIVE:**

To train the students in the field work so as to have a firsthand knowledge of practical problems related to textile technology in carrying out engineering tasks.

**SYLLABUS:**

The students individually undertake training in reputed textile and apparel industries during the summer vacation for a specified duration of four weeks. At the end of training, a detailed report on the work done should be submitted within ten days from the commencement of the semester. The students will be evaluated through a viva-voce examination by a team of internal staff.

**OUTCOMES:**

On completion of the course, the student is expected to be able to

CO1: Acquire Oral presentation skills in Textile field

CO2: Acquire Technical report writing abilities

CO3: Document various material, machine and process parameters

CO4: Analyze industry problems and their solutions

CO5: Comprehend organizational flow structure

Course Outcomes	Program Outcome												Program Specific Outcome		
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>1</b>	3	3	3	2	2	2	2	2	3	3	2	3	3	2	1
<b>2</b>	3	3	3	2	2	1	2	2	3	3	2	2	3	2	2
<b>3</b>	3	3	3	2	2	3	3	3	3	2	3	3	3	3	3
<b>4</b>	3	3	3	2	2	3	3	3	3	2	3	3	3	3	3
<b>5</b>	3	3	3	2	2	1	2	2	3	2	3	2	2	2	1
<b>Overall CO</b>	3	3	3	2	2	2	2.1	2.1	3	2.4	2.6	2.6	2..8	2.4	2

**OBJECTIVES:**

- To solve the identified problem based on the formulated methodology.
- To develop skills to analyze and discuss the test results, and make conclusions.

**SYLLABUS:**

**Project:**

The student should carryout literature survey and experimental works on selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated through based on the report and the viva-voce examination by a panel of examiners including one external examiner.

**Internship:**

The students individually undertake training in reputed textile and apparel industries and have to find solution for the industrial problems during the internship. At the end of training, a detailed report on the work done should be submitted and will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

**TOTAL: 120 PERIODS**

**OUTCOMES:**

At the end of the course, the students will be able to analyse / design and develop the products in the field of

- CO1: Sewing threads
- CO2: Garment Production machinery
- CO3: Garment Manufacturing
- CO4: Functional Apparels
- CO5: Fashion Designing

Course Outcomes	Program Outcome												Program Specific Outcome		
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	1	1	1	2	2	2	2	1	3	2	3
2	3	3	3	3	1	1	1	2	2	2	2	1	3	2	3
3	3	3	3	3	1	1	1	2	2	2	2	1	3	2	3
4	3	3	3	3	1	1	1	2	2	2	2	1	3	2	3
5	3	3	3	3	1	1	1	2	2	2	2	1	3	2	3
<b>Overall CO</b>	3	3	3	3	1	1	1	2	2	2	2	1	3	2	3



**OBJECTIVE:**

To train the students in the field work so as to have a firsthand knowledge of practical problems related to textile technology in carrying out engineering tasks.

**SYLLABUS:**

The students individually undertake training in reputed textile and apparel industries during the summer vacation for a specified duration of four weeks. At the end of training, a detailed report on the work done should be submitted within ten days from the commencement of the semester. The students will be evaluated through a viva-voce examination by a team of internal staff.

**OUTCOMES:**

On completion of the course, the student is expected to be able to

CO1: Acquire Oral presentation skills in Textile field

CO2: Acquire Technical report writing abilities

CO3: Document various material, machine and process parameters

CO4: Analyze industry problems and their solutions

CO5: Comprehend organizational flow structure

Course Outcomes	Program Outcome												Program Specific Outcome		
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>1</b>	3	3	3	2	2	2	2	2	3	3	2	3	3	2	1
<b>2</b>	3	3	3	2	2	1	2	2	3	3	2	2	3	2	2
<b>3</b>	3	3	3	2	2	3	3	3	3	2	3	3	3	3	3
<b>4</b>	3	3	3	2	2	3	3	3	3	2	3	3	3	3	3
<b>5</b>	3	3	3	2	2	1	2	2	3	2	3	2	2	2	1
<b>Overall CO</b>	3	3	3	2	2	2	2.1	2.1	3	2.4	2.6	2.6	2..8	2.4	2



**REFERENCES:**

1. Ruth E. Glock., “Apparel Manufacturing Sewn Product Analysis”, Prentice Hall, New Jersey,2005,ISBN: 0131119826 | ISBN-13: 9780131119826
2. Jacob Solinger., “Apparel Production Handbook”, Reinhold Publications, 1998, ISBN: 1879570009 / ISBN: 978-1879570009
3. Gong R.H., and Wright R.M., “Fancy yarns –Their manufacture and application”, Woodhead Publishing Ltd, England, 2002, ISBN: 0849315506 | ISBN-13: 9780849315503.

**Course Articulation Matrix**

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
<b>CO1</b>	3	3	3	2	1	1	1	-	-	-	-	1	3	3	3
<b>CO2</b>	3	3	3	2	1	1	1	-	-	-	-	1	3	3	3
<b>CO3</b>	3	3	3	2	1	1	1	-	-	-	-	1	3	3	3
<b>CO4</b>	3	3	3	2	1	1	1	-	-	-	-	1	3	3	3
<b>CO5</b>	3	3	3	2	1	1	1	-	-	-	-	1	3	3	3
<b>Overall</b>	3	3	3	2	1	1	1	-	-	-	-	1	3	3	3

**OBJECTIVES:**

To enable the students to learn about the

- Fundamentals of bonded fabrics
- Different method of web formation and bonding

**UNIT I WEB FORMATION 9**

Definitions and classification of bonded fabrics; web formation – dry and wet method of production, fibre requirements; web laying – types, influence on web structure and nonwoven properties; quality control of web

**UNIT II MECHANICAL BONDING 9**

Bonded fabric production by mechanical bonding - needling, stitching, water-jet consolidation; factors influencing the properties; applications

**UNIT III CHEMICAL AND THERMAL BONDING 9**

Chemical bonding – binder polymers and bonding technologies; thermal bonding technologies; factors influencing the properties; applications

**UNIT IV POLYMER-LAID WEB AND FABRIC FORMATION 9**

Manufacture of spun bonded fabrics, fibre orientation in spun bonded fabrics and characterization of filament arrangement; manufacture of melt blown fabrics – fibre formation and attenuation; effect of processing parameters on fabric characteristics; applications

**UNIT V FINISHING AND CHARACTERIZATION OF BONDED FABRICS 9**

Dry and wet finishing; characterization – tensile, tear, bursting, thickness, abrasion, puncture, permeability, porosity; safety measures to be taken at the nonwoven industry

**TOTAL: 45 PERIODS**

**OUTCOMES:** Upon completion of the course the student will be able to understand the

CO1: Basics of nonwoven web formation techniques

CO2: Mechanical bonding technique to produce nonwovens

CO3: Chemical and thermal bonding methods to produce nonwovens and their end uses

CO4: Production of spun bonded and melt blown nonwoven fabrics.

CO5: Understand the finishing and characterization of bonded fabrics

**TEXT BOOKS:**

1. Lunenschloss J., Albrecht W. and David Sharp., “Nonwoven Bonded Fabrics”, Ellis HorwoodLtd., New York, 1985, ISBN: 0-85312-636-4.
2. Mrstina V. and Fejgl F., “Needle Punching Textile Technology”, Elsevier, New York, 1990,ISBN: 0444988041 | ISBN-13: 9780444988041

**REFERENCES:**

1. Dharmadhikary R. K., Gilmore T. F., Davis H. A. and Batra S. K., “Thermal Bonding of Nonwoven Fabrics”, Textile Progress, Vol.26, No.2, Textile Institute Manchester, 1995, ISBN:1870812786.

2. Jirsak O. and Wadsworth L. C., "Nonwoven Textiles", Textile Institute, Manchester, 1999, ISBN: 0 89089 9788.
3. Russell S., "Hand Book of Nonwovens", Textile Institute, Manchester, 2004, ISBN: 1855736039.
4. Chapman R., "Applications of Nonwovens in Technical Textiles", Textile Institute, Manchester, 2010, ISBN: 1 84569 4376
5. Abhijit Majumdar, Apurba Das, R. Alagirusamy and V.K. Kothari., "Process Control in Textile Manufacturing", Wood Head Publishing Limited, Oxford, 2013, ISBN: 978-0-85709-027-0.

### Course Articulation Matrix

Course Outcomes	Program Outcome														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
<b>CO1</b>	3	2	2	2	2	1	2	1	1	2	1	1	2	2	2
<b>CO2</b>	3	2	2	2	2	1	2	1	1	2	1	1	2	2	2
<b>CO3</b>	3	2	2	2	2	1	2	1	1	2	1	1	2	2	2
<b>CO4</b>	3	2	2	2	2	1	2	1	1	2	1	1	2	2	2
<b>CO5</b>	3	2	2	2	2	1	2	1	1	2	1	1	2	2	2
<b>Overall</b>	3	2	2	2	2	1	2	1	1	2	1	1	2	2	2

<b>TT23C09 TECHNOLOGY OF MANUFACTURED FIBRE PRODUCTION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

To make the students learn different methods of production of manmade fibres and post spinning operations

**UNIT I POLYMER PREPARATION 9**

Synthetic fibres – Monomers, source of monomers- structural principles of polymeric fibres; Polymer rheology-Newtonian and non-Newtonian fluids – shear flow, capillary flow and elongational flow behaviour. Synthesis of polymers for fibre production-techniques, advantages- polyester, nylon, PP and acrylic

**UNIT II MELT SPINNING 9**

Melt Spinning- polymer selection and preparation, fibre spinning- process variables; structure formation, - polyester, polyamide and polypropylene fibres; integrated processes; post spinning operations, properties and applications of fibres; process control; gel spinning; Dope dyeing

**UNIT III SOLUTION SPINNING 9**

Solution spinning- polymer selection and preparation; principle of fibre spinning- wet spinning, dry spinning, dry jet wet spinning, electrospinning and process variables, structure and morphology; post spinning operations, properties and applications of acrylic, polyurethane and regenerated cellulose fibres; process control

**UNIT IV DRAWING AND SPIN FINISH 9**

Draw behaviour of thermoplastic polymers; Neck drawing, drawing systems, influence of drawing on structure and properties of various fibres; orientation and stretching; spin finish – requirements, compositions and methods of application

**UNIT V HEAT SETTING AND TEXTURING 9**

Heat setting, nature of heat set- temporary and permanent; influencing parameters on heat setting, influence of heat setting on various fibre properties; texturizing principles- thermal, chemical, mechanical and thermos-mechanical properties and evaluation of textured yarns; applications

**TOTAL: 45 PERIODS**

**OUTCOMES:**

Upon completion of the course, the student shall know about the

- CO1: Synthesis of polymers and flow behaviour of polymers
- CO2: Melt spinning of polymers and influencing factors
- CO3: Solution spinning of polymers and structure formation
- CO4: Drawing and spin finish application of fibres and filaments
- CO5: Heat setting and its influence on fibre properties and principles of texturising process

**TEXT BOOKS:**

1. Kothari V. K., "Textile Fibres: Development and Innovations", Vol. 2, Progress in Textiles, IAFL Publications, New Delhi, 2000, ISBN: 81-s901033-0-X.
2. Gupta V. B., and Kothari V. K., (Editors), "Manufactured Fibre Technology", Kluwer Academic Publishers, 1997, ISBN 0412-54030-4.

**REFERENCES:**

1. Vaidya A. A., "Production of Synthetic Fibres", Prentice Hall of India Pvt. Ltd., New Delhi, 1988. ISBN: 0876925786 / ISBN: 9780876925782.
2. Hearle J W S, Hollick L, Wilson D K., "Yarn Texturing Technology", Woodhead publishing, 2001, ISBN: 978-1-85573-575-0
3. Cook J. G., "Handbook of Textile Fibres: Vol. 2: Man Made Fibres", The Textile Inst., 5th Ed., 1984, ISBN: 1855734850.
4. Srinivasa Murthy H. V., "Introduction to Textile Fibres", Textile Association, India, 1987.
5. Nakasjima (English edition, edited by Kajiwara K. and McIntyre J. E.), "Advanced Fibre Spinning Technology", Wood head Publication Ltd., England, 1994, ISBN:1855731827

Course Outcomes	Program Outcome												Program Specific Outcome		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO 3
1	1	2	1	1	3	3	2	3	1	3	3	2	2	3	3
2	1	2	1	1	3	3	2	3	1	3	3	2	2	3	3
3	1	2	1	1	3	3	2	3	1	3	3	2	2	3	3
4	1	2	1	1	2	3	-	3	1	3	3	2	2	3	2
5	1	2	1	1	2	3	-	3	1	3	3	2	2	3	2
Overall CO	1	2	1	1	2	3	-	3	1	3	3	2	2	3	3

**OBJECTIVES:**

To enable the students to learn the

- Basics of weaving machine and important motions of looms
- Selection and control of process variables during fabric formation

**UNIT I INTRODUCTION TO WEAVING AND TAPPET SHEDDING 9**

Principle of weaving - primary, secondary and auxiliary motions; loom timing; shed geometry and shedding requirement; types of shed; tappet shedding- positive and negative shedding mechanism, reversing mechanisms; kinetics of heald shaft

**UNIT II DOBBY AND JACQUARD SHEDDING 9**

Dobby and jacquard shedding mechanisms-type, drive arrangement and principle of working; electronic doobby and jacquards; jacquard- pattern card preparation, harness tie-up

**UNIT III WEFT INSERTION 9**

Shuttle – construction, types; shuttle picking and checking mechanisms, shuttle flight timing; mechanism of weft insertions in shuttle less looms - projectile, rapier, air-jet and water-jet; multi-phase weaving systems; yarn quality requirements

**UNIT IV BEATUP, SECONDARY AND AUXILIARY MOTIONS 9**

Kinematics of sley, sley eccentricity; beat up mechanism in modern looms; take up and let-off motions; warp protector, warp and weft stop motion; automatic weft replenishment in shuttle looms — pirn changing and shuttle changing mechanism; multi shuttle looms- box changing principle; weft accumulators in shuttle less looms; selvages — types, formation techniques

**UNIT V PROCESS CONTROL &SPECIAL WEAVING PROCESS 9**

Techno-economics of shuttle less loom; loom monitoring and control, loom stoppages and efficiency; fabric defect - analysis and grading, causes and remedies; filament weaving — silk and texturized yarns; principles and mechanisms in weaving- pile fabrics, tapes, tri-axial and 3D fabrics; loom production calculation; safety measures to be taken at weaving industry.

**TOTAL: 45 PERIODS****OUTCOMES:**

Upon completion of this course, the student shall be able to

CO1: Demonstrate the functioning of weaving and explain the working of tappet shedding

CO2: Classify shedding and explain the working of doobby and Jacquard shedding

CO3: Analyze the quality requirements, explain the weft insertion techniques and calculate the weft insertion rate

CO4: Calculate the sley eccentricity and beatup force and explain the secondary and auxiliary motions of weaving

CO5: Analyze and control the process variables at loom and prepare speciality fabrics



## COURSE ARTICULATION MATRIX

Course Outcomes	Program Outcome														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
<b>CO1</b>	3	3	3	2	1	1	1	-	-	-	-	1	3	3	3
<b>CO2</b>	3	3	3	2	1	1	1	-	-	-	-	1	3	3	3
<b>CO3</b>	3	3	3	2	1	1	1	-	-	-	-	1	3	3	3
<b>CO4</b>	3	3	3	2	1	1	1	-	-	-	-	1	3	3	3
<b>CO5</b>	3	3	3	2	1	1	1	-	-	-	-	1	3	3	3
<b>Overall</b>	3	3	3	2	1	1	1	-	-	-	-	1	3	3	3

**OBJECTIVES:**

To enable the students to learn

- Theory of yarn formation by different spinning systems
- Structure of properties of yarn spun from different spinning system
- Construction of yarn spinning machines and prepare yarn using ring and rotor spinning machine

**UNIT I RING SPINNING-I 9**

Principle of yarn formation in ring frame-drafting, twisting and winding; mechanism of cop building, top arm loading; calculations of draft, twist, production and number of fibres in yarn cross section

**UNIT II RING SPINNING-II 9**

Design features of important machine elements of ring frame - ring, traveller, spindle, drive arrangement; end breakage rate — causes and remedies; automations; condensed yarn spinning—principle, different methods, properties; comparison with ring spun yarn

**UNIT III ROTOR SPINNING 9**

Principle of open end spinning; principle of yarn production by rotor spinning system; design features of important elements used in rotor spinning; techno-economic study of rotor spinning

**UNIT IV OTHER SPINNING SYSTEMS 9**

Friction, air vortex and air-jet spinning systems — principle of yarn production, raw material used, structure, properties and applications; principle of yarn production by self-twist, core, wrap, adhesive, electrostatic, disc spinning systems

**UNIT V PLYING AND FANCY YARN SPINNING 9**

Merits of plying of yarns; methods followed for plying—TFO, ring twisting; selection of twist level for plying; calculation of resultant count of plied yarns; fancy yarns-types, method of production; property requirements and production of sewing threads; safety measures at spinning machines – equipments used, safety practices

**TOTAL: 45 PERIODS**

**OUTCOMES:**

Upon completion of this course, the student shall be able to

- CO1: Describe the theory of yarn formation and construction of ring spinning system; calculate draft, twist and production of ring spinning
- CO2: Design and analyse the features and importance of different elements of ring spinning; explain the principle of compact spinning system
- CO3: Explain the mechanism of yarn formation and design features of important elements in rotor spinning; calculate draft, back doubling, twist and production
- CO4: Distinguish principle and mechanism of yarn formation of different spinning system; analyse production limitations, structure and properties of yarns
- CO5: Differentiate the concept and production of ply yarns and fancy yarns
- CO6: Draw the material passage and provide constructional parameters of spinning machines
- CO7: Calculate draft, twist and production rate of ring and rotor spinning machines
- CO8: Produce yarn using ring and rotor spinning machine

## TEXT BOOKS

1. Klein W., and Stalder H., "The Rieter Manual of Spinning, Vol.4", Rieter MachineWorks Ltd., Winterthur, 2014, ISBN: 10 3-9523173-4-9 / ISBN: 13 978-3-9523173-4-1.
2. Stalder H., "The Rieter Manual of Spinning, Vol.5", Rieter Machine Works Ltd., Winterthur, 2014, ISBN:10 3-9523173-5-7/ISBN:13978-3-9523173-5-8.

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1. Stalder H., "The Rieter Manual of Spinning, Vol.6", Rieter Machine Works Ltd., Winterthur, 2014, ISBN:10 3-9523173-6-5/ISBN:13978-3-9523173-6-5.
2. Oxtoby E., "SpunYarnTechnology", Butterworth Publications, London, 1987.
3. James Brayshaw., and Everett Backe., "Short-staple Ring Spinning, Textile Progress", The Textile Institute, Manchester, 1999, ISBN: 0890898979 | ISBN-13:9780890898970
4. Iredale J., "Yarn Preparation: A Handbook", Intermediate Technology, 1992, ISBN:5. 1853390429|ISBN-13: 9781853390425.
5. Lawrence C. A., "Advances in Yarn Spinning Technology", Wood Head publishing, 2010, ISBN:1845694449|ISBN-13:9781845694449

## Course Articulation Matrix

Course Outcomes	Program Outcome														
	P O	P O	P O	P O	P O	P O	P O	P O	P O	P O	P O	P O	PS O	PS O	PS O
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
<b>CO1</b>	3	3	3	3	2	1	1	1	2	2	2	2	3	3	3
<b>CO2</b>	3	3	3	3	2	1	1	1	2	2	2	2	3	3	3
<b>CO3</b>	3	3	3	3	2	1	1	1	2	2	2	2	3	3	3
<b>CO4</b>	3	3	3	3	2	1	1	1	2	2	2	2	3	3	3
<b>CO5</b>	3	3	3	3	2	1	1	1	2	2	2	2	3	3	3
<b>Overall</b>	3	3	3	3	2	1	1	1	2	2	2	2	3	3	3

**OBJECTIVES:**

- To enable the students to learn about the developments and properties of special textile structures

**UNIT I      3D WOVEN FABRICS      9**

3D multilayer interlock weave, 3D non-crimp weave, 3D dual interlaced weave; hollow 3D woven fabrics; properties and applications

**UNIT II      3D KNITTED FABRICS      9**

3D knitting technologies, 3D knitted structures, multi-axial warp knit, fully fashioned 3D fabrics, Spacer fabric; properties and applications

**UNIT III      BRAIDING AND NONWOVEN      9**

Tubular, bifurcated structures, track and column braiding processes; high bulk nonwovens, shaped 3D nonwovens; properties and applications

**UNIT IV      ADVANCED TEXTILE STRUCTURES I      9**

Development in leno weave fabrics, development in tri-axial woven fabric, interwoven fabrics, pile carpets, flocked fabric, knotted fabrics; properties and applications

**UNIT V      ADVANCED TEXTILE STRUCTURES II      9**

Shell woven textiles, nodal three-dimensional woven textiles; properties and applications

**TOTAL: 45 PERIODS****OUTCOMES**

Upon completion of the course, the student shall be able to

CO1: Create and assess 3D woven fabric

CO2: Create and assess 3D knitted fabric

CO3: Produce braided and 3D nonwovens fabrics and predict their properties

CO4: Design advanced structured fabrics and analyse their properties

CO5: Design shell woven and nodal 3D woven fabrics and analyse their properties

**TEXT BOOKS**

- Xiaogang Chen, "Advances in 3D Textiles 1st Edition", Woodhead Publishing, 2015 ISBN: 9781782422143.
- Yordan Kyosev, "Braiding Technology for Textiles, 1st Edition", Woodhead Publishing, 2014, ISBN: 9780857091352."

**REFERENCES:**

- Dewi Gwynfa Bailey Thomas, "An introduction to warp knitting", Mellow Publishing Company Limited, 1971, ISBN 0900541067, 9780900541063.
- Jinlian Hu., "3D Fibrous Assemblies: Properties, Applications and Modelling of Three-Dimensional Textile structures", CRC Press, 2008, ISBN: 1420079867 | ISBN-13: 9781420079869
- Antonio Miravete., "3D Textile Reinforcements in Composite Materials", Wood head Publishing, 1999, ISBN: 1855733765 | ISBN-13: 9781855733763

4. Tong L., MouritzA.P., and Bannister M., “3D Fibre Reinforced Polymer Composites”, Elsevier, 2002, ISBN: 0080439381 | ISBN-13: 9780080439389
5. NandanKhokar, “3D-Weaving and Noobing: Characterization of Interlaced and Non-interlaced 3D Fabric Forming Principles”, Ph. D. Thesis, Chalmers University of Technology, 1997. ISBN: 91-7197-492-X

Course Outcomes	Program Outcome												Program Specific Outcome		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
<b>1</b>	3	3	3	2	2	2	1	1	1	2	2	2	2	2	3
<b>2</b>	3	3	3	2	2	1	1	1	1	2	2	2	2	2	3
<b>3</b>	3	3	3	2	2	1	1	1	1	2	2	2	2	2	3
<b>4</b>	3	3	3	2	2	1	1	1	1	2	2	2	2	2	3
<b>5</b>	3	3	3	2	2	1	1	1	1	2	2	2	2	2	3
<b>Overall CO</b>	3	3	3	2	2	2	1	1	1	2	2	2	2	2	3

<b>TT23C03</b>	<b>ADVANCES IN TEXTILE FINISHING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **OBJECTIVES**

- To enable the students to learn the advances in the field of textile finishing

#### **UNIT I WATER REPELLENT AND SOIL RELEASE FINISH 9**

Wetting and wicking; surface energy — concept, measurement and relevance to repellency; water repellent, soil release – mechanism, application and assessment; self cleaning textiles

#### **UNIT II FLAME RETARDANT FINISH 9**

Flame retardant mechanisms, factors affecting flammability of fabrics, flame retarding chemicals for textile materials, standards and testing of flame retardant finishes

#### **UNIT III UV RESISTANT AND ANTISTATIC FINISH 9**

UV radiation - mechanism, factors affecting UV protection, UV protection finishes, Measurement of UV protection; Antistatic finishes - Mechanism, Agents applied and its assessment.

#### **UNIT IV ANTIMICROBIAL FINISHES 9**

Antimicrobial finishes- classification, chemistry and application of antimicrobial finishes, evaluation of antimicrobial finishes; Anti-odour and fragrance finishes, Mosquito repellent finish: application and assessment technique.

#### **UNIT V OTHER FINISHES 9**

Sol-gel technique; spin coating; spray pyrolysis; electro spraying; electrophoretic and electrochemical deposition; layer by layer deposition; plasma treatment; ozone finishing of textiles

**TOTAL: 45 PERIODS**

### **OUTCOMES**

Upon completion of this course the student shall be able to

CO1: Comprehend the theory behind water and soil repellence finish

CO2: Analyze the theory behind flame retardant finish and evaluate the performance of flame retardant fabric

CO3: Appraise a need for UV and antistatic finish and evaluate the finishes

CO4: Distinguish chemistry and assessment of antimicrobial, anti-odour and mosquito repellent finish

CO5: Examine the need for unique finishes and evaluate the performance

### **TEXT BOOKS**

- Shore J, "Colorants & Auxiliaries", Vol. I & II, Society of Dyers and Colourists, UK, 1990
- Principles of Nanotechnology by Phani Kumar
- Nanofibres & Nanotechnology in Textiles by P.J. Brown & K. Stevens

### **REFERENCES**

- Schindler W D and Hauser P J, "Chemical Finishing of Textiles", The Textile Institute, Woodhead Publishing Ltd., Cambridge, 2004.

2. Charles T, "Chemistry & Technology of Fabric Preparation & Finishing", North Carolina State University, USA, 1992.
3. Perkins W S, "Textile Colouration and Finishing", Carolina Academic Press, UK, 1996.
4. Holme L, "New developments in chemical finishing of textiles", Journal of Textile Institute, UK, 2008.
5. Heywood D., "Textile Finishing", Woodhead Publishing Ltd., 2003
6. Mohammad Shahid & Ravindra Adivarekar, "Advances in Functional Finishing of Textiles", Textile Science and Clothing Technology, 2020
7. Plasma Technology for Textiles by Roshan Shishoo, CRC Publication
8. Plasma Surface Modification and Plasma Polymerization – Norihiro Inagaki: CRC Press
9. The Nanoscope, Encyclopedia of Nano Science & nanotechnology Vol.-I to VI, Dr. Parag Diwan & Ashish Bharadwaj

Course Outcomes	Program Outcome												Program Specific Outcome		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	3	3	3	-	-	-	3	2	-	-	-	2	3	2	3
2	3	3	3	-	-	-	3	2	-	-	-	2	3	2	3
3	3	3	3	-	-	-	3	2	-	-	-	2	3	2	3
4	3	3	3	-	-	-	3	2	-	-	-	2	3	2	3
5	3	3	3	-	-	-	3	2	-	-	-	2	3	2	3
<b>Overall CO</b>	3	3	3	-	-	-	3	2	-	-	-	2	3	2	3

## VERTICALS - II

### APPAREL BUSINESS MANAGEMENT

**AT23005          SUSTAINABLE APPAREL BUSINESS MANAGEMENT          L T P C**  
**3 0 0 3**

#### **OBJECTIVES:**

- The general goal of this course is to provide an introduction to sustainability management in textile and apparel organization.
- This sustainability course is also focused on corporate sustainability strategy

#### **UNIT I          INTRODUCTION TO SUSTAINABILITY MANAGEMENT          9**

Meaning, definition, dimensions of sustainability, value of sustainability, framework for business sustainability, transformation process Model, leadership and sustainable management: management strategies for sustainable management

#### **UNIT II          SUSTAINABILITY OPERATING SYSTEM (SOS) IN AN ORGANIZATION          9**

SOS - basics, critical elements, structural elements support, standards, sustainability-related management system for apparel industries, process schedule

#### **UNIT III          STRATEGIC PLANNING FOR A SUSTAINABILITY OPERATING SYSTEM          9**

Purpose and benefits of strategic planning by functional groups, general process for sustainability planning in garment industry, pre-planning information and processes, techniques for reaching consensus on priorities, strategic planning formats for apparel divisions; the balanced scorecard and alignment tools, tactical plan

#### **UNIT IV          ENVIRONMENTAL POLICY AND SUSTAINABILITY MANAGEMENT          9**

Framework for understanding environmental policy- values dimension, political dimension, science and technology dimension in apparel industries, policy design dimension and implementation in apparel firm, green supply chain management for apparel products

#### **UNIT V          SUSTAINABILITY REPORTING          9**

Sustainability reporting, radical transparency, reasons for transparent reporting, internal reporting, public report. corporate annual sustainability report, sustainability reporting Process frameworks & guidelines: GRIG4, AA1000 SES, greenhouse gas accounting reporting, ISO related reporting

**TOTAL: 45 PERIODS**

#### **OUTCOMES**

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

CO1: Describe the process of sustainability and its procedures

CO2: Implement criteria's of sustainability in apparel industries

CO3: Enumerate the Planning and policy decision for sustainable strategic approach

CO4: Compare the Correlation between ecology and sustainability management

CO5: Critically analyse and study the report and audit of sustainability management system



## TEXT BOOKS

1. Claudia E. Henninger, Kirsi Niinimäki, Marta Blazquez, Celina Jones “Sustainable Fashion Management” routledge taylor and francis group first edition 2022
2. Dr. P. Kandhavadiyu “Sustainability In Fashion And Apparels” Woodhead Publishing 2018

## REFERENCES

1. Claudia E. Henninger (Editor), Panayiota J. Alevizou (Editor), Helen Goworek (Editor) Sustainability in Fashion: A Cradle to Upcycle Approach Palgrave Macmillan; 1st ed. 2017 edition
2. Tsan-Ming Choi (Editor), T. C. Edwin Cheng Sustainable Fashion Supply Chain Man

## Course Articulation Matrix

Course Outcomes	Program Outcome														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	3	2	3	3	2	3	2	3	2	2	3	3	3	3
CO2	2	3	2	3	3	2	3	2	3	2	2	3	3	3	3
CO3	2	3	2	3	3	2	3	2	3	2	2	3	3	3	3
CO4	2	3	2	3	3	2	3	2	3	2	2	3	3	3	3
CO5	2	3	2	3	3	2	3	2	3	2	2	3	3	3	3
Overall	2	3	2	3	3	2	3	2	3	2	2	3	3	3	3



**REFERENCES:**

1. Ronald H. Ballou, Samir K. Srivastava, “ Buisness Logistics/ Supply chain management”, Pearson Education, 2007
2. David J.Bloomberg , Stephen Lemay and Joe B.Hanna, “Logistics”, PHI 2002.
3. James B.Ayers, “Handbook of Supply chain management”, St.Lucle press, 2000.
4. Jeremy F.Shapiro, “Modeling the supply chain”, Thomson Duxbury, 2002.
5. Srinivasan G.S, “Quantitative models in Operations and Supply Chain Management”, PHI, 2010

**Course Articulation Matrix**

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
<b>CO1</b>	2	3	2	3	3	2	2	2	3	2	2	3	2	3	2
<b>CO2</b>	2	3	2	3	3	2	2	2	3	2	2	3	2	3	2
<b>CO3</b>	2	3	2	3	3	2	2	2	3	2	2	3	2	3	2
<b>CO4</b>	2	3	2	3	3	2	2	2	3	2	2	3	2	3	2
<b>CO5</b>	2	3	2	3	3	2	2	2	3	2	2	3	2	3	2
<b>Overall</b>	2	3	2	3	3	2	2	2	3	2	2	3	2	3	2

**OBJECTIVE**

To enable the students understand various aspects of human resources management and different acts related to personnel management

**UNIT I PERSPECTIVES IN HUMAN RESOURCE MANAGEMENT 9**

Evolution of human resource management – the importance of the human capital – role of human resource manager –challenges for human resource managers - trends in human resource policies – computer applications in human resource management – human resource accounting and audit.

**UNIT II HUMAN RESOURCE PLANNING AND RECRUITMENT 9**

Importance of human resource planning – forecasting human resource requirement – matching supply and demand - internal and external sources- organizational attraction- recruitment, selection, induction and socialization- theories, methods and process

**UNIT III TRAINING AND DEVELOPMENT 9**

Concept of training, roles, needs and importance of training, types of training methods- on the job training, off the job training- benefits; principles of adult learning, assessments and creating training programmes for specific needs, methods of conducting training, impacts and evaluation of training; executive development programme – best practices; occupational skill training- dexterity training and evaluation; case studies

**UNIT IV EMPLOYEE ENGAGEMENT 9**

Compensation plan – salary and wages- types; reward- types; -types, application of theories of motivation – Maslow’s hierarchy of needs, Herzberg’s two factor theory, McClelland’ theory of needs, Vroom’s theory of expectancy, McGregor’s Theory X and Theory Y, Alderfer’s ERG Theory; career management; mentoring - development of mentor; protégé relationships- job satisfaction, employee engagement, organizational citizenship behavior: theories, models.

**UNIT V PERFORMANCE EVALUATION AND CONTROL 9**

Method of performance evaluation; feedback; industry practices, promotion, demotion, transfer and separation; implication of job change; the control process – importance, methods; requirement of effective control systems grievances – causes, implications; redressal methods.

**TOTAL:45 PERIODS****OUTCOMES:**

Upon completion of this course, the students shall be able to

- CO1: Understand the concepts of human resource management
- CO2: Discuss the Importance of HR planning and recruitment
- CO3: Illustrate the types of training methods and development
- CO4: Implement the concepts learned in the workplace
- CO5:Elucidate the emerging concepts in the field of HRM

**TEXT BOOKS:**

1. Decenzo.andRobbins., “Human Resource Management”, 10thEdition, Wiley,2010, ISBN:0470169680/ISBN:978-0470169681<sub>24</sub>

2. Dessler and Gary.,“Human Resource Management”, Pearson Education Limited,2007, ISBN:0134235452| ISBN-13:9780134235455
3. MamoriaC.B.,“Personnel Management”, Himalaya Publishing Company, 2007, ISBN:8184888082/ISBN:978-8184888089

**REFERENCES:**

1. Bernadin.,“Human Resource Management”, 6<sup>th</sup> Edition, Tata McgrawHill , 2006,ISBN: 0078029163/ISBN:978-0078029165
2. EugenceMckenna., and NicBeach.,“Human Resource Management”, 2ndEdition, Pearson Education Limited,2008,ISBN:0273694189/ISBN:978-0273694182193
3. Wayne Cascio.,“Managing Human Resource”,9<sup>th</sup> Edition, McGraw Hill,2012, ISBN:0078029171 ISBN-13:9780078029172

**COURSE ARTICULATION MATRIX**

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
<b>CO1</b>	2	3	2	3	2	2	2	2	3	2	2	3	3	3	2
<b>CO2</b>	2	3	2	3	2	2	2	2	3	2	2	3	3	3	2
<b>CO3</b>	2	3	2	3	2	2	2	2	3	2	2	3	3	3	2
<b>CO4</b>	2	3	2	3	2	2	2	2	3	2	2	3	3	3	2
<b>CO5</b>	2	3	2	3	2	2	2	2	3	2	2	3	3	3	2
<b>Overall</b>	2	3	2	3	2	2	2	2	3	2	2	3	3	3	2

**OBJECTIVES**

To make the students to learn about the

- Probability distributions, sampling and testing of hypothesis
- Process control using charts and process capability
- Design of experiments for textile applications and
- Modeling the probabilistic phenomena

**UNIT I BASIC STATISTICS 6**

Frequency distribution and histogram; probability density curves; measures of central tendency – mean, median and mode; measures of dispersion – range, mean deviation about mean, mean deviation about median, variance and standard deviation; coefficient of variation

**UNIT II DISCRETE DISTRIBUTION 6**

Basic terminologies; probability distribution and its application to textile industry – binomial, Poisson, control charts for discrete variables

**UNIT III CONTINUOUS DISTRIBUTION 6**

Normal, exponential, chi-square, t-distribution, F-distribution; point and interval estimation; hypothesis testing; control charts for continuous variables

**UNIT IV ANALYSIS OF VARIANCE AND NON-PARAMETRIC TEST 6**

One-way and two-way analysis of variance; non-parametric tests - sign test, rank test, concordance test; process capability analysis

**UNIT V REGRESSION, CORRELATION AND DOE 6**

Simple linear regression, correlation analysis, rank correlation, Test of significance of regression coefficients; basic principles and applications of Design of Experiments

**TUTORIAL**

Solving the problems using spread sheet

**15 PERIODS****TOTAL: 45 PERIODS****OUTCOMES**

Upon completion of this course, the student shall be able to

CO1 Comprehend about basic calculations in statistics

CO2 analyse the problems in discrete distribution

CO3 analyse the problems in continuous distribution

CO4 analyse the variance in data and carry out non parametric test

CO5 design the experiments based on design models available and analyse them

**TEXT BOOKS**

1. Montgomery D.C., "Introduction to Statistical Quality Control", John Wiley and Sons, Inc., Singapore, 2002, ISBN: 997151351X.
2. Leaf G.A.V., "Practical Statistics for the Textile Industry, Part I and II", The Textile Institute, Manchester, 1984, ISBN: 0900739517.

## REFERENCES

1. Douglas C. Montgomery, "Design and analysis of experiments", John Wiley & Sons, Inc., Singapore, 2000, ISBN 9971 51 329 3
2. Ronald D. Moen, Thomas W. Nolan, Lloyd P. Provost, "Quality improvement through experimentation", McGraw-Hill, 1998, ISBN 0-07-913781-4

Course Outcomes	Program Outcome												Program Specific Outcome		
	PO 1	PO 2	PO 3	PO4	PO5	PO 6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
<b>1</b>	3	3	3	3	3	-	-	-	-	2	2	2	3	1	3
<b>2</b>	3	3	3	3	3	-	-	-	-	2	2	2	3	1	3
<b>3</b>	3	3	3	3	3	-	-	-	-	2	2	2	3	1	3
<b>4</b>	3	3	3	3	3	-	-	-	-	2	2	2	3	1	3
<b>5</b>	3	3	3	3	3	-	-	-	-	2	2	2	3	1	3
<b>Overall CO</b>	3	3	3	3	3	-	-	-	-	2	2	2	3	1	3

**OBJECTIVE**

- To enable the students, understand about the Enterprise Resource Planning software and its modules

**LIST OF EXPERIMENTS**

Practice on data entry, report generation in Enterprise Resource Planning software

- Costing, order booking, MRP, purchase, production planning, production orders, inventory control, packing, shipping, scheduling, sample preparation and approval, business reports
- ERP in apparel production – time study, cutting, production tracking, cut panel process, garment quality control, order completion, machine repairs and maintenance, reports
- ERP in retail management – style template, finished goods barcoding, stock taking, stock inward, retail order booking, stock allocation, scan and pack, dispatch, invoice, point of sale, reports

**TOTAL: 90 PERIODS**

**OUTCOMES:**

Upon the completion of this course the students shall be able to practically

CO1: Carryout data entry in ERP software

CO2: Execute order placement

CO3: Generate report using ERP software

CO4: Generate bill of materials report

CO5: Perform costing

**Course Articulation Matrix**

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
<b>CO1</b>	2	3	2	3	3	2	2	2	3	2	2	3	3	3	3
<b>CO2</b>	2	3	2	3	3	2	2	2	3	2	2	3	3	3	3
<b>CO3</b>	2	3	2	3	3	2	2	2	3	2	2	3	3	3	3
<b>CO4</b>	2	3	2	3	3	2	2	2	3	2	2	3	3	3	3
<b>CO5</b>	2	3	2	3	3	2	2	2	3	2	2	3	3	3	3
<b>Overall</b>	2	3	2	3	3	2	2	2	3	2	2	3	3	3	3



**OBJECTIVES:**

To enable the students to learn about preparation of cost sheet, costing of garments

**UNIT I** **9**

Cost accounting, elements of cost, classification of cost elements – examples from apparel industry, methods of costing

**UNIT II** **9**

Cost profit volume analysis, breakeven analysis; standard costing, analysis of variance , Costing of fabrics

**UNIT III** **9**

costing of apparel – accounting of prime costs and overhead costs, allocation of overheads; cost sheet preparation

**UNIT IV** **9**

Foreign exchange mechanisms, exchange rates; foreign exchange exposure management – risks, strategies to reduce risk

**UNIT V** **9**

Budget, types of budgets, budgeting and control in apparel industry

**TOTAL: 45 PERIODS**

**OUTCOMES:**

Upon completion of this course, the student shall be able to

CO1: Distinguishing and separating various costs in order to ascertain, control and make financial decisions.

CO2: Evaluate the changes in variable and fixed costs, and apply analytical skills to determine optimal production quantities/volumes/units to achieve desired financial goals.

CO3: Construct a clear cost sheets for various apparel and textile products.

CO4: Structuring and detecting taxes, foreign exchange rates and currency risks in textile manufacturing and exports

CO5: Assessing resource allocation and preparation of budget for apparel industries

**REFERENCES**

1. Pandey I. M., "Financial Management", 10<sup>th</sup> Edition, Vikas Publishing House Pvt. Ltd., New Delhi, 2010, ISBN: 8125937145 / ISBN: 978-8125937142
2. Prasanna Chandra., "Financial Management, Theory and Practice", 8<sup>th</sup> Edition, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2011, ISBN: 0071078401 / ISBN: 978-0071078405
3. Aswat Damodaran., "Corporate Finance Theory and Practice", John Wiley & Sons, 2001, ISBN: 0471283320 | ISBN-13: 9780471283324
4. James C., Van Home., "Financial Management and Policy", 12<sup>th</sup> Edition Prentice Hall of India Pvt. Ltd., New Delhi, 2001, ISBN: 0130326577 | ISBN-13: 9780130326577
5. Thukaram Rao M.E., "Cost and Management Accounting" New Age International, Bangalore, 2004, ISBN: 812241513X / ISBN: 978-8122415131

6. Khan., and Jain, "Basic financial Management & Practice", 7<sup>th</sup> Edition, Tata McGraw Hill, New Delhi, 2014, ISBN: 933921305X / ISBN: 978-9339213053

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	3	3	2	3	-	2	2	3	3	3	3	3	1
CO2	-	-	3	3	2	3	-	2	2	3	3	3	3	3	1
CO3	-	-	3	3	2	3	-	2	2	3	3	3	3	3	1
CO4	-	-	3	3	2	3	-	2	2	3	3	3	3	3	1
CO5	-	-	3	3	2	3	-	2	2	3	3	3	3	3	1
Overall	-	-	3	3	2	3	-	2	2	3	3	3	3	3	1



## REFERENCES

1. Tulsian P.C., "Quantitative Techniques Theory and Problems", Dorling Kindersley (India) Pvt. Ltd., 2006
2. Ronald L. and Rardin, "Optimization in Operations Research", Pearson Education, 1998
3. Srivastava U.K., Shenoy G.V. and Sharma S.C., "Quantitative Techniques for Managerial Decisions", Second Ed., New Age International (P) Ltd., 2007
4. Gupta P.K. and Hira D.S., "Problems in Operations Research", 3<sup>rd</sup> Ed., S.Chand&Company, 2013
5. Mustafi C.K., "Operations Research: Methods and Practice", 5<sup>th</sup> Edition, New Age International (P) Ltd., 2012
6. Sharma J. K., "Operations Research: Theory and Applications", 5<sup>th</sup> Ed., Laxmi Publication, New Delhi, 2013

Course Outcomes	Program Outcome												Program Specific Outcome		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	-	-	2	-	3	-	-	1	2	1	2	-	-	1	-
2	-	-	2	-	3	-	-	1	2	1	2	-	-	1	-
3	-	-	2	-	3	-	-	1	2	1	2	-	-	1	-
4	-	-	2	-	3	-	-	1	2	1	2	-	-	1	-
5	-	-	2	-	3	-	-	1	2	1	2	-	-	1	-
<b>Overall CO</b>	-	-	2	-	3	-	-	1	2	1	2	-	-	1	-

**VERTICALS - III  
INDUSTRIAL ENGINEERING**

**AT23008**

**PROJECT MANAGEMENT**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

To enable the students to learn

- To evaluate and select the most desirable projects.
- To plan and implement the projects.
- To control the projects.
- To close the projects.
- About software projects

**UNIT I            INTRODUCTION TO PROJECT MANAGEMENT AND  
PROJECT SELECTION** **9**

Objectives of project management- importance of project management- types of projects; project selection – feasibility study: types of feasibility- steps in feasibility study

**UNIT II            PROJECT RISK MANAGEMENT** **9**

Project management life cycle- risk management process -risk identification, assessment, monitoring and control- qualitative and quantitative risk analysis techniques.

**UNIT III            PROJECT PLANNING AND IMPLEMENTATION** **9**

Work break down structure- estimate work packages – identify task relationship – project schedule

**UNIT IV            PROJECT MONITORING AND CONTROL** **9**

Resource aggregations - resource levelling - limited resource allocation – project monitoring and control

**UNIT V            PROJECT CLOSURE AND SPECIAL TOPICS** **9**

Process project audit – post project audit – normal project closure – premature closure – perpetual project - project closure process. project management for modern information system – critical success factors for IT project - software project selection and initiation - project management discipline – project overall planning

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

Upon completion of the course, the students can

- CO1: Evaluate and select the most desirable projects.
- CO2: Apply appropriate approaches to plan a new project.
- CO3: Apply appropriate methodologies to develop a project schedule.
- CO4: Identify important risks facing a new project.
- CO5: Understanding the project management skills

### Course Articulation Matrix

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
<b>CO1</b>	2	-	1	-	-	2	-	-	3	3	3	2	2	3	1
<b>CO2</b>	2	-	1	-	-	2	-	-	3	3	3	2	2	3	1
<b>CO3</b>	2	-	1	-	-	2	-	-	3	3	3	2	2	3	1
<b>CO4</b>	2	-	1	-	-	2	-	-	3	3	3	2	2	3	1
<b>CO5</b>	2	-	1	-	-	2	-	-	3	3	3	2	2	3	1
<b>Overall</b>	2	-	1	-	-	2	-	-	3	3	3	2	2	3	1



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1. Mikell P. Groover, Automation, Production Systems, and Computer-Integrated Manufacturing, Pearson, 2007.
2. Amitabh Raturi, Production and Inventory Management, 2008.
3. Adam Jr. Ebert, Production and Operations Management, PHI Publication, 1992.
4. Muhlemann, Okland and Lockyer, Production and Operation Management, Macmillan India, 1992.
6. Chary S.N, Production and Operations Management, TMH Publications, 2010.
7. Terry Hill, Operation Management. Pal Grave McMillan (Case Study). 2005.

## COURSE ARTICULATION MATRIX

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	2	-	-	-	-	-	2	2	2	3	3	1
CO2	3	2	2	2	-	-	-	-	-	2	2	2	3	3	1
CO3	3	2	2	2	-	-	-	-	-	2	2	2	3	3	1
CO4	3	2	2	2	-	-	-	-	-	2	2	2	3	3	1
CO5	3	2	2	2	-	-	-	-	-	2	2	2	3	3	1
Overall	3	2	2	2	-	-	-	-	-	2	2	2	3	3	1



**OBJECTIVES:**

To enable the students to learn

1. Usage of business analytics for decision making
2. To apply the appropriate analytics and generate solutions
3. Model and analyse the business situation using analytics.

**UNIT I INTRODUCTION TO BUSINESS ANALYTICS (BA) 9**

Business Analytics - Terminologies, Process, Importance, Relationship with Organisational Decision Making, Business Analytics for Competitive Advantage.

**UNIT II MANAGING RESOURCES FOR BUSINESS ANALYTICS 9**

Managing Business Analytics personnel, data and technology. organisational structures aligning Business Analytics. managing information policy, data quality and change in Business Analytics.

**UNIT III DESCRIPTIVE ANALYTICS 9**

Introduction to descriptive analytics - visualising and exploring data - descriptive statistics - sampling and estimation - probability distribution for descriptive analytics - analysis of descriptive analytics

**UNIT IV PREDICTIVE ANALYTICS 9**

Introduction to predictive analytics - logic and data driven models - predictive analysis modeling and procedure - data mining for predictive analytics. analysis of predictive analytics

**UNIT V PRESCRIPTIVE ANALYTICS 9**

Introduction to prescriptive analytics - prescriptive modeling - non linear optimisation - demonstrating business performance improvement.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

Upon completion of this course the learners will be able to:

- CO1: Understand the role of Business Analytics in decision making
- CO2: Identify the appropriate tool for the analytics scenario
- CO3: Apply the descriptive analytics tools and generate solutions
- CO4: Understand Predictive Analytics and applications
- CO5: Identify Prescriptive Analytics and demonstrating business process improvement

**REFERENCES**

1. Marc J. Schniederjans, Dara G. Schniederjans and Christopher M. Starkey, " Business Analytics Principles, Concepts, and Applications - What, Why, and How" , Pearson Ed, 2014
2. Christian Albright S and Wayne L. Winston, "Business Analytics - Data Analysis and Decision Making", Fifth edition, Cengage Learning, 2015.

4. James R. Evans, "Business Analytics - Methods, Models and Decisions", Pearson Ed, 2012.

**Course Articulation Matrix**

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
<b>CO1</b>	2	2	2	2	-	-	-	-	-	2	2	2	3	2	1
<b>CO2</b>	2	2	2	2	-	-	-	-	-	2	2	2	3	2	1
<b>CO3</b>	2	2	2	2	-	-	-	-	-	2	2	2	3	2	1
<b>CO4</b>	2	2	2	2	-	-	-	-	-	2	2	2	3	2	1
<b>CO5</b>	2	2	2	2	-	-	-	-	-	2	2	2	3	2	1
<b>Overall</b>	2	2	2	2	-	-	-	-	-	2	2	2	3	2	1



CO4: Consider environmental factors in ergonomics design.

CO5: Report on importance of aesthetics to manufacturing system and product

**TEXT BOOKS:**

1. Ergonomics in Design: Methods and Techniques (Human Factors and Ergonomics) by Marcelo M. Soares, Francisco Rebelo
2. Ergonomics in Product Design by Send points Publishing Co. Ltd.

**REFERENCES:**

1. Benjamin W.Niebel, Motion and Time Study, Richard, D. Irwin Inc., 7thEdition, 2002
2. Brain Shakel, "Applied Ergonomics Hand Book", Butterworth Scientific London 1988.
3. Bridger, R.C., Introduction to Ergonomics, 2ndEdition, 2003, McGraw Hill Publications.
4. Martin Helander, A Guide to human factors and Ergonomics, Taylor and Francis, 2006
5. Mayall W.H. "Industrial design for Engineers", London Hiffee books Ltd., 1988.

**COURSE ARTICULATION MATRIX**

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	2	2	1	-	-	2	-	-	2	2	3	2	1
CO2	2	2	2	2	1	-	-	2	-	-	2	2	3	2	1
CO3	2	2	2	2	1	-	-	2	-	-	2	2	3	2	1
CO4	2	2	2	2	1	-	-	2	-	-	2	2	3	2	1
CO5	2	2	2	2	1	-	-	2	-	-	2	2	3	2	1
Overall	2	2	2	2	1	-	-	2	-	-	2	2	3	2	1

**OBJECTIVES:**

To enable the students to learn

- To understand the objectives and Importance of Quality Management.
- To analyze the phases of audit and audit plan.
- To learn about the role of Information Technology in Quality improvement.
- To prepare the formal report.

**UNIT I INTRODUCTION 9**

History of Quality – objectives and importance of quality management – contributions of quality gurus - quality information system – strategy development and deployment – need for a quality approach to strategy – definition of quality and its types – distinction between product quality and service quality

**UNIT II QUALITY IMPROVEMENT TECHNIQUES 9**

Continuous process improvement - the Juran trilogy - improvement strategies - the PDCA cycle - Kaizen - six- sigma - bench marking – cost of quality – quality function deployment - the role of information technology in quality improvement

**UNIT III INTRODUCTION TO AUDITING 9**

Brief history of auditing – general model of auditing – the compliance audit – performance audit – product audits – process audits – system audits – audit defined – management principles

**UNIT IV AUDIT PROGRAM MANAGER AND PREPARATION 9**

Accountability – resources for audit program – phases of audit – the audit team – second rule of auditing – authority – requirements – understand the process – audit plan – evaluate documents

**UNIT V PERFORMANCE AND REPORTING 9**

Opening meeting – gather the facts – tracing – interviews – interview techniques – perceptions – team meetings – daily briefings – onward – report characteristics – pain and pleasure – findings – preparing the finding sheets – recommendations – exit meeting – formal report – report distribution - closure phase – remedial action – corrective action – corrective action response – adequacy of the response – records – an example procedure - the process approach – auditing process-based quality management system – audit program management – the process of auditing – audit reporting phase – audit closure phase

**TOTAL: 45 PERIODS****COURSE OUTCOMES:**

Upon completion of this course the learners will be able to:

CO1: Distinguish between the product quality and service quality.

CO2: Analyze the model of auditing.

CO3: valueate the documents for audit plan

CO4: Analyze the Corrective action response and adequacy of the response

CO5: Apply the process of auditing

## REFERENCES

1. Daniel Galin, —Software Quality Assurance – from Theory to Implementation, Pearson Education, 2009
2. Education, 2009
3. Yogesh Singh, "Software Testing", Cambridge University Press, 2012
4. Aditya Mathur, —Foundations of Software Testing, Pearson Education, 2008
5. Ron Patton, —Software Testing , Second Edition, Pearson Education, 2007
6. SrinivasanDesikan, Gopaldaswamy Ramesh, —Software Testing – Principles and Practices, Pearson Education, 2006

## COURSE ARTICULATION MATRIX

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3	3	2	3	1	-	-	-	2	2	2	3	2	2
CO2	2	3	3	2	3	1	-	-	-	2	2	2	3	2	2
CO3	2	3	3	2	3	1	-	-	-	2	2	2	3	2	2
CO4	2	3	3	2	3	1	-	-	-	2	2	2	3	2	2
CO5	2	3	3	2	3	1	-	-	-	2	2	2	3	2	2
Overall	2	3	3	2	3	1	-	-	-	2	2	2	3	2	2

**COURSE OBJECTIVES:**

To enable the students to learn

- To explore contemporary knowledge and gain a conceptual understanding of industrial relations.
- To have a broad understanding of the legal principles governing the employment relationship at individual and collective level.

**UNIT I INDUSTRIAL RELATIONS 9**

Concept, scope- objectives- importance - approaches to IR- industrial relations system in India. Trade Unions Act, 1926- trade union movement in India- objective -role - functions-procedure for registration of trade unions- rights and responsibilities- problems- employee relations in IT sector.

**UNIT II INDUSTRIAL CONFLICTS AND LABOUR WELFARE 9**

The Industrial Disputes Act, 1947-disputes – impact – causes – strikes – prevention – industrial peace – government machinery – conciliation – arbitration – adjudication. labour welfare- statutory voluntary- welfare funds-welfare of unorganized labour

**UNIT III LABOUR LEGISLATIONS-I 9**

Origin and growth of labour legislation in India- Principles of labour legislations-Factories Act 1948-Minimum Wages Act, 1948- Payment of Wages Act, 1936- Payment of Bonus Act, 1965-

**UNIT IV LABOUR LEGISLATIONS-II 9**

The Industrial employment (standing orders) Act, 1946- The Apprentices act, 1961-The Equal Remuneration act, 1976- Payment of Gratuity act 1972- Employee compensation act in 2013

**UNIT V LABOUR LEGISLATIONS-III 9**

Employees' Provident fund and Miscellaneous provisions act, 1952- Employees' state insurance (ESI) Act, 1948- Maternity Benefit Act, 1961- Contract Labour Regulations and Abolition Act, 1970 -The Child Labour Prevention and Regulation Act, 1986.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

The student gets to learn about

CO1: Industrial relations system and Trade unions

CO2: Industrial Disputes and labour welfare measures

CO3: Labour legislation introduction and legal provisions for factory workers, wages and Bonus

CO4: Legal provisions for equal remuneration, gratuity, compensation, industrial employment and Apprenticeship

CO5: Legal provisions for EPF, ESI, Maternity, contract labours, and child labour prevention.

**REFERENCES :**

1. Mamoria C.B. and Sathish Mamoria, Dynamics of Industrial Relations, Himalaya Publishing House, New Delhi, 2016.
2. Kapoor N. D , Elements of Mercantile Law, Sultan Chand, 2014.
3. ArunMonappa, RanjeetNambudiri, PatturajaSelvaraj. Industrial relations &Labour Laws. Tata
4. McGraw Hill. 2012
5. P.K. Padhi, Industrial Laws, PHI, 2017.

6. P.R.N Sinha, InduBala Sinha, Seema PriyadarshiniShekhar. Industrial Relations, Trade Unions and Labour Legislation. Pearson. 2017
7. Tax Mann, Labour Laws, 2018.
8. Srivastava, Industrial Relations and Labour laws, Vikas, 2015.
9. P.N.Singh, Neeraj Kumar. Employee relations Management. Pearson. 2011.
10. Ratna Sen, Industrial Relations in India, Shifting Paradigms, Macmillan India Ltd., New Delhi, 2007.
11. C.S.VenkataRatnam, Globalisation and Labour Management Relations, Response Books, 2007

### COURSE ARTICULATION MATRIX

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
<b>CO1</b>	1	3	2	2	-	2	-	2	2	2	-	2	2	2	1
<b>CO2</b>	1	3	2	2	-	2	-	2	2	2	-	2	2	2	1
<b>CO3</b>	1	3	2	2	-	2	-	2	2	2	-	2	2	2	1
<b>CO4</b>	1	3	2	2	-	2	-	2	2	2	-	2	2	2	1
<b>CO5</b>	1	3	2	2	-	2	-	2	2	2	-	2	2	2	1
<b>Overall</b>	1	3	2	2	-	2	-	2	2	2	-	2	2	2	1





CO4: Explain strategic decisions using online technology  
 CO5: outline the importance of online marketing and E advertising

**TEXT BOOKS:**

1. P.T. Joseph , E-Commerce: An Indian Perspective, PHI Learning, 2015
2. Kenneth C. Laudon, Carol Guercio Traver, E-Commerce 2016: Business, Technology, Society, Pearson; 12 edition, 2016
3. Clare Harris, The Fundamentals of Digital Fashion Marketing, Bloomsbury Visual Arts, 2017 147
4. Harriet Posner, Marketing Fashion, Second edition: Strategy, Branding and Promotion, Laurence King Publishing; 2 edition, 2015

**REFERENCES:**

1. David Whiteley, E - Commerce: Strategy, Technologies and Applications, McGraw Hill Education, 2017
2. Henry Chan (Author), Raymond Lee (Author), Tharam Dillon (Author), Elizabeth Chang, ECommerce: Fundamentals and Applications, Wiley; 1 edition 2007
3. Wendy K. Bandoni , Social Media for Fashion Marketing: Storytelling in a Digital World, Bloomsbury Visual Arts, 2017
4. Mike Easey , Fashion Marketing, Wiley; 3rd Edition edition, 2009

Course Outcomes	Program Outcome												Program Specific Outcome		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
<b>1</b>	2	3	2	3	3	2	2	2	3	2	2	3	3	3	3
<b>2</b>	2	3	2	3	3	2	2	2	3	2	2	3	3	3	3
<b>3</b>	2	3	2	3	3	2	2	2	3	2	2	3	3	3	3
<b>4</b>	2	3	2	3	3	2	2	2	3	2	2	3	3	3	3
<b>5</b>	2	3	2	3	3	2	2	2	3	2	2	3	3	3	3
<b>Overall CO</b>	2	3	2	3	3	2	2	2	3	2	2	3	3	3	3

**COURSE OBJECTIVES**

To enable the students to learn

Define and appreciate the significance and role of visual merchandising in a retail environment, in order to present the merchandise to the consumers

**UNIT I FUNDAMENTALS OF VISUAL MERCHANDISING 9**

Visual Merchandising-definition, objectives and scope. Types of display and display settings; Retail stores and approaches of visual merchandising -Types of retail stores, store atmospherics, Approaches in Visual Merchandising in various stores-In house staffing, Department Store Approach, Small Store Approach; Role of Visual Merchandising in changing face of retailing.

**UNIT II ELEMENTS OF VISUAL PRESENTATION 9**

Overview of the various elements – Color, lighting, line and composition, graphics and signage, store exteriors and interiors, sensory stimulants like scent, sound etc; Application of color schemes and color psychology to create mood in garment display

**UNIT III MANNEQUINS AND FIXTURES 9**

Mannequins and other human forms, alternatives to mannequins; Criteria for selection of fixtures, dressing fixtures, modular fixtures; Store exterior – Signs, Marquees, Outdoor Lighting, Banners, Planters, Awnings, Windows in Storefront Design, store fronts.

**UNIT IV STORE INTERIORS AND POINTS OF DISPLAY 9**

Focal points, island displays, risers and platforms, the runway the catwalk, counters and display cases, museum cases, demonstration cubes, ledges, shadow boxes, enclosed displays, fascia, walls. Point of purchase display, Display techniques; virtual store information and interaction.

**UNIT V STORE PLANNING AND EXECUTION OF A VISUAL PRESENTATION 9**

Store layout planning-grid, racetrack, free form and their direction of flow; Floor plans and reading of floor plans – Plan-o-gram- definition, purpose and planning -theme, ensemble, racks, shelves, bins etc; Assortment planning- Assortment planning, optimize apparel assortments: Display calendar and planning a display, scheduling the promotion, budgeting and safety factors in visual merchandising.

**TOTAL: 45 PERIODS****COURSE OUTCOMES**

Upon completion of this course, the student would be able to

CO1: Classify various elements of Visual presentation and understand their significance in visually presenting a display

CO2: Analyze and identify the best suitable environment for merchandise including interior, exterior and point of displays

CO3: Appraise on various techniques used in presenting merchandise

CO4: Plan on optimizing the merchandise and retail space to customers

CO5: Summarize the various features available in a computer controlled visual merchandising

**TEXT BOOKS:**

1. Pegler M.M., "Visual Merchandising and Display", IV Edition, Fair child Publications, New York,2001.
2. Diamond.J,Diamond,E.,"Contemporary Visual Merchandising", Prentice HallInc. New Jersey2003.
3. Diamond.E, Fashion Retailing–A Multichannel Approach,IIEdition, Prentice HallInc. New Jersey2006. 137

**REFERENCES:**

1. RathP.M.,PetersonJ., Greensley.P, Gill.P, Introduction to Fashion Merchandising, Delmar PublishersInc., NewYork1994.
2. PhillipsP.M. Fashion Sales Promotion, IIEdition, Prentice HallInc, NewJersey,1996. 3. CurtisE, Fashion Retail, John Wiley and SonsLtd, England, 2004.

**COURSE ARTICULATION MATRIX**

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3	2	3	3	2	2	2	3	2	2	3	3	3	3
CO2	2	3	2	3	3	2	2	2	3	2	2	3	3	3	3
CO3	2	3	2	3	3	2	2	2	3	2	2	3	3	3	3
CO4	2	3	2	3	3	2	2	2	3	2	2	3	3	3	3
CO5	2	3	2	3	3	2	2	2	3	2	2	3	3	3	3
Overall	2	3	2	3	3	2	2	2	3	2	2	3	3	3	3

**COURSE OBJECTIVES**

To enable the students to

- Gain knowledge on the fundamentals of retailing
- Understand the importance of effective location for retailing
- Understand the importance of atmospherics and space management of retail outlets

**UNIT I INTRODUCTION 9**

Retailing, current global and indian retail scenario in garment and fashion, key drivers of indian apparel retail business, growth of organised apparel retail in India; understanding the retail policy and Indian retail economics, foreign direct investment in Indian apparel retail; emerging trends in apparel retail formats – MNC's role in organized retail formats

**UNIT II RETAIL OPERATIONS AND FORMATS 9**

Operational excellence, customer service strategies, pricing strategies, inventory levels and merchandise availability as a strategy, case studies on Indian and International retail stores, retail business formats, retail management information system

**UNIT III RETAIL PLANNING 9**

Objectives of store planning, location, design, retail image mix, layout plan for retail stores. buying, mark-up and mark-down in merchandise management, private labels; apparel franchising- types, key success factors

**UNIT IV RETAIL SHOP MANAGEMENT 9**

Product management, brand management and retailing, merchandise management, model stock plan, constraining factors, types of suppliers and selection criteria, category management, merchandise management planning in retail segments. OTB planning, sample plan.

**UNIT V E-COMMERCE IN RETAILING 9**

An introduction to fashion e-commerce, apparel and fashion e-business, application of technology infrastructure in apparel and fashion e-commerce; advertising, marketing and e-CRM; e-business: delivery management system, payments, security and legal requirements; case studies

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

Upon completion of this course, the student would be able to

- CO1: Gain knowledge on Indian and global retailing
- CO2: Understand the retail business formats and strategies
- CO3: Understand the importance of effective location for retailing
- CO4: Acquire Knowledge on management of merchandise
- CO5: Outline the benefits of E-commerce business and E marketing

**TEXT BOOKS:**

1. Gibson G. Vedamani., “Retail Management Functional Principles & Practices”, Third Edition, Jaico Publishing House, 2003, ISBN -10:81-7992-151-4
2. Martin.M. Pegler., “Visual Merchandising and Display”, (fifth edition), Fair Child Publications, 2011, ISBN 10: 1563674459
3. Harvey M.Deitel., Paul J.Deitel., and Kate Steinbuhler., “e-business and e-commerce for managers”, Pearson, 2011, ISBN: 0130323640 | ISBN-13: 9780130323644 142

**REFERENCES:**

1. Efraim Turban., Jae K. Lee., David King., Ting Peng Liang., and Deborrah Turban., “Electronic Commerce –A managerial perspective”, Pearson Education Asia, 2012, ISBN: 0139752854 / ISBN: 978-0139752858
2. John Fernie, Suzanne Fernie and Christopher Moore, “Principles of Retailing”, Reed Elsevier India Private Limited, New Delhi, 2007

**COURSE ARTICULATION MATRIX**

Course Outcomes	Program Outcome														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	3	2	3	3	2	2	2	3	2	2	3	3	3	2
CO2	2	3	2	3	3	2	2	2	3	2	2	3	3	3	2
CO3	2	3	2	3	3	2	2	2	3	2	2	3	3	3	2
CO4	2	3	2	3	3	2	2	2	3	2	2	3	3	3	2
CO5	2	3	2	3	3	2	2	2	3	2	2	3	3	3	2
Overall	2	3	2	3	3	2	2	2	3	2	2	3	3	3	2

**OBJECTIVES**

To enable the students to learn

To introduce students to the concept of brand, brand building, branding strategies and legal issues in brand management

**UNIT I PRODUCT DEVELOPMENT 9**

Product – definition, types; product line, product mix; new product development; estimating market and sales potential, sales forecasting

**UNIT II BRANDING TERMINOLOGIES 9**

Brand – definition, evolution, importance; product vs brand; terminologies used in branding; branding – meaning, creation, challenges; brand design – understanding consumer, competition, components, brand identity - brand naming, logos, characters, slogans, tools to maintain identity, illustrations from apparel industry

**UNIT III BRAND BUILDING 9**

Brand building: brand insistence model; advertising – definition, objectives, modes, economic and ethics; non-traditional marketing approach

**UNIT IV BRAND CONCEPTS 9**

Branding strategies; brand extension, brand revitalization, brand repositioning, brand recall, brand elimination, brand imitation

**UNIT V BRAND LEGAL ISSUES AND APPEALS 9**

Brand equity measurement systems; legal issues in brand management; global branding, appeals - basis for appeals, buying motives, appeals and advertising message, types of appeals, essentials of an advertisement appeal; design, trademarks - procedures

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

Upon completion of this course, the student would be able to

CO1: Apply knowledge on product and sales

CO2: Understand the concept of brand and brand identity

CO3: Apply skills for brand building and advertising

CO4: Demonstrate the branding strategies and Extension strategies

CO5: Understand global branding and legal issues

**TEXT BOOKS:**

1. Brad Van Auken, "Branding", Jaico Publishing House, Mumbai, India, 2010.
2. MahimSagar, Deepali Singh, Agrawal DP, Achintya Gupta, "Brand Management", Ane Books India Pvt. Ltd., India, 2009.

**REFERENCES:**

1. Harsh V Verma, " Brand Management", Excel Books, New Delhi, India, 2004
2. Gordon T Kendall, "Fashion Brand Merchandising", Fairchild Publications, New York, 2009

### Course Articulation Matrix

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
<b>CO1</b>	2	3	2	3	3	2	2	2	3	2	2	3	3	3	2
<b>CO2</b>	2	3	2	3	3	2	2	2	3	2	2	3	3	3	2
<b>CO3</b>	2	3	2	3	3	2	2	2	3	2	2	3	3	3	2
<b>CO4</b>	2	3	2	3	3	2	2	2	3	2	2	3	3	3	2
<b>CO5</b>	2	3	2	3	3	2	2	2	3	2	2	3	3	3	2
<b>Overall</b>	2	3	2	3	3	2	2	2	3	2	2	3	3	3	2



**OBJECTIVES**

To enable the students to learn

To impart knowledge on principles marketing, marketing research. Domestic and international market.

**UNIT I FASHION DEVELOPMENT 9**

Consumer demand and fashion marketing; fashion change and consumer acceptance; fashion research and resources; domestic fashion – festival fashion, cultural fashion, sports fashion; international fashion; product and design development

**UNIT II FASHION TREND FORECASTING AND ADOPTION 9**

Introduction to fashion trends; fashion trends in context; the framework for fashion change - forecasting terminologies; overview of fashion forecasting ; fashion adoption -innovation adoption process, factors influencing the rate of adoption - attributes of the innovation, consumer adopter categories; fashion forecasting by qualitative methods and quantitative methods, commercial agencies, role of artificial intelligence in fashion forecasting

**UNIT III COLORS OF THE PAST, PRESENT AND FUTURE 9**

Color forecasting - meaning and symbolism, cultural trends, popular brands, influence of – celebrities, trade shows, movies, domestic and western culture; communicating in color - perceptions of color, color as light - additive colors, subtractive colors, the color wheel, building color schemes; color cycles - historical color cycles, fads and trends, length of color cycles, drivers of color cycles and preferences, trend adoption, the bell curve of color cycles, tradition in color cycles, color forecasting tools and methodologies; color application; intuition and inspiration in color forecasting

**UNIT IV MATERIALS OF THE PAST, PRESENT AND FUTURE 9**

Fabric forecasting – traditional weaves and knits, practical weaves and knits, fabrics of commercial importance; conventional and new material for fibres and yarns; textile product development and marketing; trims, leather and fur; impact of new manufacturing techniques, changes in lifestyle and sustainability

**UNIT V PRODUCT LINE DEVELOPMENT 9**

Analyzing the historic and present trends of product lines; changing consumer demands and need for new product lines; line forecasting and development – principles and methods; styling vs design, transformation - elements, design principles and environment, response time; product development, prototyping and adoption to markets; market segments and categories

**TOTAL: 45 PERIODS****COURSE OUTCOMES**

Upon completion of this course, the student would be able to understand

CO1: understand the fashion market and marketing environment

CO2: understand what is Fashion, Fad, style and its application

CO3: understand the Applied illusions and its Physical effects

CO4: understand what fashion marketing research is, how to do fashion forecasting and what is marketing mix

CO5: impart knowledge in Fashion Products and its importance in Fashion Industry & new Product Development

**TEXT BOOKS:**

- 1) Marian L. Davis, "Visual Design in Dress", Prentice Hall Inc., 1976.
- 2) Elaine Stone," Fashion Merchandising", Blackwell Science Ltd., 2000.
- 3) Mike Easey, "Fashion Marketing", Blackwell Science, 2002.

**REFERENCE:**

- 1) Eundeok Kim, Ann Marie Fiore, Alice Payne, Hyejeong Kim," Fashion Trends: Analysis and Forecasting", 2 nd Ed., Bloomsbury Visual Arts 2021

**Course Articulation Matrix**

Course Outcomes	Program Outcome														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	3	2	3	3	2	2	2	3	2	2	3	3	3	3
CO2	2	3	2	3	3	2	2	2	3	2	2	3	3	3	3
CO3	2	3	2	3	3	2	2	2	3	2	2	3	3	3	3
CO4	2	3	2	3	3	2	2	2	3	2	2	3	3	3	3
CO5	2	3	2	3	3	2	2	2	3	2	2	3	3	3	3
Overall	2	3	2	3	3	2	2	2	3	2	2	3	3	3	3



CO5: develop a fashion photography portfolio by using proper tools and methods

**TEXT BOOKS:**

1. Julie Bradford, Fashion Journalism, Routledge publications, 2015
2. Sanda Miller and Peter McNeil, Fashion Journalism History, Theory, and Practice, Bloomsbury Publishing, 2018

**REFERENCES:**

1. Olivier Gerval Richmond Hill , "Fashion: concept to catwalk", FireflyBooks, USA, 2010.
2. Jeff Rojas , "Photographing Women - posing, lighting, and shooting techniques for portrait and fashion photograph", Rocky Nook Inc, CA, USA, 2016
3. Kate Nelson Best, The History of Fashion Journalism, Bloomsbury Publishing, 2017
4. Peter McNeil and Sanda Miller Fashion Writing and Criticism History, Theory, Practice, Bloomsbury Publishing, 2014

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
<b>CO1</b>	2	2	3	3	-	-	2	-	2	-	-	3	2	1	2
<b>CO2</b>	2	2	3	3	-	-	2	-	2	-	-	3	2	1	2
<b>CO3</b>	2	2	3	3	-	-	2	-	2	-	-	3	2	1	2
<b>CO4</b>	2	2	3	3	-	-	2	-	2	-	-	3	2	1	2
<b>CO5</b>	2	2	3	3	-	-	2	-	2	-	-	3	2	1	2
<b>Overall</b>	2	2	3	3	-	-	2	-	2	-	-	3	2	1	2

**OBJECTIVES**

To enable the students to learn

To give the students an exposure on artificial intelligence.

**UNIT I INTRODUCTION 9**

Concept of AI, history, current status, scope, agents, environments, problem formulations, review of tree and graph structures, state space representation, Search graph and Search tree

**UNIT II SEARCHALGORITHMS 9**

Random search, search with closed and open list, depth first and breadth first search, Heuristic search, best first search, A\* algorithm, game search; application in fashion domain

**UNIT III PROBABILISTIC REASONING 9**

Probability, conditional probability, Bayes rule, Bayesian networks- representation, construction and inference, temporal model, hidden Markov model; application in fashion domain

**UNIT IV MARKOV DECISION PROCESS 9**

MDP formulation, utility theory, utility functions, value iteration, policy iteration and partially observable MDPs; application in fashion domain

**UNIT V REINFORCEMENT LEARNING 9**

Passive reinforcement learning, direct utility estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning- Q learning; application in fashion domain

**TOTAL: 45 PERIODS**

**OUTCOMES:**

Upon completion of this course, the student shall be able to

CO1: Comprehend the concepts of artificial intelligence

CO2: Apply the search algorithm

CO3: Explain the application of probabilistic reasoning

CO4: Discuss the Markov decision process

CO5: Appraise the reinforcement learning

**TEXT BOOKS**

1. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach" , 3rd Edition, Prentice Hall
2. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill

**REFERENCES**

1. Trivedi, M.C., "A Classical Approach to Artificial Intelligence", Khanna Publishing House, Delhi.
2. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2011.

3. David Poole and Alan Mackworth, "Artificial Intelligence: Foundations for Computational Agents", Cambridge University Press 2010.

### Course Articulation Matrix

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
<b>CO1</b>	3	3	3	3	3	-	-	-	-	3	-	2	3	3	2
<b>CO2</b>	3	3	3	3	3	-	-	-	-	3	-	2	3	3	2
<b>CO3</b>	3	3	3	3	3	-	-	-	-	3	-	2	3	3	2
<b>CO4</b>	3	3	3	3	3	-	-	-	-	3	-	2	3	3	2
<b>CO5</b>	3	3	3	3	3	-	-	-	-	3	-	2	3	3	2
<b>Overall</b>	3	3	3	3	3	-	-	-	-	3	-	2	3	3	2

**OBJECTIVES:**

To enable the students to learn

- To acquaint students with the concept of sustainability and its relevance in textile and fashion industry.
- To impart knowledge about eco-friendly processes, products and circular economy.

**UNIT I ECO-FRIENDLY AND SUSTAINABLE APPROACHES TO FASHION TEXTILES 9**

Sustainable development goals for the textile and fashion industry; overview of textile industry and sustainability practices for environmental, social and economic impacts across the textiles and fashion industry; consumer behavior and its importance in the sustainability of the clothing field

**UNIT II SUSTAINABLE TEXTILES AND CERTIFICATIONS 9**

Cotton-organic, naturally coloured, bast fibre based -hemp, flax, jute, ramie, wool, silk; Standards and certification: GOTS, Organic Content Standard (OCS) and the Recycled Claim Standard (RCS), Global Recycle Standard, Responsible wool standard, Oeko-tex, SA 8000, Fair Trade, WRAP.

**UNIT III REGULATIONS AND RECOMMENDATIONS FOR USING CHEMICALS, RAW MATERIALS 9**

Waste handling for sustainable textiles & clothing. red listed textile chemicals, their sources, recommendations and remedial measures; environmental impact audit for pollution control, toxicology of textile dyes and chemicals, eco-parameters and testing of various toxic chemicals and dyes; reduction of carbon footprints and water foot print in textile processing.

**UNIT IV ECO-FRIENDLY GARMENT PROCESSING 9**

Modern approaches to eco-friendly wet processing of woven and knitted garments; washing and processing of denims using eco-friendly methods; use of enzymes and natural dyes; introduction and importance of recycling and up cycling for growing source of innovative design in the fashion and accessories, processing, production and their applications; ethical, standard practices for sourcing of sustainable fashion clothing and accessory.

**UNIT V CIRCULAR ECONOMY 9**

Ethical practices such as fair trade, living wages and safe working. environmental issues relating to textiles and fashion industry; concept of circular economy in textile and apparel industry; traceability and transparency for sustainable fashion-apparel supply chain.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

Upon completion of this course, the student would be able to

CO1: Gain knowledge on sustainable approaches in apparel sector

CO2: Understand the availability of different sustainable textile materials

CO3: Understand the regulations and recommendations followed for sustainable materials used in apparel processing

CO4: Gain knowledge on various approaches of eco-friendly garment processing

CO5: Understand the ethical and environmental issues with the textile processing

**TEXT BOOKS:**

1. Christie R M, "Environmental aspects of textile dyeing", Woodhead Publishing Ltd UK, 2007.
2. Mahapatra N N, "Textile and Environment", Woodhead Publishing India Pvt. Ltd., 2015.
3. Richard Blackburn, "Sustainable textiles: Life cycle and environmental impact", Woodhead Publishing Ltd, UK, 2009.

**REFERENCES:**

1. Parthiban M, Srikrishnan M R, Kandhavadi P, "Green Apparels", Woodhead Publishing India Pvt., Ltd., 2019.
2. Parthiban M, Srikrishnan M R, Kandhavadi P, "Sustainability in Fashion and Apparels", Woodhead Publishing India Pvt. Ltd., 2017.
3. Subramanian Senthilkannan Muthu, "Fast Fashion, Fashion Brands and Sustainable Consumption", Springer, 2019.

**Course Articulation Matrix**

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3	3	3	-	2	3	3	-	2	-	2	2	2	2
CO2	2	3	3	3	-	2	3	3	-	2	-	2	2	2	2
CO3	2	3	3	3	-	2	3	3	-	2	-	2	2	2	2
CO4	2	3	3	3	-	2	3	3	-	2	-	2	2	2	2
CO5	2	3	3	3	-	2	3	3	-	2	-	2	2	2	2
Overall	2	3	3	3	-	2	3	3	-	2	-	2	2	2	2



**OBJECTIVES**

To enable the students to learn

- To develop skills on draping the different styles of the garment and analyse the fit of the garment on construction

Design, drape, construct and analyse the fit of the following designs

- Cowl variations
- Skirt
- Pants
- Shift dress
- Empire line dress
- Bias cut dress
- Strapless dress
- Shirt
- Knit halter dress
- Styles of saree draping

**TOTAL: 90 PERIODS**

**COURSE OUTCOMES**

Upon completion of this course, the student would be able to

CO1: Design different drapery style of garments

CO2: Construct the draped style using appropriate seams

CO3: Analyse the fit of the draped styles

**Course Articulation Matrix**

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	3	3	-	-	2	-	2	-	-	3	2	3	2
CO2	2	2	3	3	-	-	2	-	2	-	-	3	2	3	2
CO3	2	2	2	2	-	-	2	-	2	-	-	2	2	2	2
Overall	2	2	2.6	2.6	-	-	2	-	2	-	-	2.6	2	2.6	2

**OBJECTIVES**

To enable the students to learn

This course aims at introducing the evolution of clothing and traditional textiles of India

**UNIT I INTRODUCTION 9**

Evolution of clothing – Origin & functions of clothing – beginning of civilization –Historical significance, colour, motif and manufacturing techniques

**UNIT II TEXTILES OF NORTHERN INDIA 9**

Traditional Woven textiles of North India – Brocades of Banaras, Baluchari, Chanderi and Tanchoi. Traditional Embroideries of North India – Kashida, Phulkari, Chambarumal and Chikankari. Traditional costumes of North States of India – Jammu & Kashmir, Punjab, Himachal Pradesh, Haryana, Uttaranchal and Uttar Pradesh.

**UNIT III TEXTILES OF SOUTHERN INDIA 9**

Traditional woven textiles of Southern states of India – Paithani and Pitambar, Pochampalli, Kancheevaram, Himrus, Kalamkari, Pipli, Mysore silk, Aarni Silk. Traditional embroideries of South India – Thoda embroidery, Kasuti of Karnataka and Aari embroidery. Traditional costumes of Southern states of India – Tamil Nadu, Kerala, Karnataka and Andhra Pradesh.

**UNIT IV TEXTILES OF EASTERN INDIA 9**

Traditional woven textiles of Eastern states of India – Dacca muslin, Applique work of Bihar. Traditional embroideries of East India – Kantha of Bengal, Sujani embroidery, Manipuri embroidery and Nagaland embroidery. Traditional costumes of Eastern states of India – West Bengal, Bihar, Jharkand, Arunachal Pradesh, Assam, Sikkim, Nagaland, Manipur, Mizoram, Meghalaya and Tirupura.

**UNIT V TEXTILES OF WESTERN INDIA 9**

Traditional woven textiles of Western states of India – Maheshwari sarees of Madhya Pradesh, Patola, Bandhini and Amrus. Traditional embroideries of Western India – Sindhi embroidery – Kutch, Ari Bharath, Kanbi Bharath, Mochi Bharath, Shisha embroidery. Traditional costumes of Western states of India – Rajasthan, Gujarat, Maharastra, Madhya Pradesh, Chhattisgarh and Goa.

**TOTAL = 45 PERIODS****COURSE OUTCOMES**

After successful completion of this course, the students should be able to

CO1 Understand the various century's costumes and traditional textiles in India

CO2 Acquire knowledge on the concepts on colour, motif and specialization in different state costumes of India

CO3 Classify regional embroideries of India

CO4 Identify a specific embroidery style of India on the basis of colours, motifs and layout

CO5 Identify the influencing factors for development and evolution of a specific embroidered textile.

## REFERENCES

1. John Gillow & Nicholas Barnad, "Traditional Indian Textiles". Thames & Hudson, 1993
2. Rta Kapur chishti & Amba Sanyal, "Saris of India – Madhya Pradesh," Wiley Eastern Ltd. 1989
3. The Guide to Historic Costumes, Karen Baclawski, Drama Publishers (1995)
4. Ancient Indian Costume, Roshen Alkazi, Art Heritage (1983)
5. Martand Singh, "Saris' of India – Bihar & West Bengal", Wiley Eastern Ltd. 1993
6. Costumes and textiles of Royal India – Ritu Kumar Published by Christie's Books.
7. Impressions – a classic collection of Indian textiles design (with cd) Prakasha.K
8. Traditional Embroideries of India Shailaja D. Naik

**OBJECTIVE**

To enable the students to learn

This course aims at introducing the fundamentals of chemistry and technology of leather manufacture in response to current market scenario, application avenues and future requirements.

**UNIT I INTRODUCTION****9**

Classification of Leather Goods and Garments; Selection of Materials, grading and assorting of leathers for leather goods and garments; Property requirements for leather and other materials; Accessories for Leather goods and garments - Various types of fasteners, fittings and other accessories. Alternative materials and their adaptability for goods and garments. Operational sequences in leather goods and garments production.

**UNIT II MACHINERIES****9**

Machinery needs for leather goods and garments manufacture: Various types of sewing machines – flat bed, cylinder bed, post bed and other special sewing machines – different feed mechanisms: Clicking, splitting, skiving, folding, embossing, creasing machines – their working principles operation and maintenance.

**UNIT III PATTERN MAKING****9**

Pattern design and development – measurement/ sizing for various types of garments, pattern design of leather goods and garments, pattern grading for leather garments. CAD applications for leather goods and garments: Fashion and material trends.

**UNIT IV CONSTRUCTION****9**

Fabrication of leather garments- principle of cutting components, type of stitching and attachment, sequence of operation for assembly of components, accessories used. Preparation of sectional patterns, pattern sets, arrangements of patterns to minimize wastage of leathers: Types of leather garments, Leather jackets –pattern and construction sequence, Shoe: parts, selection of leather, designing and fabrication of shoes, machineries.

**UNIT V QUALITY CONTROL****9**

Quality control of leather garments: General properties of leather such as feel, texture, strength, elongation, comfort, rub resistance, uniformity of shades, defects in skin. Types of tests carried out, testing instruments and methods. In process and final process control of leather garments. Impact of leather processing on environment and remedial measures

**TOTAL : 45 PERIODS****OUTCOMES:**

On the completion of the course students are expected

CO1.To know various materials and components for the manufacture of leather goods and garments.

CO2.To understand various operations involved in making of leather good and garments.

CO3.To understand the working principle, operation and maintenance of different machineries used for making leather goods and garments

CO4.To gain fundamental knowledge on design and development of leather goods and garments

CO5.To understand Organisation and management of leather goods and garments manufacturing unit.

**TEXT BOOKS:**

1. Pattern Making Manual - Womens Garments, ESMOD, Paris, 1991.
2. Fashion Drawing Method, ESMOD, Paris, 1992.
3. Metric Pattern cutting for Menswear, Winifred Aldrich, BSP Professional Books, London, 1990.
4. Grading Manual, ESMOD, Paris, 1994.
5. Skiving Manual, First Edition, 1994 CLRI, Madras.
6. A course manual on leather garment pattern designing.
7. Leather garments making, NIMI publication, 2012.
8. Leather and sports goods – Pattern and Template marker, NIMI Publications, 2011
9. Dutta.S S , "An Introduction to the Principles of Leather Manufacture", Indian Leather Technologists Association, Calcutta, 2002.
10. Thomas C, and Thorstensen , "Practical Leather Technology", Krieger Publishing Company, USA, 2001.

**REFERENCES:**

1. Sandy Scrivano , "Sewing with Leather & Suede", Lark Books, New York, 2002.
2. Sarkar.K.T , "Theory and practice of leather manufacture", Macmillan India Press, Madras, 1997.
3. Somenath Ganguly, "Comprehensive Footwear Technology", Indian Leather Technologists' Association, India, 2005.
4. Dutta.S.S , "An Introduction to the Principles of Physical Testing of Leather", Indian Leather Technologists' Association, India, 1991.

**Course Articulation Matrix**

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
<b>CO1</b>	3	3	3	2	3	1	1	2	3	3	1	3	3	2	1
<b>CO2</b>	2	2	3	2	3	1	1	2	1	3	1	3	3	2	1
<b>CO3</b>	1	2	3	3	2	2	2	1	2	2	2	3	3	2	1
<b>CO4</b>	3	3	3	2	1	1	1	2	3	3	1	3	3	2	1
<b>CO5</b>	3	3	3	2	1	1	1	2	3	3	1	3	3	2	1
<b>OVERALL</b>	3	2	3	1	2	2	2	2	3	2	1	3	3	2	1

**OBJECTIVES:**

To enable the students to learn

- To enable the students to learn about human anthropometrics, sizing system and concepts of clothing fit and its evaluation.

**UNIT I HUMAN ANTHROPOMETRICS 9**

Terms and definitions, selection of anthropometric data for clothing design, selection of anthropometric design approach, anthropometric methods - traditional anthropometry, three dimensional methods, international standards, landmarks, body measurement devices and techniques, body scanning and its applications.

**UNIT II SIZING ANALYSIS AND SHAPE REQUIREMENTS 9**

Body shape analysis, classification of body shapes, characteristic differences among figures, posture – types, figure types- vertical, horizontal; sizing and shape requirements of children, male, female, elderly, maternity and intimate wears, clothing style selection for figure types.

**UNIT III SIZING SYSTEM DEVELOPMENT 9**

Sizing system development- importance, size and shape surveys, anthropometric analysis, size analysis, key or control measurements, developing and validating sizing system, statistics used in sizing system development, apparel size designation and labeling, International sizing.

**UNIT IV TESTING AND EVALUATION OF FIT 9**

Fit -Definition, importance, standards, influences of clothing fit; Testing methods for dimensional fit; Evaluating fit – subjective method - rating scales, subjective fitting guide; Objective method- moiré optics, algebraic evaluation of clothing fit, clothing waveform, pressure evaluation of clothing fit, 3D modeling of pressure fit; Alternative methods for evaluating fit using structural line, grain line, wrinkles, pinch test, inside measurement; Influence of material and movement on fit

**UNIT V PATTERN ALTERATION 9**

Commercial patterns and block; pattern alteration- importance, principles, pattern alteration for different types of garments and irregular figures; garment fit- evaluation techniques; fitting problem & analysis - length, back, shoulder, sleeve, neckline, bust & upper body.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

Upon the completion of the course the student shall be able to

CO1: Analyze the measurement methods and devices used for the collection of anthropometry data

CO2: Analyse the various sizing and shape requirements of different categories of human figures

CO3: Analyse the anthropometric data for developing the sizing system for differing categories

CO4: Test and evaluate the fit of the garment through objective and subjective methods

CO5: Interpret the various pattern alteration requirements in relation to different body shapes

**TEXT BOOKS:**

1. Deeptigupta, NorsaadahZakaria, "Anthropometry, sizing and design", Wood head Publishing Limited, England, 2019.

2. Fan J, Yu W and Hunter L, "Clothing Appearance and Fit", The Textile Institute, Wood head Publishing Limited, England, 2004, ISBN:9781855737457
3. Ashdown S P, "Sizing in clothing", The Textile Institute, Woodhead Publishing Limited,England, 2007, ISBN: 9781845690342

**REFERENCES:**

1. Jacob Solinger., "Apparel Production Handbook", Reinhold Publications, 1998, ISBN: 1879570009 / ISBN: 978-1879570009
2. Shaeffer Claire., "Sewing for the Apparel Industry", Prentice Hall, New Jersey, 2001, ISBN: 0321062841 | ISBN-13: 9780321062840
3. Patty Brown., and Janett Rice., "Ready-To-Wear Apparel Analysis", Third Edition, PrenticeHall Inc., New Jersey,2000, ISBN: 0130254347 | ISBN-13: 9780130254344
4. Chuter A.J., "Introduction to Clothing Production Management", Blackwell Scientific Publications, Oxford, 2001, ISBN: 0632039396 | ISBN-13: 9780632039395
5. Sandra Betzina , "Fast Fit-Easy pattern alterations for every figure", The Taunton Press, Inc., Singapore, 2003, ISBN:978-1561586493

**Course Articulation Matrix**

Course Outcomes	Program Outcome														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	CO1	2	1	3	1	-	-	2	2	-	-	-	2	2	1
CO2	2	1	3	1	-	-	2	2	-	-	-	2	2	1	2
CO3	2	1	3	1	1	-	0	0	-	-	-	2	2	1	2
CO4	2	1	3	1	1	-	0	0	-	-	-	2	2	1	2
CO5	2	1	3	1	-	-	2	2	-	-	-	2	2	1	2
Overall	2	1	3	1	1	-	2	2	-	-	-	2	2	1	2

**VERTICAL - VI  
FUNCTIONAL TEXTILES  
PROTECTIVE GARMENTS**

**AT23025**

**L T P C  
3 0 0 3**

**OBJECTIVES**

To enable the students to learn

- To Introduce about basic elements required for protective garments
- To impart the conceptual knowledge about the chemical finishes required for protective garments
- To understand the different application areas of protective garments
- To understand the implicit knowledge of protective garment construction
- To analyse and evaluate the protective garments codes of standards

**UNIT I            FIBRES, YARNS AND FABRICS FOR PROTECTIVE GARMENTS            9**

Selection of fibres-suitability and properties of fibres for various protective clothing, chemical composition and physical structure, characteristics and working of various fibres according to different end uses like ballistic protection, protection against extreme temperatures, protection against electromagnetic fields and anti-microbial protection; yarn and fabric (knitted, woven and non-woven) parameters, methods of production, effect of structure on their performance; use of composite materials in protective clothing.

**UNIT II            CHEMICAL FINISHES FOR PROTECTIVE GARMENTS            9**

Use of coated fabrics – different types of finishes like fire retardant finishes, water repellent finishes, anti-microbial finishes; chemical finishes against radiation and chemicals – method of application of those finishes; coating machines and techniques used for such applications; finishes for garments worn by health care workers; coatings for high visibility fabrics and pressure suit fabrics.

**UNIT III           GARMENT CONSTRUCTION AND DESIGN OF PROTECTIVE GARMENTS            9**

Garment construction –seams and stitches, method of construction for physical integrity and strength of garments; sewing techniques and humanistic design for – boiler suits, NBC suits, bomb disposal suits, fire proximity suits, hazmat suits and immersion suits; other advanced materials and garment accessories used in protective garments; other protective gears – gas/functional masks, respirators, gloves, guards/pads and knee caps, helmets, harness.

**UNIT IV           EVALUATION OF PROTECTIVE TEXTILES I            9**

Standards and test methods for evaluating the performance of protective textile against physical and mechanical hazards; test methods for finished protective textiles; analysis of comfort properties of protective clothing – concept of dynamic manikins, thermal manikins and segmented thermal manikins

**UNIT V            EVALUATION OF PROTECTIVE TEXTILES II            9**

Standards and test methods for evaluating the performance of chemical, biological resistance textiles - permeation resistance test-index of penetration and index of repellency; liquid tight integrity and gas tight integrity; evaporative resistance measurement-moisture permeability index, skin model; test for protection against electromagnetic fields

**TOTAL: 45 PERIODS**





**OBJECTIVE:**

To enable the students to learn

- To acquaint students on the design, material, accessories and sewing aspects of intimate garments

**UNIT I MATERIAL 9**

Intimate apparels –classification; materials-fibre, fabric, accessories and finishes; physical and physiological requirements of intimate apparels

**UNIT II MEN'S INTIMATE APPAREL 9**

Design analysis, measurements, pattern drafting of men's intimate apparel – long johns, tank top, basic shorts, knickers, bikini underwear, thong, briefs, boxer shorts and jock strap.

**UNIT III WOMEN'S INTIMATE APPAREL 9**

Design analysis, measurements, pattern drafting of women's intimate apparel – petticoats, panties, camisoles, tube top, shape wear, bikini and brassier – seamless, half cup and full cup bra.

**UNIT IV INTIMATE APPAREL MANUFACTURE I 9**

Intimate apparel accessories - bra wire, hook and eye tape, ring and slider, buckle, plastic bone, elastics and sewing threads

**UNIT V INTIMATE APPAREL MANUFACTURE II 9**

Sewing of intimate apparels - seams, stitches, machines; lamination; moulding and ultrasonic welding technique

**TOTAL: 45 PERIODS**

**OUTCOMES:**

Upon completion of this course, the students will have the skills essential to

CO1 - Select fibres and fabric for intimates

CO2 - Design and draft pattern for men's intimate apparel

CO3 - Design and draft pattern for women's intimate apparel

CO4 - Select required accessories

CO5 - Know about seams, stitches and seamless technology to develop intimates

**TEXT BOOKS:**

1. Yu W., Fan J., Harlock S.C., and Ng S. P., "Innovations and Technology of Women's Intimate Apparel", Wood head Publishing Limited, England 2006, ISBN: 0849391059 | ISBN-13: 9780849391057.
2. Ann Haggard., "Pattern Cutting for Lingerie, Beachwear and Leisurewear", Black Well Science Limited, France, 2004, ISBN: 140511858X / ISBN: 978-1405118583.

**REFERENCES:**

1. Winnie Yu, "Advances in Women's Intimate Apparel Technology", Wood head Publishing Limited, UK, 2016, ISBN: 978-1-78242-369-0 / ISBN: 978-1-78242-390-4.

2. Ruth E. Glock., and Grace I. Kunz., "Apparel Manufacturing, Sewn Product Analysis", fourth edition, Pearson Education,2004, ISBN: 0131119826 ISBN-13: 9780131119826

**Course Articulation Matrix**

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
<b>CO1</b>	3	3	2	3	2	2	2	2	2	2	2	2	2	2	3
<b>CO2</b>	3	3	2	3	2	2	2	2	2	2	2	2	2	2	3
<b>CO3</b>	3	3	2	3	2	2	2	2	2	2	2	2	2	2	3
<b>CO4</b>	3	3	2	3	2	2	2	2	2	2	2	2	2	2	3
<b>CO5</b>	3	3	2	3	2	2	2	2	2	2	2	2	2	2	3
<b>Overall</b>	3	3	2	3	2	2	2	2	2	2	2	2	2	2	3

**OBJECTIVES**

- To enable the students to understand the concept and construction of smart fabrics and interactive garments

**UNIT I          SENSORS****6+3**

Smart fabrics – passive, active, very smart; classification of smart materials, concept of wearable computing; Introduction to sensors; principle, design, working mechanism and application- Thermal sensors, Light sensors, Sound sensors, Humidity sensors, Strain sensors, Chemical sensors, Biosensor; development of textile based sensors

**UNIT II          ACTUATORS AND STORAGE DEVICE****6+3**

Introduction to actuators; materials for actuators; types of actuations, design, working mechanism, types of actuators and application; storage device- introduction, types, materials, working mechanism and applications; development of textile based actuators and storage devices

**UNIT III          CONTROL UNITS AND DATA PROCESSING****6+3**

Control units- introduction, types, materials, working mechanism and applications; communication and data processing

**UNIT IV          INTEGRATION OF ELECTRONICS TO TEXTILE STRUCTURES****6+3**

Integration of sensors, actuators, storage devices and control units into textiles by spinning, weaving, e-broidery, printing, coating techniques; e- composites

**UNIT V          DESIGN OF SMART INTERACTIVE GARMENTS****6+3**

Requirements, selection of material and sensors, garment construction for smart interactive garments - military applications, hospital and patient care, sports and fitness activities; smart home textiles

**TUTORIALS****15**

Design and development of smart textiles and garments

**TOTAL: 45 PERIODS****OUTCOMES:**

Upon completion of this course, the students shall be able to

CO1: Classify and explain the design of sensors

CO2: Explain and analyse the functions of actuators

CO3: Discuss on control units and data processing

CO4: Comprehend the integration of electronics to textile

CO5: Design smart interactive garments

## TEXT BOOKS

1. Sanjay Gupta, "Smart Textiles their Production and Marketing Strategies", NIFT, New Delhi, 2000.
2. William C. Smith., "Smart Textile Coatings and Laminates", Wood Head Publishing Series in Textiles, UK, 2010, ISBN 978-1-84569-379-4.
3. Mattila HR, "Intelligent Textiles and Clothing", The Textile Institute, CRC press, New York, & Washington, Wood Head Publishing Ltd., England, 2006.
4. Xiaoming T, "Wearable Electronics and Photonics", The Textile Institute, Wood Head Publishing Ltd., England, 2005 203

## REFERENCES

1. Tao X.M., "Smart Fibres, Fabrics and Clothing Fundamentals and Application", Wood Head Publishing Ltd., October 2001, ISBN 1 855735466.
2. Mc Cann J. and Bryson D., "Smart Clothes and Wearable Technology", Wood Head Publishing Series in Textiles, UK, 2010, ISBN-10: 1845693574.
3. Langenhove L V, "Smart textiles for medicine and healthcare", Textile Institute & CRC press, Woodhead publishing ltd., England, 2007.
4. Xiaoming Tao, Hand book of smart textiles, Springer-Verlag, Singapur,2015

## Course Articulation Matrix

Course Outcomes	Program Outcome														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	2	2	2	1	2	1	1	2	1	1	2	2	2
CO2	3	2	2	2	2	1	2	1	1	2	1	1	2	2	2
CO3	3	2	2	2	2	1	2	1	1	2	1	1	2	2	2
CO4	3	2	2	2	2	1	2	1	1	2	1	1	2	2	2
CO5	3	2	2	2	2	1	2	1	1	2	1	1	2	2	2
Overall	3	2	2	2	2	1	2	1	1	2	1	1	2	2	2

**COURSE OBJECTIVES**

To enable the students to learn

To impart knowledge on requirements of sports textiles, coated and laminated sports textiles, sports garment designing and evaluation

**UNIT I                      SPORTSWEAR - PHYSIOLOGICAL COMFORT                      9**

Sportswear – introduction, types; textiles in sportswear; sportswear - comfort and protection from injury, functional requirements; wear comfort of sportswear, measurement of physiological comfort; heat exchange mechanism and heat balance, water resistance, water vapour transfer, condensation problem in waterproof breathable fabrics for sportswear

**UNIT II                      COATED AND LAMINATED TEXTILES IN SPORTSWEAR                      9**

Sports products from coated and laminated fabrics; fibre and fabric preparation for coated fabrics; transfer, rotary screen, micro porous coating; determination of coating add-on; lamination in sportswear; finishes for sportswear- mechanism, chemistry and application

**UNIT III                      SPORTS GARMENT DESIGNING                      9**

Design of sports garments – selection of fibre, yarn and fabrics for different types of sports, construction of sports garments; advancements in textile materials for active wears

**UNIT IV                      OTHER SPORTS PRODUCTS DESIGNING                      9**

Design of sports foot wear, protective gears, glove – components, design features, selection of material, construction

**UNIT V                      EVALUATION OF SPORTS TEXTILES                      9**

Standards and test methods for sports textiles, testing of coated and laminated sportswear fabrics

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

At the end of the course the students would be able to

CO1: Explain physiological comfort requirement of sports textile products

CO2: Explain development and application of coated and laminated textiles as sports textiles.

CO3: Design sports garments

CO4: Design sports footwear, glove and protective gears.

CO5: Explain evaluating of sportswear

**TEXT BOOKS**

1. R.Shishoo, "Textiles for sportswear", Woodhead Publishing Series in Textiles, Cambridge, England, 2015

2. Ghosh. S. K., "Functional Coatings", Wiley-VCH Verlag, GmbH & Co. KGaA, Weinheim, 2006, ISBN:3-527-31296-X.
3. R.Shishoo, Textiles in Sports, Woodhead Publishing Series in Textiles, Cambridge, England, 2005.

#### REFERENCES

1. A.R. Horrocks& S.C. Anand (Eds.), "Handbook of Technical Textiles", The Textile Institute, Manchester, U.K., Woodhead Publishing Ltd., Cambridge, England, 2000.
2. S. Adanur "Wellington Sears Handbook of Industrial Textiles", Technomic Publishing Co. Inc., Lancaster, Pennsylvania, 1995.
3. A.K.Sen, Coated Textiles: Principal and Applications, Technomic Publication, Lancaster, 206 Pennsylvania, USA, 2001.
4. Schindler W.D and Hauser P., "Chemical Finishing of Textiles"., Woodhead Publications, ISBN: 18557390545. Richard. A.Scott, Textiles for Protection, CRC press, Woodhead Publication, USA, 2005
5. Fung.W, Coated and Laminated Textiles", Woodhead Publishing Ltd.,Cambridge,UK,2002, 6. ISBN1-85573-576-8.

#### Course Articulation Matrix

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	3	2	-	-	-	-	-	-	-	2	2	2	2
CO2	2	2	3	2	-	-	-	-	-	-	-	2	2	2	2
CO3	2	2	3	2	-	-	-	-	-	-	-	2	2	2	2
CO4	2	2	3	2	-	-	-	-	-	-	-	2	2	2	2
CO5	2	2	3	2	-	-	-	-	-	-	-	2	2	2	2
Overall	2	2	3	2	-	-	-	-	-	-	-	2	2	2	2

**OBJECTIVES:**

To enable the students to learn about

- Scope of textile materials in medical field
- Significance of biomaterials and applications
- Biomedical application of different textile structures

**UNIT I MATERIALS USED IN MEDICAL APPLICATIONS 9**

Biomaterials; Classification of medical textiles - types, features, applications and limitations; chemistry and synthesis of biopolymers - synthetic and natural biopolymers, metals and ceramics; super absorbent polymers; cell- biomaterial interaction

**UNIT II WOUND DRESSINGS AND BANDAGES 9**

Wound - classification, stages of healing, and type of care required; wound dressing - requirements, types, construction, features and limitations; bandages – types, construction, features and applications; testing of wound dressing and bandages; standards

**UNIT III IMPLANTABLE DEVICES AND INTELLIGENT TEXTILES 9**

Sutures - specifications, types, manufacturing, characteristics and applications; Implantable biomedical devices, vascular grafts, artificial tendons and ligaments- materials, types, features

**UNIT IV EXTRA-CORPOREAL DEVICES 9**

Extra-corporeal devices - artificial leg, kidney, liver, lungs; scaffolds for tissue engineering - development and characterization; safety, legal and ethical issues involved in conducting trials with medical textile materials;

**UNIT V INFECTION CONTROL, BARRIER AND HYGIENE CARE 9**

Healthcare and hygiene products: surgical gowns, masks, respirators, wipes, napkins, antibacterial, antiodour textiles- materials, types, construction, features, applications and limitations; Regulations - disposal of medical textile products

**TOTAL:45 PERIODS****OUTCOMES:**

Upon completion of this course, the student shall be able to

CO1: Comprehend the use of materials in medical applications

CO2: Appraise various types and characteristics of wound dressings, bandages and pressure garments

CO3: compare the various types of implantable and intelligent textiles

CO4: comprehend about the requirement, material of extracorporeal devices and to study safety and legal issues in medical textiles

CO5: comprehend about textiles used for infection control and hygiene care

**TEXT BOOKS**

1. Allison Mathews., and Martin Hardingham., "Medical and Hygiene Textile Production- A Hand Book", Intermediate Technology Publications, 1994, ISBN: 1853392111 | ISBN-13: 9781853392115



- Anand S.C., Kennedy J.F., Mirafteb M., and Rajendran S., "Medical Textiles and Biomaterials for Health Care", Wood head Publishing Ltd., 2006, ISBN: 0849317800 | ISBN-13: 9780849317804

## REFERENCES

- Joon B. Park., and Joseph D. Bronzino., "Biomaterials – Principles and Applications", CRC Press, Boca Raton London, New York, Washington, D.C. 2002, ISBN: 0849314917 | ISBN-13: 9780849314919
- Anand S., " Medical Textiles", Textile Institute, 1996, ISBN: 185573317X
- Horrocks A.R., and Anand S.C., "Technical Textiles", Textile Institute, 1999, ISBN: 185573317X
- Adanur S., "Wellington Sears Handbook of Industrial Textiles", Technomic Publishing Co. Inc., Lancaster Pennsylvania, 1995, ISBN 1-56676-340-1
- Michael Szycher., and Steven James Lee., "Modern Wound Dressing: A Systematic Approach to Wound Healing", Journal of Biomaterials Applications.

Course Outcomes	Program Outcome												Program Specific Outcome		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
<b>1</b>	-	-	3	3	-	2	2	3	1	2	2	3	-	2	3
<b>2</b>	2	-	3	3	-	2	3	2	1	1	1	3	2	2	3
<b>3</b>	-	-	2	3	-	2	2	2	-	1	1	3	-	2	1
<b>4</b>	2	-	3	3	-	3	3	3	1	1	2	3	2	2	3
<b>5</b>	-	-	3	1	-	3	2	3	1	2	2	1	-	2	2
<b>Overall CO</b>	0.8	-	2.8	2.6	-	2.4	2.4	2.6	0.8	1.4	1.6	2.6	0.8	2	2.4

**OBJECTIVES**

To enable the students to learn about

- Various kinds of materials used as home textiles
- Recent developments in home furnishing, floor covering and other home textile products
- Finishes and Evaluation required for home textiles.

**UNIT I INTRODUCTION 9**

Concepts of Home textiles and its market scenario, consumer expectation from home textiles; fibers and fabrics used - Woven, nonwoven and knits; manufacturing concepts- damask, brocade, organdie, chiffon, oxford, tapestry Textile surface design - basic techniques and applications.

**UNIT II HOME FURNISHING 9**

Living room furnishings – types, fabric selection and design concepts; bed room furnishings- types, fabric selection and design concepts; advances in the production of different types of bed linen, bed sheets, blankets, blanket covers, comforts, comfort covers, bed spreads, mattress and mattress covers, pads, pillows; kitchen furnishing - fabric selection and finishing for dish cloth, hand towels, aprons, mittens and runners

**UNIT III FLOOR COVERING AND DRAPES 9**

Recent developments in manufacturing of floor coverings - hard floor coverings, resilient floor coverings; soft floor coverings – carpets and rugs, laying procedure, maintenance and care; cushion and pads; factors affecting the selection of floor covering; advances in home decoration -draperies – choice of fabrics ,curtains, finishing of draperies- tucks and pleats; types of drapery rods, hooks, tape rings and pins.

**UNIT IV FINISHES USED IN HOME TEXTILES 9**

Introduction, thermal draperies, protection against unpleasant odour, antimicrobial finish, moisture management finish, flame retardant finish, towel finishing; sensory perception technology; insect and mite repellent finish, antistatic finish; temperature regulated beddings

**UNIT V EVALUATION OF HOME TEXTILES 9**

Test methods - towels, rugs; flammability standards for curtains, test methods for pot holders and woven mittens; labelling and care instructions of home textiles

**TOTAL: 45 PERIODS****OUTCOMES:**

Upon completion of this course, the student shall be able to understand

- CO 1 - Different types of materials used as home textiles
- CO 2 - Selection of fabric and design for living room, bed room and kitchen furnishings
- CO 3 – Selection of floor coverings and draperies
- CO 4 - Finishes used for various home textile products
- CO 5 - Evaluation of home textile products

**TEXT BOOKS:**

1. Alexander N.G., "Designing Interior Environment", Mas Court Brace Covanorich, Newyork, 1972 67

2. Donserkery K.G., "Interior Decoration in India", D.B. Taraporeval Sons and Co. Pvt. Ltd., 1979, ISBN: 0906216338 | ISBN-13: 9780906216330
3. Brian. D Coleman , "Luxurious Home Interiors", Gibbs Smith Publication, Hong Kong, 2004.
4. Premavathy Seetharaman and Parveen Pannu , "Interior Design and Decoration", CBS Publishers and Distributors, New Delhi, India, 2005.

**REFERENCES:**

1. Wingate J. F., and Mohler I. B., "Textile Fabrics & Their Selection", Prentice Hall Inc., New York, 1984, ISBN: 0139128654 | ISBN-13: 9780139128653
2. Subra Das, "Performance of home textiles", Woodhead Publishing India Pvt.Ltd., 2010, ISBN: 0857090070 | ISBN-13: 9780857090072
3. Rowe T., "Interior Textiles Design and Developments", Woodhead Publishing India Pvt.Ltd., 2009, ISBN: 1845693515 | ISBN-13: 9781845693510
4. Schindler W. D., and Hauser P. J., "Chemical finishing of textiles", Woodhead Publishing, England, 2004, ISBN: 1855739054 | ISBN-13: 9781855739054
5. Jay Diamond and Ellen Diamond , "Fashion Apparel, Accessories and Home Furnishings", Prentice Hall, New Delhi, 2007.
6. Katrin Cargill , "Simple Curtains", Ryland Peters and Small, London, 2002.
7. Wendy Baker , "Curtain and Fabric Selector", Collins and Brown, London, 2000.

Course Outcomes	Program Outcome												Program Specific Outcome		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
<b>1</b>	2	2	3	3	-	-	2	-	-	-	-	1	2	1	2
<b>2</b>	2	2	3	3	-	-	2	-	-	-	-	1	2	1	2
<b>3</b>	2	2	3	3	-	-	2	-	-	-	-	1	2	1	2
<b>4</b>	2	2	3	3	-	-	2	-	-	-	-	1	2	1	2
<b>5</b>	2	2	3	3	-	-	2	-	-	-	-	1	2	1	2
<b>Overall CO</b>	2	2	3	3	-	-	2	-	-	-	-	1	2	1	2

## EMERGING TECHNOLOGY COURSES

<b>AT23E01</b>	<b>WEB DESIGNING FOR TEXTILES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### OBJECTIVES:

To enable the students to learn

- To enable the students to learn about fascinating and appealing websites using computer programs and graphics for textile industry.

### **UNIT I INTRODUCTION TO WEB DESIGN 9**

Difference between internet and web, concepts of web page address; anatomy of web page; fundamentals of web page design; dizzying multitude devices; responsive web design

### **UNIT II HTML MARKUP FOR STRUCTURE 9**

Creating a simple page; marking up text; adding links, image, table markup, forms

### **UNIT III CASCADING STYLE SHEET ORIENTATION 9**

Cascading style sheet orientation (CSS); forming text, colors background, thinking inside the box, floating and positioning, page layout with CSS; transitions, transforms, animations, and CSS techniques

### **UNIT IV JAVASCRIPT FOR BEHAVIORS 9**

Basics of java script, adding java script to a page, the anatomy of a script, the browser object and events; use of java script -meet the (Document Object Model) DOM, polyfills, java script libraries

### **UNIT V WEB GRAPHICS 9**

Basics of web graphics -image sources, formats, image size and resolution; introduction to (Scalable Vector Graphics) SVG; lean and mean web graphics-general image optimization strategies, optimizing GIFs, JPEGs, PNGs, optimize to file size

**TOTAL:45 PERIODS**

### COURSE OUTCOMES

Upon completion of this course, the student would be able to

**CO1** Comprehend the basics of web design

**CO2** Visualize the fundamental concepts and elements of HTML

**CO3** Recognize the theory of CSS, Java script and web graphics

**CO4** Comprehend the fundamentals of Java script

**CO5** Explain the theory of web graphics

### TEXT BOOKS:

- Jennifer Niederst Robbins, "Learning Web Design", 4<sup>th</sup> Ed, 2012, ISBN: 978-1-449-31927-4
- Steven M. Schafer, "HTML, XHTML, and CSS Bible", 5<sup>th</sup> Ed, Wiley India

**REFERENCES:**

1. K. Arnold, J. Gosling and D. Holmes, The Java Programming Language, 3rd Ed, Addison Wesley, 2000.
2. P. Deitel and H. Deitel, Java - How to Program, 6th Ed, Prentice-Hall, 2005.
3. B. Breedlove, Web Programming Unleashed, Sams Net Publishing, 1996.
4. C. Musciano and B. Kennedy, HTML: The Definitive Guide, 2nd Ed, O'Reilly, May 1997.
5. D. Flanagan, Java in a Nutshell, O'Reilly, 1997 (also published by Shroff Publishers and Distributors Pvt. Ltd., Mumbai).

**Course Articulation Matrix**

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
<b>CO1</b>	3	2	3	1	3	2	0	1	3	2	2	2	0	3	0
<b>CO2</b>	3	2	3	1	3	2	0	1	3	2	2	2	0	3	0
<b>CO3</b>	3	2	3	1	3	2	0	1	3	2	2	2	0	3	0
<b>CO4</b>	3	2	3	1	3	2	0	1	3	2	2	2	0	3	0
<b>CO5</b>	3	2	3	1	3	2	0	1	3	2	2	2	0	3	0
<b>Overall</b>	3	2	3	1	3	2	0	1	3	2	2	2	0	3	0

**OBJECTIVES:**

- To learn the basic concepts of UX/UI designing
- To provide knowledge on the various tools and techniques used in developing the design

**UNIT I UX/UI & DESIGN THINKING 9**

Scope of UX/UI; Design Thinking - Empathize, Define, Ideate, Prototype, Test; UX Research & Research Data analysis; User research; basic types in user research - Primary Research, Secondary Research; Research Data Analysis; User Personas; Empathy & User Journey Mapping

**UNIT II DESIGN STRATEGY & PROTOTYPING 9**

Information Architecture; Story boarding; Sketching; Low fidelity wireframe Heuristics & Laws; Heuristics – definition, heuristic evaluation in project; UX Laws

**UNIT III ADOBE PHOTOSHOP & ILLUSTRATOR 9**

Photoshop - Layers; Colors & Adjustment Layers, Tools panel, Selections, Mastering pen tool, Maskings, Filters & Smart objects; Illustrator - Tool Panels, pen tool, Drawing in illustrator, Types & Fonts

**UNIT IV FIGMA 9**

Figma - Frames - Desktop & Mobile, color Palettes Solid & gradients , Pen Tool, Overview of Grids, Layers & Assets, Design & Prototypes, Effects & Exports, Components, Variants & Plugins, Frame interactions

**UNIT V UI DESIGN 9**

Understanding Layouts, Mobile & Web layouts, Visual Hierarchy, Iconography & Typography, Contrast, Colors & Color Palettes, Margin & Padding, High Fidelity prototype, Interaction design fundamentals; Usability Testing - A/B & Remote Usability Testing, Gorilla Testing, Heuristics Evaluation

**TOTAL: 45 PERIODS****COURSE OUTCOMES:**

Upon the completion of this course, the students shall be able to

- CO1:comprehend the concepts and tools of design thinking  
 CO2: analyse the strategy for developing the prototype  
 CO3:.comprehend the tools of illustrator and photoshop in designing  
 CO4: comprehend the tools of Figma in designing  
 CO5: understand the concepts of UI designing and usability testing

**TEXT BOOKS:**

1. Walter Brenner, Falk Uebernickel, Design Thinking for Innovation Research and Practice by Walter Brenner, Falk Uebernickel , Springer, 2016
2. Gavin Ambrose and Paul Harris, “Design Thinking”, AVA publishing, Singapore, 2010.
3. Russ Unger, Carolyn Chandler, “A Project Guide to UX Design: For User Experience Designers in the Field or in the Making”, New Riders, 2009

**REFERENCES:**

1. Tracy Jennings, “Creativity in Fashion Design – An Inspiration Workbook”, Fairchild books, Newyork, 2011.
2. Frédéric Darbellay, Zoe Moodyand Todd Lubart, Creativity, Design Thinking and Interdisciplinarity, Springer, 2017

Course Outcomes	Program Outcome												Program Specific Outcome		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	2	2	3	3	-	-	2	3	2	-	-	3	1	2	3
2	2	2	3	3	-	-	2	3	2	-	-	3	1	2	3
3	2	2	3	3	-	-	2	3	2	-	-	3	1	2	3
4	2	2	3	3	-	-	2	3	2	-	-	3	1	2	3
5	2	2	3	3	-	-	2	3	2	-	-	3	1	2	3
<b>Overall CO</b>	2	2	3	3	-	-	2	3	2	-	-	3	1	2	3

**OBJECTIVES**

To enable the students to learn the advances in the field of textile printing

**UNIT I INTRODUCTION 6+8**

Difference between conventional and digital printing; Ink systems; Importance of fabric pre-treatment-reactivity and substantivity; Pre-treatments and Post-treatments of various textiles for ink jet printing; Effect of pretreatments on print quality

**Practical:**

1. Pretreatment of cotton fabric
2. Pretreatment of polyester fabric

**UNIT II PRINTING INK 6+14**

Comparison of CMYK colors to Spot colors; Characteristics of pigment based ink-viscosity, surface tension; Aqueous ink - Organic solvents and surface energy of ink; Additives

**Practical:**

1. Printing of cotton and polyester using reactive and disperse dye ink
2. Determination surface tension of printing ink
3. Determination of viscosity of printing ink

**UNIT III MECHANISM OF DIGITAL PRINTER 6**

Ink printing techniques-Continuous ink jet printing, Drop on Demand; Piezoelectric inkjet and Thermal inkjet techniques; Various types of print head; Advantages and limitations of various printing technique

**UNIT IV DIGITAL PRINTING OF TEXTILES 6**

Dye-fibre interaction; Printing of textile using reactive, disperse, acid and direct dye inks; Digital printing of cationized cotton using reactive dye ink

**UNIT V TESTING OF PRINTED TEXTILE 6+8**

Test methods for pigmented textile ink-viscosity, surface tension, pH, particle size, total solids, regulatory and safety etc,; print quality and its measurement

**Practical:**

1. Assessment of sharpness of printed textile
2. Assessment of wash, rub, perspiration and light fastness behavior of printed textile

**TOTAL: 30 PERIODS + 30 PERIODS**

**COURSE OUTCOMES**

Upon completion of this course the student shall be able to

CO1: Comprehend about importance of pretreatment of textile for digital printing process

CO2: Distinguish characteristics of dye and pigment based ink

CO3 Describe about principle of digital printing



CO4: Comprehend about method of printing of various textiles using ink

CO5: Explain about various test methods for digital printed substrate

### TEXT BOOKS

1. Miles L W C, "Textile Printing", Society of Dyers and Colourists, Hobbs the Printers, Hampshire, UK, 2003.
2. Shenai V A, "Technology of Printing", Sevak Publishers, Mumbai, 1990.

### REFERENCES

1. Tyler D, "Textile Digital Printing Technologies", Textile Institute Publication UK, Vol.37 No.4, 2005
2. Ujiie, "Digital Printing of Textiles", CRC, Wood Head Publishing Ltd, UK, 2006.

Course Outcomes	Program Outcome												Program Specific Outcome		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	3	3	3	2	-	1	2	2	-	-	-	2	3	1	3
2	3	3	3	2	-	1	2	2	-	-	-	2	3	1	3
3	3	3	3	2	-	1	2	2	-	-	-	2	3	1	3
4	3	3	3	2	-	1	2	2	-	-	-	2	3	1	3
5	3	3	3	3	-	1	2	2	-	-	-	2	3	1	3
Overall CO	3	3	3	3	-	1	2	2	-	-	-	2	3	1	3

**OBJECTIVES:**

To learn the design, manufacture and quality aspects of 3D woven fabrics using various techniques and techniques to create complex geometrically shaped components

**UNIT I INTRODUCTION 9**

Constraints of 2D weaving; differentiation between 2D and 3D weaving process; basic aspects of 3D fabric manufacturing; shedding systems in 3D weaving; basic requirements of 3D weaving process; applications of 3D woven structures

**UNIT II ORTHOGONAL WEAVING 9**

Constraints of 2D weaving; Weave structure; loom requirements; types of manufacturing – plate weaving method, conventional weaving loom; shape weaving methods – pleat weaving, tapered weaving, surface integration by weft, weaving of complex shapes; preform calculations

**UNIT III ANGLE INTERLOCK WEAVING 9**

Weave architecture basics, variants; fibre content calculations; combination of angle interlock and orthogonal weave architectures

**UNIT IV QUALITY CONTROL ASPECTS FOR 3D WOVEN PREFORMS 9**

Control parameters; notating 3D preforms; checking of weaving uniformity; data sheet and weave designs for different types of 3D woven preforms; case study on weaving a complex geometrically shaped component

**UNIT V DUAL PLANE SHEDDING BASED 3D WEAVING 9**

Working principle; theoretical information governing machine design; yarn control; shedding; picking; beat-up; take-up; design and development of a prototype 3D weaving machine; weaving cycles; advantages

**TOTAL: 45 PERIODS****COURSE OUTCOMES:**

Upon the completion of this course, the students shall be able to

CO1: explain the fundamentals of 3D weaving

CO2: comprehend the design and manufacture 3D woven fabrics using orthogonal weaving

CO3: explain the design and manufacture 3D woven fabrics using angle interlock weaving.

CO4: appraise the design and operate a dual plane shedding based 3D weaving machine

CO5: Inspect and control the quality of 3D woven preforms

**TEXTBOOKS:**

1. N. Gokarneshan a & R. Alagirusamy, "Weaving of 3D fabrics: A critical appreciation of the developments, Textile Progress, 2013
2. Bangalore Sridharan Sugun (Ed.), "Practical Approach to 3D weaving", Springer publications, 2021

**REFERENCES:**

1. Xiaogang Chen (Ed.), "Advances in 3D textiles" Woodhead publishing series in textiles, 2015

Course Outcomes	Program Outcome												Program Specific Outcome		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
<b>1</b>	2	2	3	3	-	-	2	3	2	-	-	3	1	2	3
<b>2</b>	2	2	3	3	-	-	2	3	2	-	-	3	1	2	3
<b>3</b>	2	2	3	3	-	-	2	3	2	-	-	3	1	2	3
<b>4</b>	2	2	3	3	-	-	2	3	2	-	-	3	1	2	3
<b>5</b>	2	2	3	3	-	-	2	3	2	-	-	3	1	2	3
<b>Overall CO</b>	2	2	3	3	-	-	2	3	2	-	-	3	1	2	3

## SKILL BASED COURSES

**AT23S01**

**COMPUTER AIDED FABRIC DESIGNING**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

### OBJECTIVES

To train the students in CAD used for designing of fabrics using Adobe Substance 3D software.

### LIST OF EXPERIMENTS

1. Introduction to the interface and basic tools of Adobe Substance 3D
2. Basic Weave Creation
3. Repeatable Pattern Design – checks, stripes and other repeats
4. Texture Mapping on Fabrics
5. Texture Export and Integration: Demonstrate the process of exporting textures from Substance 3D for use in other 3D modeling and rendering software or virtual reality applications
6. Surface Variation - Experiment with creating different surface variations such as wrinkled fabric, embroidered textures using procedural techniques in Substance 3D.
7. Material Realism - Create realistic fabric materials that mimic specific physical properties like reflectivity, translucency, and surface roughness.
8. Color Variations and Dyeing - Explore the effects of dyeing on fabrics by modifying colors.
9. Custom Fabric Weaving - Digitally weave custom patterns and designs, experimenting with different weave structures (plain, twill, satin)
10. Designing fabric with various prints, embroidery and laces

**TOTAL: 60 PERIODS**

### COURSE OUTCOMES

Upon completion of this course the student will be able to

CO1: Design fabrics with different textures and patterns fabrics using software

CO2: Design fabrics with surface variation and color variations

CO3: Design fabrics with various prints and embroidery

### Course Articulation Matrix

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
<b>CO1</b>	2	-	2	-	3	2	1	2	-	2	-	2	3	2	1
<b>CO2</b>	2	-	2	-	3	2	1	2	-	2	-	2	3	2	1
<b>CO3</b>	2	-	2	-	3	2	1	2	-	2	-	2	3	2	1
<b>Overall</b>	2	-	2	-	3	2	1	2	-	2	-	2	3	2	1

**OBJECTIVES**

To enable the students to

- Use Microsoft Office (Word, Excel, PowerPoint, Outlook) to create and manage files
- Work efficiently and collaborate using Microsoft Office tools

**LIST OF EXPERIMENTS**

1. Familiarize with the interfaces of Word, Excel, PowerPoint, and Outlook, and practice file management.
2. Create and format a Word document with various text and paragraph styles.
3. Create a worksheet in Excel and perform basic calculations.
4. Create and customize charts to visually represent data.
5. Design a PowerPoint presentation with text, images, and multimedia.
6. Create a professional presentation using templates and themes.
7. Practice managing emails and scheduling events using Outlook.
8. Utilize advanced formatting techniques to enhance a Word document.
9. Analyze data using pivot tables.
10. Learn to integrate and share data across Word, Excel, PowerPoint, and Outlook.

**COURSE OUTCOMES**

Upon completion of this course, the student would be able to

CO1: use Microsoft Office applications (Word, Excel, PowerPoint, and Outlook) to create, edit, and manage documents, data, and presentations.

CO2: integrate Microsoft Office applications, apply advanced techniques, and troubleshoot common issues to enhance productivity and collaboration.

Course Outcomes	Program Outcome														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	CO1	2	2	3	3	3	-	2	-	2	3	3	3	2	1
CO2	2	2	3	3	3	-	2	-	2	3	3	3	2	1	2
Overall	2	2	3	3	3	-	2	-	2	3	3	3	2	1	2

**OBJECTIVES**

To enable the students to master the technical skills, creative vision, and knowledge required to produce high-quality fashion photographs

**LIST OF EXPERIMENTS**

1. Introduction to camera settings and functions
2. Experiment with the effects of depth of field and focal length on the rendering of the human face.
3. Experiment with different light sources of direct sun, open shade and available artificial light sources
4. Experiment with distance and amplitude
5. Experiment with light modifiers
6. Introduction to software tools and processing RAW files
7. Experiment with colour corrections for proper skin tone
8. Experiment with colour corrections for accurate garment or object reproduction
9. Experiment with retouch methods for skin, eyes, and clothing
10. Create a mood board by choosing appropriate models, makeup, locations, styling and wardrobe concepts for studio shooting
11. Create a mood board by choosing appropriate models, makeup, locations, styling and wardrobe concepts for outdoor shooting

**TOTAL: 60 PERIODS****COURSE OUTCOMES**

Upon completion of this course, the student would be able to

CO1: comprehend the different settings and requirements for photography

CO2: develop a fashion photography portfolio by using proper tools and methods

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	3	3	-	-	2	-	2	-	-	3	2	1	2
CO2	2	2	3	3	-	-	2	-	2	-	-	3	2	1	2
Overall	2	2	3	3	-	-	2	-	2	-	-	3	2	1	2

**COURSE OBJECTIVE**

- To enable the students to develop different structures and textures using value addition techniques

**List of Experiments**

- Theme based conceptualization, illustration, rendering of apparel and accessory for product development.
- Surface value addition technique: prints, embroidery and painting technique from regional arts of India.
- Structure and texture development and its application for designing apparel: Patch work, applique work, cutwork, drawn thread work, bead work, mirror work and metal work.
- Structure development for apparel: smocking, quilting, macrame, crochet.
- Dyeing techniques - tie and dye, batik.
- Decorative Effects – tassels, fringes and pompom

**TOTAL: 60 PERIODS****OUTCOME**

Upon completion of this course, the student shall be able to

CO1: identify the theme and render the different accessories based on the theme

CO2: Experiment the surface value addition technique

CO3: Design and develop structure and texture for designing apparel using different techniques

**Course Articulation Matrix**

Course Outcomes	Program Outcome														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	CO1	2	2	3	3	-	-	2	-	2	-	-	3	2	3
CO2	2	2	3	3	-	-	2	-	2	-	-	3	2	3	2
CO3	-	-	2	2	-	-	2	-	2	-	-	2	2	2	2
Overall	2	2	2.6	2.6	-	-	2	-	2	-	-	2.6	2	2.6	2

**COURSE OBJECTIVE:**

To enable the students to apply creative reuse techniques to transform old clothing and repurposed materials into innovative textile products, including accessories, composites, and interior design elements

**LIST OF EXPERIMENTS**

1. Design and develop new accessories from used clothes using creative reuse techniques.
  - a. trims
  - b. bags
  - c. scarves
  - d. fashion accessories
2. Develop textile composites from repurposed materials, enhancing performance.
3. Design and develop home textile products
  - a. Pillow covers
  - b. Wall hangings
  - c. Mittens
  - d. Floor mat

**TOTAL: 60 PERIODS****OUTCOMES**

Upon completion of this course, the student shall be able to

CO1: design and develop unique and creative accessories, such as trims, bags, scarves, and fashion accessories, demonstrating expertise in creative reuse techniques from used clothes..

CO2: develop composite from the used clothes

CO3: design and develop creative home textile based products

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	3	3	-	-	2	-	2	-	-	3	2	3	2
CO2	2	2	3	3	-	-	2	-	2	-	-	3	2	3	2
CO3	-	-	3	3	-	-	2	-	2	-	-	3	2	3	2
Overall	2	2	3	3	-	-	2	-	2	-	-	3	2	3	2



**COURSE OBJECTIVE:**

To enable the students to develop and characterize composite laminates using various fabrication techniques and evaluate their mechanical properties and they also understand the designing and manufacturing of moulds using prepreg materials to produce complex composite shapes

**LIST OF EXPERIMENTS**

1. Fabricate a simple composite laminate using hand layup technique
2. Fabricate a simple composite laminate using vacuum bagging technique
3. Fabricate a simple composite laminate using compression moulding technique
4. Study on the tensile strength of the developed composites and analyse the failure modes
5. Study on the flexural strength of the developed composites using three point bending test
6. Study on the impact strength testing of the composites
7. To identify the fibre volume fraction of the composites
8. Designing and Manufacturing moulds using prepreg materials

**TOTAL: 60 PERIODS****OUTCOMES**

Upon completion of this course, the student shall be able to

CO1: fabricate composites using hand layup, vacuum bagging, and compression moulding techniques.

CO2: evaluate and analyze the mechanical properties of composites, including tensile strength, flexural strength, and impact strength.

CO3: design and manufacture moulds using prepreg materials to produce complex composite shapes, and apply their knowledge to real-world engineering applications.

**Course Articulation Matrix**

Course Outcomes	Program Outcome														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	2	2	-	-	2	-	2	-	-	2	2	3	2
CO2	2	2	2	2	-	-	2	-	2	-	-	2	2	3	2
CO3	-	-	2	2	-	-	2	-	2	-	-	2	2	2	2
Overall	2	2	2	2	-	-	2	-	2	-	-	2	2	2	2

**TOTAL: 60 PERIODS****OUTCOMES**

Upon completion of this course, the student shall be able to

CO1: fabricate composites using hand layup, vacuum bagging, and compression moulding techniques.

CO2: evaluate and analyze the mechanical properties of composites, including tensile strength, flexural strength, and impact strength.

CO3: design and manufacture moulds using prepreg materials to produce complex composite shapes, and apply their knowledge to real-world engineering applications.

### Course Articulation Matrix

Course Outcomes	Program Outcome														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	3	3	-	-	2	-	2	-	-	3	2	3	2
CO2	2	2	3	3	-	-	2	-	2	-	-	3	2	3	2
CO3	-	-	2	2	-	-	2	-	2	-	-	2	2	2	2
Overall	2	2	2.6	2.6	-	-	2	-	2	-	-	2.6	2	2.6	2



**UNIT V GARMENT FINISHING****6**

Garment finishing, Garment pressing - categories and equipment, packing; care labeling of apparels

**TOTAL: 30 PERIODS + 30 PERIODS****COURSE OUTCOMES:**

Upon completion of this course, the students shall be able to

- CO1: prepare pattern, marker and cut components
- CO2: distinguish types of seams, stitches and functions of needles
- CO3: comprehend components and trims used in garment
- CO4: design and develop men's and women's garment
- CO5: demonstrate working of garment pressing, packing machines

**TEXT BOOK:**

1. Carr H., and Latham B., "The Technology of Clothing Manufacture", Blackwell Science Ltd., Oxford, 1994, ISBN: 0632037482.
2. Winifred Aldrich., "Metric Pattern Cutting", Blackwell Science Ltd., Oxford, 2004, ISBN: 1405102780 | ISBN-13: 9781405102780

**REFERENCES:**

1. Peggall H., "The Complete Dress Maker", Marshall Caverdish, London, 1985.
2. Gerry Cooklin., Steven George Hayes., and John McLoughlin, "Introduction to Clothing Manufacture", Blackwell Scientific Publications, London, 2006, ISBN: 0632058463 | ISBN-13: 9780632058464.
3. Jai Prakash., and Gaur R.K., "Sewing Thread", NITRA, 1994.
4. Ruth E. Glock., and Grace I. Kunz., "Apparel Manufacturing – Sewn Product Analysis" 4th Edition, Upper Sadle River Publications, New York, 2004. ISBN: 0131119826 | ISBN-13: 9780131119826
5. Pradip V. Mehta., "An Introduction to Quality Control for the Apparel Industry", J.S.N. Internationals, 1992, ISBN: B015X4YGIE.

Course Outcomes	Program Outcome												Program Outcome Specific		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
<b>1</b>	1	2	2	-	2	1	1	2	2	2	2	2	2	2	-
<b>2</b>	1	2	2	-	2	1	1	2	2	2	2	2	2	2	-
<b>3</b>	1	3	2	-	2	1	1	2	2	3	2	2	2	2	-
<b>4</b>	2	2	2	-	2	1	2	2	3	3	3	2	2	2	-
<b>5</b>	1	2	2	-	2	1	1	2	2	2	2	2	2	2	-
<b>Overall CO</b>	1.2	2.2	2	-	2	1	1.2	2	2.2	2.4	2.2	2	2	2	-

**OBJECTIVES**

- To train the students in CAD used for designing, pattern making and marker planning of garments

**LIST OF EXPERIMENTS:**

1. Practice on tools of the Software used for 3D simulation.
2. Creating an avatar using body measurement for men, women and children.
3. 3D Simulation of kids frock and analyse the simulation of visual effects of varying fabric
4. 3D Simulation of kids romper and analyse the simulation of visual effects of varying seams
5. 3D Simulation of women's top and analyse the simulation of visual effects of varying print
6. 3D Simulation of women's skirt and analyse the simulation of visual effects of varying fabric
7. 3D Simulation of women's blouse and analyse the fit of the garment
8. 3D Simulation of men's shirt and analyse the simulation of visual effects of varying print
9. 3D Simulation of men's trouser and analyse the influence of fabric low stress mechanical properties on fit of the garment

**TOTAL: 90 PERIODS****COURSE OUTCOMES**

Upon completion of this course the student will be able to

CO1: simulate the pattern and analyse the visual effects of fabric on kid's wear

CO2: simulate the pattern and analyse the fit of the women's wear for varying fabrics

CO3: simulate the pattern and analyse the fit of the men's wear

Course Outcomes	Program Outcome														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	3	3	3	-	2	-	2	-	-	3	2	3	2
CO2	2	2	3	3	3	-	2	-	2	-	-	3	2	3	2
CO3	-	-	2	2	3	-	2	-	2	-	-	2	2	2	2
Overall	2	2	2.6	2.6	3	-	2	-	2	-	-	2.6	2	2.6	2

**OBJECTIVES:**

The main objectives of this course are to:

1. Understand the importance, principles, and search methods of AI
2. Provide knowledge on predicate logic and Prolog.
3. Introduce machine learning fundamentals
4. Study of supervised learning algorithms.
5. Study about unsupervised learning algorithms.

**UNIT I INTELLIGENT AGENT AND UNINFORMED SEARCH 6**

**Introduction** - Foundations of AI - History of AI - The state of the art - Risks and Benefits of AI - **Intelligent Agents** - Nature of Environment - Structure of Agent - Problem Solving Agents - Formulating Problems - **Uninformed Search** - Breadth First Search - Dijkstra's algorithm or uniform-cost search - Depth First Search - Depth Limited Search

**UNIT II PROBLEM SOLVING WITH SEARCH TECHNIQUES 6**

**Informed Search** - Greedy Best First - A\* algorithm - Adversarial Game and Search - **Game theory** - Optimal decisions in game - Min Max Search algorithm - Alpha-beta pruning - **Constraint Satisfaction Problems (CSP)** - Examples - Map Coloring - Job Scheduling - Backtracking Search for CSP

**UNIT III LEARNING 6**

Machine Learning: Definitions – Classification - Regression - approaches of machine learning models - Types of learning - Probability - Basics - Linear Algebra – Hypothesis space and inductive bias, Evaluation. Training and test sets, cross validation, Concept of over fitting, under fitting, Bias and Variance - **Regression**: Linear Regression - Logistic Regression

**UNIT IV SUPERVISED LEARNING 6**

**Neural Network**: Introduction, Perceptron Networks – Adaline - Back propagation networks - **Decision Tree**: Entropy – Information gain - Gini Impurity - classification algorithm - Rule based Classification - **Naïve Bayesian classification** - **Support Vector Machines (SVM)**

**UNIT V UNSUPERVISED LEARNING 6**

**Unsupervised Learning** – Principle Component Analysis - **Neural Network**: Fixed Weight Competitive Nets - Kohonen Self-Organizing Feature Maps – **Clustering**: Definition - Types of Clustering – Hierarchical clustering algorithms – k-means algorithm

**TOTAL : 30 PERIODS****PRACTICAL EXERCISES: 30 PERIODS****Programs for Problem solving with Search**

1. Implement breadth first search
2. Implement depth first search
3. Analysis of breadth first and depth first search in terms of time and space
4. Implement and compare Greedy and A\* algorithms.

**Supervised learning**

5. Implement the non-parametric locally weighted regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs
6. Write a program to demonstrate the working of the decision tree based algorithm.
7. Build an artificial neural network by implementing the back propagation algorithm and test the same using appropriate data sets.
8. Write a program to implement the naïve Bayesian classifier.

**Unsupervised learning**

9. Implementing neural network using self-organizing maps
10. Implementing k-Means algorithm to cluster a set of data.
11. Implementing hierarchical clustering algorithm.

Note:

- Installation of gnu-prolog, Study of Prolog (gnu-prolog).
- The programs can be implemented in using C++/JAVA/ Python or appropriate tools can be used by designing good user interface
- Data sets can be taken from standard repositories (<https://archive.ics.uci.edu/ml/datasets.html>) or constructed by the students.

**OUTCOMES:**

CO1: Understand the foundations of AI and the structure of Intelligent Agents

CO2: Use appropriate search algorithms for any AI problem

CO3: Study of learning methods

CO4: Solving problem using Supervised learning

CO5: Solving problem using Unsupervised learning

**TOTAL PERIODS: 60**

**TEXT BOOK**

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Fourth Edition, 2021
2. S.N.Sivanandam and S.N.Deepa, Principles of soft computing-Wiley India.3 rd ed,

**REFERENCES**

1. Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997.
2. I. Bratko, "Prolog: Programming for Artificial Intelligencell, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.
3. C. Muller & Sarah Alpaydin, Ethem. Introduction to machine learning. MIT press, 2020.

**OBJECTIVES:**

- To apprise students with basic knowledge of IoT that paves a platform to understand physical and logical design of IOT
- To teach a student how to analyse requirements of various communication models and protocols for cost-effective design of IoT applications on different IoT platforms.
- To introduce the technologies behind Internet of Things(IoT).
- To explain the students how to code for an IoT application using Arduino/Raspberry Pi open platform.
- To apply the concept of Internet of Things in real world scenario.

**UNIT I INTRODUCTION TO INTERNET OF THINGS 5**  
Evolution of Internet of Things – Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT Models – Simplified IoT Architecture and Core IoT Functional Stack – Fog, Edge and Cloud in IoT

**UNIT II COMPONENTS IN INTERNET OF THINGS 5**  
Functional Blocks of an IoT Ecosystem – Sensors, Actuators, and Smart Objects – Control Units - Communication modules (Bluetooth, Zigbee, Wifi, GPS, GSM Modules)

**UNIT III PROTOCOLS AND TECHNOLOGIES BEHIND IOT 6**  
IoT Protocols - IPv6, 6LoWPAN, MQTT, CoAP - RFID, Wireless Sensor Networks, BigData Analytics, Cloud Computing, Embedded Systems.

**UNIT IV OPEN PLATFORMS AND PROGRAMMING 7**  
IoT deployment for Raspberry Pi /Arduino platform-Architecture –Programming – Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins – Connecting to the Cloud.

**UNIT V IOT APPLICATIONS 7**  
Business models for the internet of things, Smart city, Smart mobility and transport, Industrial IoT, Smart health, Environment monitoring and surveillance – Home Automation – Smart Agriculture

**30 PERIODS****PRACTICAL EXERCISES: 30 PERIODS**

1. Introduction to Arduino platform and programming
2. Interfacing Arduino to Zigbee module
3. Interfacing Arduino to GSM module
4. Interfacing Arduino to Bluetooth Module
5. Introduction to Raspberry PI platform and python programming
6. Interfacing sensors to Raspberry PI
7. Communicate between Arduino and Raspberry PI using any wireless medium
8. Setup a cloud platform to log the data
9. Log Data using Raspberry PI and upload to the cloud platform
10. Design an IOT based system

**OUTCOMES:****CO 1:** Explain the concept of IoT.**CO 2:** Understand the communication models and various protocols for IoT.**CO 3:** Design portable IoT using Arduino/Raspberry Pi /open platform**CO 4:** Apply data analytics and use cloud offerings related to IoT.**CO 5:** Analyze applications of IoT in real time scenario.**TOTAL PERIODS:60**



## **TEXTBOOKS**

1. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017
2. Samuel Greengard, The Internet of Things, The MIT Press, 2015

## **REFERENCES**

1. Perry Lea, "Internet of things for architects", Packt, 2018
2. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012
3. IOT (Internet of Things) Programming: A Simple and Fast Way of Learning, IOT Kindle Edition.
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet of Things", Springer, 2011.
5. ArshdeepBahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015
6. <https://www.arduino.cc/>  
[https://www.ibm.com/smarterplanet/us/en/?ca=v\\_smarterplanet](https://www.ibm.com/smarterplanet/us/en/?ca=v_smarterplanet)

**COURSE OBJECTIVES:**

- Familiarize students with the data science process.
- Understand the data manipulation functions in Numpy and Pandas.
- Explore different types of machine learning approaches.
- Understand and practice visualization techniques using tools.
- Learn to handle large volumes of data with case studies.

**UNIT I INTRODUCTION 6**

Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – data preparation - Exploratory Data analysis – build the model – presenting findings and building applications - Data Mining - Data Warehousing – Basic statistical descriptions of Data

**UNIT II DATA MANIPULATION 9**

Python Shell - Jupyter Notebook - IPython Magic Commands - NumPy Arrays-Universal Functions – Aggregations – Computation on Arrays – Fancy Indexing – Sorting arrays – Structured data – Data manipulation with Pandas – Data Indexing and Selection – Handling missing data – Hierarchical indexing – Combining datasets – Aggregation and Grouping – String operations – Working with time series – High performance

**UNIT III MACHINE LEARNING 5**

The modeling process - Types of machine learning - Supervised learning - Unsupervised learning - Semi-supervised learning- Classification, regression - Clustering – Outliers and Outlier Analysis

**UNIT IV DATA VISUALIZATION 5**

Importing Matplotlib – Simple line plots – Simple scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn

**UNIT V HANDLING LARGE DATA 5**

Problems - techniques for handling large volumes of data - programming tips for dealing with large data sets- Case studies: Predicting malicious URLs, Building a recommender system - Tools and techniques needed - Research question - Data preparation - Model building – Presentation and automation.

**30 PERIODS****PRACTICAL EXERCISES: 30 PERIODS****LAB EXERCISES**

1. Download, install and explore the features of Python for data analytics.
2. Working with Numpy arrays
3. Working with Pandas data frames
4. Basic plots using Matplotlib
5. Statistical and Probability measures
  - a) Frequency distributions
  - b) Mean, Mode, Standard Deviation
  - c) Variability
  - d) Normal curves
  - e) Correlation and scatter plots
  - f) Correlation coefficient
  - g) Regression

6. Use the standard benchmark data set for performing the following:
  - a) Univariate Analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis.
  - b) Bivariate Analysis: Linear and logistic regression modelling.
7. Apply supervised learning algorithms and unsupervised learning algorithms on any data set.
8. Apply and explore various plotting functions on any data set.

**Note: Example data sets like: UCI, Iris, Pima Indians Diabetes etc.**

#### **COURSE OUTCOMES:**

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

- CO1:** Gain knowledge on data science process.
- CO2:** Perform data manipulation functions using Numpy and Pandas.
- CO3:** Understand different types of machine learning approaches.
- CO4:** Perform data visualization using tools.
- CO5:** Handle large volumes of data in practical scenarios.

**TOTAL PERIODS:60**

#### **TEXT BOOKS**

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016.
2. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016.

#### **REFERENCES**

1. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017.
2. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.

**OBJECTIVES:**

- To impart the fundamental aspects and principles of AR/VR technologies.
- To know the internals of the hardware and software components involved in the development of AR/VR enabled applications.
- To learn about the graphical processing units and their architectures.
- To gain knowledge about AR/VR application development.
- To know the technologies involved in the development of AR/VR based applications.

**UNIT I INTRODUCTION****7**

Introduction to Virtual Reality and Augmented Reality – Definition – Introduction to Trajectories and Hybrid Space-Three I's of Virtual Reality – Virtual Reality Vs 3D Computer Graphics – Benefits of Virtual Reality – Components of VR System – Introduction to AR-AR Technologies- Input Devices – 3D Position Trackers – Types of Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces – Types of Gesture Input Devices – Output Devices – Graphics Display – Human Visual System – Personal Graphics Displays – Large Volume Displays – Sound Displays – Human Auditory System.

**UNIT II VR MODELING****6**

Modeling – Geometric Modeling – Virtual Object Shape – Object Visual Appearance – Kinematics Modeling – Transformation Matrices – Object Position – Transformation Invariants –Object Hierarchies – Viewing the 3D World – Physical Modeling – Collision Detection – Surface Deformation – Force Computation – Force Smoothing and Mapping – Behavior Modeling – Model Management.

**UNIT III VR PROGRAMMING****6**

VR Programming – Toolkits and Scene Graphs – World ToolKit – Java 3D – Comparison of World ToolKit and Java 3D

**UNIT IV APPLICATIONS****6**

Human Factors in VR – Methodology and Terminology – VR Health and Safety Issues – VR and Society-Medical Applications of VR – Education, Arts and Entertainment – Military VR Applications – Emerging Applications of VR – VR Applications in Manufacturing – Applications of VR in Robotics – Information Visualization – VR in Business – VR in Entertainment – VR in Education.

**UNIT V AUGMENTED REALITY****5**

Introduction to Augmented Reality-Computer vision for AR-Interaction-Modelling and Annotation-Navigation-Wearable devices

**30 PERIODS  
30 PERIODS****PRACTICAL EXERCISES:**

1. Study of tools like Unity, Maya, 3DS MAX, AR toolkit, Vuforia and Blender.
2. Use the primitive objects and apply various projection types by handling camera.
3. Download objects from asset store and apply various lighting and shading effects.
4. Model three dimensional objects using various modelling techniques and apply textures over them.
5. Create three dimensional realistic scenes and develop simple virtual reality enabled mobile applications which have limited interactivity.
6. Add audio and text special effects to the developed application.
7. Develop VR enabled applications using motion trackers and sensors incorporating full haptic interactivity.
8. Develop AR enabled applications with interactivity like E learning environment, Virtual walkthroughs and visualization of historic places.

9. Develop AR enabled simple applications like human anatomy visualization, DNA/RNA structure visualization and surgery simulation.
10. Develop simple MR enabled gaming applications.

**TOTAL PERIODS:60**

**OUTCOMES:**

**On completion of the course, the students will be able to:**

- CO1:** Understand the basic concepts of AR and VR
- CO2:** Understand the tools and technologies related to AR/VR
- CO3:** Know the working principle of AR/VR related Sensor devices
- CO4:** Design of various models using modeling techniques
- CO5:** Develop AR/VR applications in different domains

**TEXTBOOKS:**

1. Charles Palmer, John Williamson, "Virtual Reality Blueprints: Create compelling VR experiences for mobile", Packt Publisher, 2018
2. Dieter Schmalstieg, Tobias Hollerer, "Augmented Reality: Principles & Practice", Addison Wesley, 2016
3. John Vince, "Introduction to Virtual Reality", Springer-Verlag, 2004.
4. William R. Sherman, Alan B. Craig: Understanding Virtual Reality – Interface, Application, Design", Morgan Kaufmann, 2003

**CO's – PO's & PSO's MAPPING**

CO's	PO's												PSO's			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
<b>1</b>	3	2	2	-	3	-	-	-	2	2	1	2	2	1	2	
<b>2</b>	3	2	2	1	3	-	-	-	3	2	2	3	3	1	2	
<b>3</b>	3	3	2	2	3	-	-	-	3	2	1	2	3	2	2	
<b>4</b>	3	3	3	2	3	-	-	-	3	2	2	3	3	2	2	
<b>5</b>	3	3	3	3	3	-	-	-	3	3	3	3	3	3	3	
<b>AVg.</b>	<b>3.00</b>	<b>2.60</b>	<b>2.40</b>	<b>2.00</b>	<b>3.00</b>	-	-	-	<b>2.80</b>	<b>2.20</b>	<b>1.80</b>	<b>2.60</b>	<b>2.80</b>	<b>1.80</b>	<b>2.20</b>	