ANNA UNIVERSITY, CHENNAI

UNDERGRADUATE CURRICULUM (UNIVERSITY DEPARTMENTS)

Campus : CEG

Department : Printing and Packaging Technology

Programme : B.E. Printing and Packaging Technology

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

OVERVIEW OF CREDITS

Sem	PCC	PEC	ESC	HSMC	ETC	OEC	SDC	UC	SLC	Total
I			8	11			4	1		24
II			3	14			**3**	1		21
III	14		4	4			2			24
IV	13		3				5	2		23
V	16				3		3	3		25
VI		12			3	3	1	2	1	22
VII	9	6				3	4	1		23
VIII							8			8
Total	52	18	18	29	6	6	30	10	1	170
% of Category	31	10.5	10.5	17	3.5	3.5	17.5	6	0.5	100

CATEGORY OF COURSES

PCC – Professional Core Course
PEC – Professional Elective Course
ETC – Emerging Technology Course
OEC – Open Elective Course
SLC – Self Learning Course
ESC – Engineering Science Course
HSMC – Humanities Science and Management Course
SDC – Skill Development Course
UC – University Course

For Honours & Minor Degree, please refer the Regulations 2023 (Revised 2024).

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.	ME23C01	Engineering Drawing and 3D Modelling	LIT	2-0-4	6	4	SDC
5.	ME23C03	Engineering Mechanics	T	3-1-0	4	4	ESC
6.	CS23C02	Computer Programming in Python	LIT	3-0-2	5	4	ESC
7.	UC23H01	தமிழர் மரபு / Heritage of Tamils	T	1-0-0	1	1	UC
8.		NCC / NSS / NSO / YRC	L	0-0-2	2	0	UC
9.		Audit Course – I*	T	2-0-0	2	0	UC
				Total Credits		**24**	

*** TCP –** Total Contact Period(s)

#**TYPE OF COURSE**

LIT – Laboratory Integrated Theory
T – Theory
L – Laboratory Course
IPW – Internship cum Project Work
PW – Project Work
CDP – Capstone Design Project

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.	ME23C04	Makerspace	LIT	1-0-4	5	3	SDC
5.	EE23C03	Basics of Electrical and Electronics Engineering	LIT	2-0-2	4	3	ESC
6.	CY23C04	Chemistry for Printing Technology	T	3-0-0	3	3	HSMC
7.	UC23H02	தமிழரும் தொழில் நுட்பமும் / Tamils and Technology	T	1-0-0	1	1	UC
				Total Credits		**21**	

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.	CE23C01	Mechanics of Materials	LIT	3-0-2	5	4	ESC
3.	PP23301	Machine Kinematics and Maintenance	LIT	3-0-2	5	4	PCC
4.	PP23302	Design for Print Media	T	3-0-0	3	3	PCC
5.	PP23303	Flexography Printing and Converting	T	3-0-0	3	3	PCC
6.	PP23304	Paper and Paperboard	LIT	3-0-2	5	4	PCC
7.		Audit Course – II*	T	2-0-0	2	0	UC
8.		Skill Development Course – I	L	0-0-4	2	2	SDC
				Total Credits		**24**	

Semester – III							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods / Week**		**Credits**	**Category**
				L-T-P	**TCP**		
Semester – IV							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods / Week**		**Credits**	**Category**
				L-T-P	**TCP**		
1.	ME23C12	Mechatronics and IOT	T	3-0-2	5	4	ESC
2.	PP23401	Offset Printing Technology	T	3-0-0	3	3	PCC
3.	PP23402	Prepress Imaging Technology	LIT	3-0-4	7	5	PCC
4.		Skill Development Course II	LIT	3-0-4	7	5	SDC
5.	PP23403	Packaging Materials I	T	3-0-0	3	3	PCC
6.	UC23U01	Universal Human Values	LIT	1-0-2	3	2	UC
7.	PP23404	Printing Machine Lab	L	0-0-4	4	2	PCC
				Total Credits		**24**	

Semester – V							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods / Week**		**Credits**	**Category**
				L-T-P	**TCP**		
1.	PP23501	Gravure and Screen Printing Technology	T	3-0-0	3	3	PCC
2.	PP23502	Packaging Materials II	LIT	3-0-2	5	4	PCC
3.	PP23503	Print Conversion Techniques	T	3-0-0	3	3	PCC
4.		Emerging Technology I				3	ETC
5.	PP23504	Print Operations Management	T	3-0-0	3	3	PCC
6.	PP23U02	Perspectives of Sustainable Development – Printing and Packaging	LIT	2-0-2	4	3	UC
7.	PP23505	Printing Inks	T	3-0-0	3	3	PCC
8.		Industry Oriented Course – I	L	1-0-0	1	1	SDC

9.		Skill Development Course III	L	0-0-4	4	2	SDC
						25	

Courses for Honours Degree							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods / Week**		**Credits**	**Category**
				L-T-P	**TCP**		
1.	PP23D01	Capstone Design Project – Level I	CDP	0-0-8	8	4	SDC
(OR)							
1.		Honours Elective – I				3	
2.		Honours Elective – II				3	
Courses for Minor Degree							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods / Week**		**Credits**	**Category**
				L-T-P	**TCP**		
1.		Minor Elective – I		3-0-0	3	3	
2.		Minor Elective – II		3-0-0	3	3	

Semester – VI (Preference for Foreign Exchange)							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods / Week**		**Credits**	**Category**
				L-T-P	**TCP**		
1.		Emerging Technology II				3	ETC
2.		PEC – I	T	3-0-0	3	3	PEC
3.		PEC – II	T	3-0-0	3	3	PEC
4.		PEC – III	T	3-0-0	3	3	PEC
5.		PEC – IV	T	3-0-0	3	3	PEC
6.		Open Elective – I	T	3-0-0	3	3	OEC
7.		Self-Learning Course		-	0	1	SLC
8.	UC23E01	Engineering Entrepreneurship Development	LIT	2-0-2	4	3	UC
9.		Industry Oriented Course II	L	1-0-0	1	1	SDC
				Total Credits		**22**	
Courses for Honours Degree							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods / Week**		**Credits**	**Category**
				L-T-P	**TCP**		
1.	PP23D02	Capstone Design Project – Level II	CDP	0-0-12	12	6	SDC
(OR)							
1.		Honours Elective – III				3	
2.		Honours Elective – IV				3	

Courses for Minor Degree							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods / Week**		**Credits**	**Category**
				L-T-P	**TCP**		
1.		Minor Elective – III		3-0-0	3	3	
2.		Minor Elective – IV		3-0-0	3	3	

Semester – VII							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods / Week**		**Credits**	**Category**
				L-T-P	**TCP**		
1.	PP23701	Costing and Estimating for Printing and Packaging	T	3-0-0	3	3	PCC
2.	PP23702	Electronic Publishing	LIT	2-0-4	6	4	PCC
3.	PP23703	Logistics and Supply Chain Management for Packaging	T	2-0-0	2	2	PCC
4.		PEC – V	T	3-0-0	3	3	PEC
5.		PEC – VI	T	3-0-0	3	3	PEC
6.		Open Elective – II	T	3-0-0	3	3	OEC
7.	PP23U01	Standards - Printing and Packaging Technology	T	1-0-0	1	1	UC
8.	PP23704	Summer internship*		0-0-*	0	1	SDC
9.		Industry Oriented Course - III	T	1-0-0	1	1	SDC
10.	PP23705	Creative and Innovative Project	PW	0-0-4	4	2	SDC
***** Two weeks of industrial training in VI semester vacation				**Total Credits**		**23**	
Courses for Honours Degree							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods / Week**		**Credits**	**Category**
				L-T-P	**TCP**		
1.	PP23D03	Capstone Design Project – Level III	CDP	0-0-16	16	8	SDC
(OR)							
1.		Honours Elective – V				3	

Semester – VII							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods / Week**		**Credits**	**Category**
				L-T-P	**TCP**		
2.		Honours Elective – VI				3	
Courses for Minor Degree							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods / Week**		**Credits**	**Category**
				L-T-P	**TCP**		
1.		Minor Elective – V				3	
2.		Minor Elective – VI				3	

Semester – VIII							
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods / Week**		**Credits**	**Category**
				L-T-P	**TCP**		
1.	PP23801	Project Work / Internship with Project Work	IPW	0-0-16	16	8	SDC
				Total Credits		**8**	

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Printing	Packaging	Publishing	Print Management	Print Media	Diversified Group of Electives
Security Printing	Package Design and Standards	Publishing Workflow and Processes	Print Marketing Management	Creativity and Innovation in Printing and Packaging	Ergonomics and Human Factors Engineering
Web Offset Printing Technology	Consumer Goods Packaging	Digital Media Management	Elements of Financial Management	Mass Communication	Safety Engineering and Management
Additive Manufacturing for Print Prototyping	Healthcare Packaging	UI & UX Design	Operations Research	Book Publishing	Lean Manufacturing and Six Sigma
Printed Electronics	Quality Control in Printing and Packaging	Software Testing for Graphic Applications	Professional Ethics in Engineering	Newspaper and Periodical Publishing	Smart Manufacturing
Specialty Printing	Industrial packaging	Data Science and Machine Learning	Human Resource Management for Entrepreneurs	Advertising Techniques	Sustainable Manufacturing
Printing Machinery Maintenance	Packaging laws and regulations	Cloud Computing and cyber security	Total Quality Management	Visual Communication	Design Thinking

Registration of Professional Elective Courses from Verticals:

Professional Elective Courses will be registered from Semesters IV to VII. These courses are listed in groups called verticals that represent a particular area of specialisation / diversified group. Students are permitted to choose all the Professional Electives from a particular vertical or from different verticals. Further, only one Professional Elective course shall be chosen in a semester horizontally (row-wise). However, more than one course is permitted from the same row, provided each course is enrolled in Semester IV/VI and another in semester V/VII.

The registration of courses for B.E./B.Tech. (Hons) degree shall be done from Semester V to VIII. The procedure for registration of courses explained above shall be followed for the courses of B.E/B.Tech. (Hons) also. For more details on B.E./B.Tech. (Hons) refer to the Regulations 2023, Clause 4.11.

List of Skill Development Courses							
S. No.	**Course Code**	**Course Name**	**Course Type#**	**Periods / Week**		**Credits**	**Category**
				L-T-P	**TCP***		
Level I							
1.	PP23S01	Graphic Design Laboratory	L	0-0-4	4	2	SDC
Level II							
2.	PP23S02	Packaging Techniques and Processes	LIT	3-0-4	7	5	SDC
Level III							
3	PP23S03	Print Conversion Laboratory	L	0-0-4	4	2	SDC

Emerging Technology Courses							
S. No.	**Course Code**	**Course Name**	**Course Type#**	**Periods / Week**		**Credits**	**Category**
				L-T-P	**TCP***		
1.	PP23E01	Artificial Intelligence and Machine Learning	T	3-0-0	3	3	ETC
2.	PP23E02	Digital Printing Technologies	LIT	2-0-2	4	3	ETC
3.	PP23E03	Augmented Reality in Graphic Design	LIT	2-0-2	4	3	ETC
4.	PP23E04	Industry 4.0	T	3-0-0	3	3	ETC

VERTICAL I: PRINTING

SL. NO.	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	CATEGORY
			L	T	P			
1.	PP23001	Security Printing	3	0	0	3	3	PEC
2.	PP23002	Web Offset Printing Technology	3	0	0	3	3	PEC
3.	PP23003	Additive Manufacturing for Print Prototyping	3	0	0	3	3	PEC
4.	PP23004	Printed Electronics	3	0	0	3	3	PEC
5.	PP23005	Specialty Printing	3	0	0	3	3	PEC
6.	PP23006	Printing Machinery Maintenance	3	0	0	3	3	PEC

VERTICAL II: PACKAGING

SL. NO.	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	CATEGORY
			L	T	P			
1.	PP23007	Package Design and Standards	3	0	0	3	3	PEC
2.	PP23008	Consumer Goods Packaging	3	0	0	3	3	PEC
3.	PP23009	Healthcare Packaging	3	0	0	3	3	PEC
4.	PP23010	Quality Control in Printing and Packaging	3	0	0	3	3	PEC
5.	PP23011	Industrial packaging	3	0	0	3	3	PEC
6.	PP23012	Packaging laws and regulations	3	0	0	3	3	PEC

VERTICAL III: PUBLISHING

SL. NO.	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	CATEGORY
			L	T	P			
1.	PP23013	Publishing Workflow and Processes	3	0	0	3	3	PEC
2.	PP23014	Digital Media Management	3	0	0	3	3	PEC
3.	PP23015	UI & UX Design	3	0	0	3	3	PEC
4.	PP23016	Software Testing for Graphic Applications	3	0	0	3	3	PEC
5.	PP23017	Data Science and Machine Learning	3	0	0	3	3	PEC
6.	PP23018	Cloud Computing and cyber security	3	0	0	3	3	PEC

VERTICAL IV: PRINT MANAGEMENT

SL. NO.	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	CATEGORY
			L	T	P			
1.	PP23019	Print Marketing Management	3	0	0	3	3	PEC
2.	PP23020	Elements of Financial Management	3	0	0	3	3	PEC
3.		Operations Research	3	0	0	3	3	PEC
4.	PP23021	Professional Ethics in Engineering	3	0	0	3	3	PEC
5.	PP23022	Human Resource Management for Entrepreneurs	3	0	0	3	3	PEC
6.	IE23C07	Total Quality Management	3	0	0	3	3	PEC

VERTICAL V: PRINT MEDIA

SL. NO.	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	CATEGORY
			L	T	P			
1.	PP23023	Creativity and Innovation in Printing and Packaging	3	0	0	3	3	PEC
2.	PP23024	Mass Communication	3	0	0	3	3	PEC
3.	PP23025	Book Publishing	3	0	0	3	3	PEC
4.	PP23026	Newspaper and Periodical Publishing	3	0	0	3	3	PEC
5.	PP23027	Advertising Techniques	3	0	0	3	3	PEC
6.	PP23028	Visual Communication	3	0	0	3	3	PEC

VERTICAL VI: DIVERSIFIED GROUP OF ELECTIVES

SL. NO.	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	CATEGORY
			L	T	P			
1.	MF23C03	Ergonomics and Human Factors Engineering	3	0	0	3	3	PEC
2.	IE23C09	Safety Engineering and Management	3	0	0	3	3	PEC
3.	IE23C03	Lean Manufacturing and Six Sigma	3	0	0	3	3	PEC
4.	PP23029	Smart Manufacturing	3	0	0	3	3	PEC
5.	MF23C05	Sustainable Manufacturing	3	0	0	3	3	PEC
6.	ME23C06	Design Thinking	3	0	0	3	3	PEC

Honors Degree Courses

S. No.	Course Code	Course Name	Course Type	Periods / Week		Credits
				L-T-P	TCP	
1.	PP23030	Computer aided product modelling and die design	T	2-0-2	4	3
2.	PP23031	Package Simulation	T	1-0-4	5	3
3.	PP23032	Industrial Instrumentation	T	3-0-0	3	3
4.	PP23033	Colour Management	T	2-0-2	4	3
5.	PP23034	Biopolymers and Biodegradable Polymers	T	3-0-0	3	3
6.	PP23035	Advanced Packaging Material Characterization	T	2-0-2	4	3
7.	PP23036	Advanced Paper and Board Packaging	T	3-0-0	3	3
8.	PP23037	Coatings and Adhesives	T	3-0-0	3	3

Minors Degree Courses (PRINT PRODUCTION)

S. No.	Course Code	Course Name	Course Type	Periods / Week		Credits
				L-T-P	TCP	
1.	PP23038	Designing and Planning for Print Production	T	3-0-0	3	3
2.	PP23039	Digital Prepress Technology	T	3-0-0	3	3
3.	PP23401	Offset Printing Technology	T	3-0-0	3	3

Minors Degree Courses (PRINT PRODUCTION)						
S. No.	**Course Code**	**Course Name**	**Course Type**	**Periods / Week**		**Credits**
				L-T-P	**TCP**	
4.	PP23503	Print Conversion Techniques	T	3-0-0	3	3
5.	PP23005	Speciality Printing	T	3-0-0	3	3
6.	PP23026	Advertising Techniques	T	3-0-0	3	3

Bridge Degree Courses							
S. No.	**Course Code**	**Course Name**	**Course Type#**	**Periods / Week**		**Credits**	**Category**
				L-T-P	**TCP***		
1.	ME23C03	Engineering Mechanics	T	3-1-0	4	4	ESC
2.	CY23C04	Chemistry for Printing Technology	T	3-0-0	3	3	HSMC

Open Elective Courses							
S. No.	**Course Code**	**Course Name**	**Course Type#**	**Periods / Week**		**Credits**	**Category**
				L-T-P	**TCP***		
1.	PP23901	Fundamentals of Printing and Packaging Technology	T	3-0-0	3	3	OEC
2.	PP23902	Digital Photography	T	3-0-0	3	3	OEC
3.	PP23903	Screen Printing	T	3-0-0	3	3	OEC

EN23C01 **FOUNDATION ENGLISH** **L T P C**
2 0 2 3

COURSE OBJECTIVES:

- To develop students' foundational skills in reading, writing, grammar and vocabulary to enable them to understand and produce various forms of communication.
- To enhance students' proficiency in reading comprehension, narrative and comparative writing.
- To comprehend and analyse descriptive texts and visual images
- To articulate similarities and differences in oral and written forms.
- To improve students' proficiency in reading and writing formal letters and emails.

UNIT I BASICS OF COMMUNICATION **6**

Reading - Telephone message, bio-note; Writing – Personal profile; Grammar – Simple present tense, Present continuous tense, wh-questions, indirect questions; Vocabulary – Word formation (Prefix and Suffix).

LAB ACTIVITY: **6**

Listening – Telephone conversation; Speaking Self-introduction; Telephone conversation – Video conferencing etiquette

UNIT II NARRATION **6**

Reading – Comprehension strategies - Newspaper Report, An excerpt from an autobiography; Writing – Narrative Paragraph writing (Event, personal experience etc.); Grammar – Subject-verb agreement, Simple past, Past continuous Tenses; Vocabulary – One-word substitution

LAB ACTIVITY: **6**

Listening – Travel podcast; Speaking – Narrating and sharing personal experiences through a podcast

UNIT III DESCRIPTION **6**

Reading – A tourist brochure, Travel blogs, descriptive article/excerpt from literature, visual images; Writing –Descriptive Paragraph writing, Grammar – Future tense, Perfect tenses, Preposition; Vocabulary – Descriptive vocabulary

LAB ACTIVITY: **6**

Listening – Railway / Airport Announcements, Travel Vlogs; Speaking – Describing a place or picture description

UNIT IV COMPARE AND CONTRAST **6**

Reading – Reading and comparing different product specifications - Writing – Compare and Contrast Essay, Coherence and cohesion; Grammar – Degrees of Comparison; Vocabulary – Transition words (relevant to compare and contrast)

LAB ACTIVITY: **6**

Listening – Product reviews, Speaking – Product comparison based on product reviews - similarities and differences

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										√		√

MA23C01

MATRICES AND CALCULUS

L	T	P	C
3	1	0	4

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 undermined 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", 10th Edition, Wiley India Pvt Ltd., New Delhi, 2018.
2. Greenberg M.D., "Advanced Engineering Mathematics", Pearson Education2nd Edition, 5th Reprint, Delhi, 2009.
3. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics",Narosa Publications, 5th 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 th Edition, New Delhi , 2012.
6. 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**
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

CY23C01 **ENGINEERING CHEMISTRY** **L T P C**
3 0 2 4

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 Na_2CO_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 – H_2-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 $H_2 – O_2$ 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: Tg, 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

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

1’ = Low; ‘2’ = Medium; ‘3’ = High

ME23C01	ENGINEERING DRAWING AND 3D MODELLING	L	T	P	C
		2	0	4	4

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.

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

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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 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, 2nd edition, 2018.
2. "Engineering Drawing" by Basant Agrawal and C M Agrawal, Vikas Publishing House, 3rd edition, 2020.
3. "Engineering Drawing With Auto CAD" by B V R Gupta, McGraw Hill Education, 4th edition, 2019.
4. "Engineering Drawing" by P S Gill, Tata McGraw Hill Education, 5th edition, 2018.
5. "Engineering Drawing with an Introduction to AutoCAD" by Dhananjay Jolhe, Cengage Learning, 2nd edition, 2020.
6. "Engineering Drawing" by M B Shah, Charotar Publishing House, 3rd edition, 2019
7. "Fundamentals of Engineering Drawing" by Imtiaz Hashmi, Pearson Education, 2nd edition, 2018.
8. "Computer Aided Engineering Drawing" by S Trymbaka Murthy, Scitech Publications, 3rd edition, 2020.
9. "CAED: Computer Aided Engineering Drawing for I/II Semester BE/Btech Courses" by Reddy K B, CBS Publishers & Distributors, 2nd, 2019.
10. "Computer-Aided Engineering Drawing" by Subrata Pal, Oxford University Press, 2nd, 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

ME23C03	ENGINEERING MECHANICS	L T P C 3 1 0 4

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:
Determining the resultant forces acting on a particle in 2D and 3D and for applying methods of equilibrium on a particle in 2D and 3D.

Evaluating the reaction forces for bodies under equilibrium, for determining the moment of a force, moment of a couple, for resolving force into a force-couple system and for analyzing trusses

Assessing the centroids of 2D sections / center of gravity of volumes and for calculating area moments of inertia for the sections and mass moment of inertia of solids.

Evaluating the frictional forces acting at the contact surfaces of various engineering systems and for applying the work-energy principles on a particle.

Determining kinetic and kinematic parameters of the rigid bodies subjected to concurrent coplanar forces.

UNIT I STATICS OF PARTICLES 9+3

Fundamental Concepts and Principles, Systems of Units, Method of Problem Solutions, Statics of Particles -Forces in a Plane, Resultant of Forces, Resolution of a Force into Components, Rectangular Components of a Force, Unit Vectors. Equilibrium of a Particle- Newton's First Law of Motion, Space and Free-Body Diagrams, Forces in Space, Equilibrium of a Particle in Space.

UNIT II EQUILIBRIUM OF RIGID BODIES AND TRUSSES 9+3

Principle of Transmissibility, Equivalent Forces, Vector Product of Two Vectors, Moment of a Force about a Point, Varignon's Theorem, Rectangular Components of the Moment of a Force, Scalar Product of Two Vectors, Mixed Triple Product of Three Vectors, Moment of a Force about an Axis, Couple - Moment of a Couple, Equivalent Couples, Addition of Couples, Resolution of a Given Force into a Force -Couple system, Further Reduction of a System of Forces, Equilibrium in Two and Three Dimensions - Reactions at Supports and Connections – Analysis of Trusses – Method of Joints and Method of Sections.

UNIT III DISTRIBUTED FORCES 9+3

Centroids of lines and areas – symmetrical and unsymmetrical shapes, Determination of Centroids by Integration, Theorems of Pappus-Guldinus, Distributed Loads on Beams, Centre of Gravity of a Three-Dimensional Body, Centroid of a Volume, Composite Bodies, Determination of Centroids of Volumes by Integration.

Moments of Inertia of Areas and Mass - Determination of the Moment of Inertia of an Area by Integration , Polar Moment of Inertia , Radius of Gyration of an Area , Parallel-Axis Theorem , Moments of Inertia of Composite Areas, Moments of Inertia of a Mass - Moments of Inertia of Thin Plates , Determination of the Moment of Inertia of a Three-Dimensional Body by Integration.

UNIT IV FRICTION AND WORK PRINCIPLES 9+3

The Laws of Dry Friction. Coefficients of Friction, Angles of Friction, Wedges, Wheel Friction. Rolling Resistance, Ladder friction. Work of a Force, Kinetic Energy of a Particle, Principle of Work and Energy, Principle of Impulse and Momentum, Impact, Method of Virtual Work - Work of a Force, Potential Energy, Potential Energy and Equilibrium.

UNIT V DYNAMICS OF PARTICLES AND RIGID BODIES 9+3

Kinematics - Rectilinear Motion and Curvilinear Motion of Particles. Kinetics- Newton's Second Law of Motion -Equations of Motions, Dynamic Equilibrium, Energy and Momentum Methods – Kinematics of Rigid Bodies and Plane Kinetics.

TOTAL : 60 Periods

COURSE OUTCOMES:

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

1. To determine the resultant forces acting on a particle in 2D and 3D and to apply methods of equilibrium on a particle in 2D and 3D.
2. Evaluate the reaction forces for bodies under equilibrium, to determine moment of a force, moment of a couple, to resolve force into a force-couple system and to analyze trusses
3. Assess the centroids of 2D sections / center of gravity of volumes and to calculate area moments of inertia for the sections and mass moment of inertia of solids.
4. Evaluate the frictional forces acting at the contact surfaces of various engineering systems and apply the work-energy principles on a particle. evaluate the kinetic and kinematic parameters of a particle.
5. Determine kinetic and kinematic parameters of the rigid bodies subjected to concurrent coplanar forces.

TEXT BOOKS:

1. Beer Ferdinand P, Russel Johnston Jr., David F Mazurek, Philip J Cornwell, Sanjeev Sanghi, Vector Mechanics for Engineers: Statics and Dynamics, McGraw Higher Education., 12th Edition, 2019.
2. Vela Murali, "Engineering Mechanics-Statics and Dynamics", Oxford University Press, 2018.

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

ME23C04	MAKERSPACE	L	T	P	C
		1	0	4	3

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 Stell 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, 1st 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, 1st edition 2013.

6. Visualization, Modeling, and Graphics for Engineering Design, D.K. Lieu, S.A. Sorby, Cengage Learning; 2nd edition.

UC23H01 **தமிழர் மரபு** **L T P C**
1 0 0 1

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 திருவள்ளுவர் 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, ஒயிலாட்டம், 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, கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

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. பொருநை – 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 ofArchaeology & 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.

UC23H01 **HERITAGE OF TAMILS** **L T P C**
1 0 0 1

UNIT I LANGUAGE AND LITERATURE 3

Language Families in India - Dravidian Languages – Tamil as aClassical 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, Village deities, 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, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT IV THINAI CONCEPT OF TAMILS 3

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of 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. பொருநை – 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 ofArchaeology & 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*

UC23P01	**(ARMY WING) NCC Credit Course Level - I**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**

NCC GENERAL		**6**
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
NATIONAL INTEGRATION AND AWARENESS		**4**
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
PERSONALITY DEVELOPMENT		**7**
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
LEADERSHIP		**5**
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour 'Code	3
L 2	Case Studies: Shivaji, Jhasi Ki Rani	2
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT		**8**
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

NCC Credit Course Level 1*

UC23P02	**(NAVAL WING) NCC Credit Course Level – I**	**L T P C**
		2 0 0 2

NCC GENERAL		**6**
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
NATIONAL INTEGRATION AND AWARENESS		**4**
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
PERSONALITY DEVELOPMENT		**7**
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
LEADERSHIP		**5**
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code	3
L 2	Case Studies: Shivaji, Jhasi Ki Rani	2
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT		**8**
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

NCC Credit Course Level 1*

		L	T	P	C
UC23P03	**(AIR FORCE WING) NCC Credit Course Level – I**	**2**	**0**	**0**	**2**

NCC GENERAL		**6**
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
NATIONAL INTEGRATION AND AWARENESS		**4**
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
PERSONALITY DEVELOPMENT		**7**
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
LEADERSHIP		**5**
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code	3
L 2	Case Studies: Shivaji, Jhasi Ki Rani	2
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT		**8**
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

EN23C02 **PROFESSIONAL COMMUNICATION** **L T P C**
2 0 2 3

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.

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

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

MA23C02	ORDINARY DIFFERENTIAL EQUATIONS AND TRANSFORM TECHNIQUES	L	T	P	C
		3	1	0	4

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) – Parsevals'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", 10th 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 Education2nd 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

PH23C01 **ENGINEERING PHYSICS** **L T P C**
(Common to all branches of B.E/B.Tech Programmes) **3 0 2 4**

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 Walls'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 – Czocharalski 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.

4. Non-uniform bending -Determination of Young's modulus of the material of the beam.
5. Uniform bending -Determination of Young's modulus of the material of the beam
6. 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.

7. Torsional pendulum-Determination of rigidity modulus of wire and moment of inertia of the disc
8. Melde's string experiment - Standing waves.
9. 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_2 laser, Semiconductor laser - Industrial and medical applications - Optical Fibers – Total internal reflection – Numerical aperture and acceptance angle – Fiber optic communication – Fiber sensors – Fiber lasers.

10. 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
11. Air wedge -Determination of the thickness of a thin sheet/wire
12. Optical fibre - Determination of Numerical Aperture and acceptance angle

    -Determination of bending loss of fibre.
13. 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.

14. Photoelectric effect – Determination of Planck's constant.
15. Black Body Radiation (Demonstration)
16. 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,10th 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.

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

CS23C02 **COMPUTER PROGRAMMING IN PYTHON** **L T P C**
3 0 2 4

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 Ill – 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
1	2		2		1								1	1	
2	2		2		1								1	1	
3	2	1	2		1								1	1	
4	2	1	2	1	1								1	1	
5	2	1	2	1	1								1	1	
Avg	2	1	2	1	1								1	1	

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

EE23C03	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
		2	0	2	3

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

LAB COMPONENET:

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			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3	PSO4
CO 1	2	1														
CO 2	2	1														
CO 3	2	1														
CO 4	2	1														
CO 5	2	1														
Avg	2	1														

CY23C04 **CHEMISTRY FOR PRINTING TECHNOLOGY** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To introduce the basic concepts of surface chemistry and colloids.
- To impart knowledge on the properties of lubricants and understand the mechanism of adhesive action.
- To familiarize the preparation and properties of various commercial polymers, composite materials and foams.
- To facilitate the understanding the concepts of dye chemistry
- To inculcate understanding of principle, instrumentation and data analysis of instrumental methods of analysis.

UNIT I SURFACE CHEMISTRY **9**

Adsorption-Types of adsorption-adsorption of gases on solids- adsorption from solutions-Types of isotherms–Freundlich adsorption isotherm, Langmuir adsorption isotherm, Applications of adsorption studies-detergency, wetting, foaming, defoaming, spreading, water repellency. Colloids-types-multimolecular, macromolecular, and associated colloids-preparation, purification and characteristics of colloidal solutions-coagulation of sols-origin of charge on colloids-stability of colloids- protective colloids-emulsions-gels and micelles

UNIT II LUBRICANTS AND ADHESIVES **9**

Lubricants and lubrication- functions-classification with examples-properties (viscosity index, flashand fire point, oiliness, carbon residue, aniline point, cloud and pour point)-greases (calcium based, sodium based, lithium based only)-solid lubricants-graphite and molybdenum sulphide. Adhesives- adhesive action-development of adhesive strength-physical and chemical factors influencing adhesive action-bonding process of adhesives-phenol formaldehyde resins, polyurethane, epoxy resins and urea formaldehyde.

UNIT III POLYMERS, COMPOSITES AND FOAMS **9**

Polymers-classification; commodity-polyethylene, polypropylene, polyvinyl chloride, polystyrene; polyamide, polyethylene terephthalate, polycarbonate, acrylonitrile-butadiene-styrene, specialtypolyether ether ketone, polyethersulfone, polyphenylene oxide- preparation, properties, uses. Composites-Introduction-definition-constitution-classification-applications of composite materials-fiber reinforced composites-properties of reinforced composites. Foams-polystyrene, polyurethane, polyolefins characterization, development,processing and applications.

UNIT IV DYE CHEMISTRY **9**

Dye- Theory of color and constitution: chromophore and auxochrome, bathochromic and hypsochromic shift, Classification based on chemical composition and applications, chemistry of azo dye, synthesis of methyl red, methyl orange, congo red, malachite green, p-rosaniline, phenolphthalein, fluorescence, eosin dyes.

UNIT V INSTRUMENTAL METHODS AND ANALYSIS **9**

Principle, instrumentation (block diagram) and applications - X-Ray diffraction analysis, ICP-OES Microscopic analyses: Scanning Electron Microscopy, Tunneling Electron Microscopy. Thermal methods: Thermo-gravimetric analysis, Differential thermal analysis. Chromatography-column chromatography, TLC.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

- To identify and apply basic concepts of surface chemistry in the preparation of colloids, gels and micelles and apply in printing technology methods and applications to futuristic material fabrication needs.
- To recognize and apply basic knowledge on lubricants and their application in printing press and adhesives for packaging technology.
- To recognize and apply basic knowledge on different types of polymeric, composite materials and foams, their manufacturing and applications to innovative high performance material needs.
- To identify and recognize the usage of dyes in the field of printing technology.
- To demonstrate the knowledge of various instrumental methods of analysis in characterisation of materials.

TEXT BOOKS:

1. Jain P.C. and Monica Jain, Engineering Chemistry, Dhanpat Rai Publishing Company; 16th Edition, 2015.
2. Dara S.S and Umare S.S. A Textbook of Engineering Chemistry, S. Chand & Company Ltd., 2010.
3. Kannan P., Ravikrishnan A., Engineering Chemistry, Srikrishna Hitech Publishing Company, 2014.

REFERENCES:

1. Budinski K.G. and Budinski M.K., Engineering Materials: Properties and Selection, Prentice Hall India Learning Private Limited; 9th edition 2009.
2. Misra G.S., Introductory Polymer Chemistry, New Age International (P) Ltd., 2010.
3. Sivasankar B., Instrumental Methods of Analysis", Oxford University Press, 2012.
4. Klaus Hunger, Industrial Dyes: Chemistry, Properties, Applications, Wiley-VCH Verlag GmbH; 1st edition, 2003.

CO-PO & PSO MAPPING

CO	PO											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	3	2	1	1	-	2	-	-	-	-	-	2
2	3	1	2	-	-	2	2	-	-	-	-	1
3	3	1	2	-	-	2	2	-	-	-	-	1
4	3	-	2	-	-	2	2	-	-	-	-	1
5	3	2	1	-	3	-	-	-	-	-	-	1
Avg.	3	1.5	1.6	1	3	2	2					1.2

UC23H02 **தமிழரும் தொழில்நுட்பமும்** **L T P C**
1 0 0 1

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 இந்தோ-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 குமுழித் 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. பொருநை – 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 C ivilization on the banks of river Vaigai' (Jointly Published by: Department ofArchaeology & 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.

UC23H02 TAMILS AND TECHNOLOGY L T P C
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 Nayakar Mahal - Chetti Nadu 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 Stone beads -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 Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

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-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. பொருநை – 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 C ivilization on the banks of river Vaigai' (Jointly Published by: Department ofArchaeology & 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.

MA23C05	PROBABILITY AND STATISTICS	L	T	P	C
		3	1	0	4

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, 8th 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, 9th Edition, 2024.

REFERENCES:

1. Richard A. Johnson, Irwin Miller, John Freund "Miller & Freund's Probability and Statistics for Engineers", Person Education, 8th Edition, 2015.
2. Ross, S.M. "Introduction to Probability and Statistics for Engineers and Scientists", Elsevier,
   New Delhi, 5th 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, 3rd Edition, Reprint, 2017.
4. Devore, J.L. "Probability and Statistics for Engineering and the Sciences", Cengage Learning, 9th 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

CE23C01 **MECHANICS OF MATERIALS** **L T P C**
3 0 2 4

COURSE OBJECTIVES:

1. To develop the understanding of the principle concepts of stress, strain and deformation of solids for various engineering applications.
2. To analyse the flexural and shear stresses induced in beams due to different loading conditions
3. To analyse the effect of torsion on shafts and springs.
4. To understand and analyse the deflection of beams for different support and loading conditions
5. To examine the stresses induced in thin and thick shells.

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 9

Rigid bodies and deformable solids –Stresses and strains: Tension, Compression and Shear - Elastic constants – Relationships – Compound bars – Thermal stresses –Volumetric strains – Stress on inclined planes – Principal stresses and principal planes – Mohr's circle of stress.

PRACTICALS

- Tension test on mild steel rod

UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM 9

Beams – Types - Transverse loading on beams – Shear force and bending moment in beams – Cantilevers – Simply supported beams and over hanging beams - Theory of simple bending – Bending stress distribution - Load carrying capacity - Proportioning of sections –Flitched beams –Carriage springs – Shear stress distribution- Shear Centre.

PRACTICALS

- Deflection test on carriage spring

UNIT III TORSION 9

Theory of Pure Torsion- Stresses and deformation in circular and hollows shafts – Transmission of power through hollow & solid shafts – Stepped shafts –Shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs.

PRACTICALS

- Torsion test on mild steel rod

UNIT IV DEFLECTION OF BEAMS 9

Double Integration method – Macaulay's method – Area moment method - Conjugate beam method - Strain energy method - computation of slopes and deflections in beams- Maxwell's reciprocal theorem.

PRACTICALS

- Compression test on helical spring

UNIT V THIN &THICK SHELLS, THEORIES OF FAILURE 9

Stresses and deformations in thin cylindrical shells and spherical shells subjected to internal pressure – Stresses in thick cylinders – Lame's theory – Application of theories of failure- Euler's buckling theory.

PRACTICALS

- Hardness test on metal beam (Rockwell and Brinell hardness test)

TOTAL: 45L+30P =75 PERIODS

COURSE OUTCOMES:

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

CO1 Have thorough understanding of the fundamental concepts of stress and strains and understand the mechanical behaviour of materials such as tension, compression and hardness.

CO2 Understand the bending and shear stress distribution in beams.

CO3 Have sufficient knowledge on designing shafts to transmit power and understand the behaviour of helical springs

CO4 Have the ability to determine the deflection of beams and carriage springs

CO5 Have the knowledge of behaviour of cylindrical and spherical shells.

TEXT BOOKS:

1. Bansal, R.K., Strength of Materials, Laxmi Publications (P) Ltd., 2018
2. Rajput, R.K., Strength of Materials, S Chand And Company Ltd., New Delhi, 2018

REFERENCES:

1.) Strength of Materials Laboratory Manual, Anna University, Chennai - 600025.
2.) IS 432 (art I) -1992, Specification for mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement.
3.) Egor. P.Popov"Engineering Mechanics of Solids" Prentice Hall of India, New Delhi, 2015.
4.) Ferdinand P. Beer, Russell Johnson, Jr. and John J. Dewole Mechanics of Materials, 7 th Edition, Tata McGraw Hill publishing 'co. Ltd., New Delhi, 2014.
5.) Hibbeler, R.C., Mechanics of Materials, Pearson Education, 10th Edition, 2022.
6.) Subramanian R., Strength of Materials, Oxford University Press, Oxford Higher Education Series, 2007

CO-PO-PSO MAPPING: MECHANICS OF MATERIALS

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

PP23301	MACHINE KINEMATICS AND MAINTENANCE	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To understand the fundamental theories of mechanisms and their kinematics.
- To understand the various bearings, shafts, rollers and mechanical drives in printing machine.
- To understand the different lubricants and Use different pneumatic and electrical drives in printing machines

UNIT I MECHANISMS AND MACHINES

Mechanisms – Elements or links, classification - rigid, flexible and fluid link, types of kinematics pair - sliding, turning, rolling, screw and spherical pair. kinematics analysis in simple mechanisms – velocity and acceleration polygons. Mechanism of Printing and Allied Machines, detailed technical specification of machines, mechanism of power transmission

UNIT II BEARNINGS, SHAFTS AND ROLLERS

Bearing - Selection of bearing, different types of bearings used in printing machine, Bearing failure. Shaft - Types of shafts in pile feeder, delivery, stock register (vaccum belt), and inking unit. Rollers - types of rollers in inking and continuous dampener system.

UNIT III MECHANICAL DRIVES

Chain – Roller chain and its application areas in printing, Sprocket-with hub and without hub and its application in printing. Maintenance of chains and sprocket. Belt and pulleys – Definition, classification, maintenance. Definition, application areas in printing. Gear terminology, material, different types of gears used in printing machines. Cam & followers.

UNIT IV LUBRICATION SYSTEMS

Types of lubricants, Purpose of lubrication – control of friction, control of wear, control of temperature, removal of contaminants, shock absorption. Characteristic – wetting ability, surface tension, viscosity, adhesion. lubrication pump mechanism, Lubrication maintenance failure, Automatic lubrication.

UNIT V ELECTRICAL AND HYDRAULIC, PNEUMATIC DRIVES

Electrical Maintenance – Introduction to AC and DC motors, Maintenance Check list for motors, Common problems with Electricity. Pneumatic System Maintenance - Introduction to pneumatic system functioning, Compressor types - Reciprocating compressor in front separation feeder. Rotary compressor (vanes-type) in back separation feeder. Air compressor pipe connections, Compressor maintenance

List of Lab Exercise:

1) Identify the various links in the printing machine with proper justification
2) Sketch oscillating roller mechanism in printing machine
3) Identify and draw the wobble gear and ductor drive Shaft in printing machine
4) Draw the chain drive mechanism in printing machine
5) Draw the chain various belt drive mechanism in printing machine
6) Sketch the various gear drive mechanism employed in printing machine
7) Draw the lubrication pump mechanism in printing machine
8) Construction of various cam profiles.
9) Draw the delivery control station in printing machine
10) Sketch DC drive motor assembly

OUTCOMES:

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

1. Summarize the various sources for paper and board manufacturing process
2. Appraise the various Properties and testing of papers and paper board
3. Follow the standards used for testing of paper and board
4. Rectify the paper related problems in printing and packaging
5. Recognize the need, importance of corrugated box in printing and packaging applications.

TEXTBOOKS:

1. Lawrence H.Wilson, What the printer should know about paper, GATF Press, Third Edition, 2000.
2. Lothar Gottsching & Heikki Pakarinen, Papermaking Science and Technology, Book7, Fapet Publishing, 2000

REFERENCES:

1. Bob Thompson, Printing Materials Science and Technology, Pira International Publications 2nd edition,2004.
2. Charles Finley,Printing Paper, andInk,DelmarPublisher,1997.
3. Christopher J. Biermann, Handbook of Pulping and Papermaking,1996.
4. Herbert Holik, Handbook of Paper and Board, Wiley–VCH,2006.
5. John Christopher Roberts, Paper Chemistry, Springer, 1996

PP23302	DESIGN FOR PRINT MEDIA	L T P C 3 0 0 3

OBJECTIVES:

- To introduce the fundamentals of graphic design.
- To impart knowledge on prepress elements, devices and tone and colour reproduction
- To comprehend the stages in digital, prepress workflow.

UNIT I PRINCIPLES OF DESIGN 9

Basic concepts of designing, Creativity, Steps in creativity; Elements of graphic design; Principles of Design; Color; Typography; Symbols and logos. Layout – purpose & advantages; layout styles; layout components; stages in preparing a layout; Marking-up; Dummy; Designing For Media; Sustainable Graphic Design; Anticounterfeiting; Augmented Reality; Generative AI; Case studies

UNIT II TEXT, GRAPHICS AND IMAGE 9

Text encoding - ASCII, Unicode; Text compression; Typeface - Anatomy, Taxonomy, Measurement, Classification, Typeface family; Type spacing; Font - Types, Design, Metrics; Font engine and rasterization - Hinting, Antialiasing, subpixel rendering; Font embedding; Font management; Web fonts; Typography; Typesetting; Copy editing; Proof reading; ISO standards. Originals for reproduction; Raster and vector images; File formats – Vector, Raster;

UNIT III TONE AND COLOUR REPRODUCTION 9

Optical Density; Continuous tone; Halftone – Need, Conventional method, Dot shape, Screen ruling, Screen angle, Rosette, Moire; Screening Process - Amplitude modulation, Frequency modulation, Intensity modulation, Hybrid screening; Output Device Resolution - Addressability, Gray levels; Tone Reproduction - Dot area, Tone value increase, Tone value sum, Transferable tonal range; Densitometer – Working principle; Colour Reproduction – Additive and Subtractive Theory; Color spaces – RGB, CMYK, CIELAB, CIELCH; Gamut; Color management; Color Profiles;

UNIT IV INTRODUCTION TO PRINTING PROCESSES 9

Printed Products; Substrates; Workflow – Prepress, Press, Postpress; Types of printing technologies, Classification; Principle, Process Characteristics, Merits, Demerits, Applications - Letterpress, Offset, Gravure, Flexography, Screen printing, Pad Printing, Electrophotography, Inkjet, Thermal; Hybrid Printing;

UNIT V DESIGN MANAGEMENT & PRODUCTION PLANNING 9

Relationship between designer, customer and printer; selection and co-ordination of production process; Finishing and Converting operations – cutting, folding, gluing, binding, hot foil stamping, laminating, varnishing, embossing, die cutting; ancillary processes; Standard Paper and board sizes; Selection and specification of ink, paper and other materials; Production strategy; Case studies

OUTCOMES:

Upon completion of the course, the student should be able to:

1. Summarize the types of printing technologies and apply graphic design principles
2. Explain the significance of typographic and image acquisition parameters in graphic design
3. Explain the halftoning considerations, techniques and evaluate tone reproduction capabilities
4. Specify colour in device independent colour space and determine imposition schemes, job sequence, software and hardware requirements in prepress workflow
5. Describe the working principle of imaging devices

TEXT BOOKS:

1. Helmut Kipphan, Handbook of Print Media, Springer-Verlag, 2001.
2. Kaj Johansson, Peter Lundberg, Robert Ryberg, A Guide to Graphic Print Production, Wiley,3rd edition, 2011.

REFERENCES:

1. Sharma, G and Bala, R. Digital Color Imaging Handbook (1st ed.). CRC Press, 2003
2. James Felici, The Complete Manual of Typography: A Guide to Setting Perfect Type, Peachpit, Second Edition, 2012
3. Daniel L. Lau, Gonzalo R. Arce, Modern Digital Halftoning, CRC Press, Second Edition, 2001.
4. Gerald F. Marshall and Glenn E. Stutz, Handbook of Optical and Laser Scanning, CRC Press, 2004.
5. Roy S. Berns, Billmeyer and Saltzman's Principles of Color Technology, Wiley, 4th Edition, 2019

PP23303	FLEXOGRAPHY AND CONVERTING PROCESS	L T P C 3 0 0 3

OBJECTIVES:

- To learn the basic principles of flexographic printing and designing for flexo
- To understand the various plate preparation methods, the mounting and proofing methods
- To comprehend the parts of flexo press and its operation with quality control principles

UNIT I INTRODUCTION 9

Flexography – Basic principle, advantages, limitations, applications; Designing for flexo - Type, Tint, Vignette, Reverse, Registration tolerances, Barcode design; Template/Dieline preparation; Preflighting; Proofing; Design considerations, Screening Technologies for flexo; Environment and safety aspects; Ink, substrates.

UNIT II IMAGE CARRIER PREPARATION 9

Construction, Characteristics, Preparation - Moulded rubber plates, Sheet photopolymer plates,Liquid photopolymer plates; Direct Imaged Plates - Image Masking Technologies, Equipments; Plate considerations – plate handling, storage, wrap distortion, Ink and solvent compatibility, quality.

UNIT III PLATE MOUNTING AND PRESS CONFIGURATION 9

Plate mounting procedures - Optical, Pin Register, Microdot, Video, Sleeve; Mounting tapes - types,properties, selection; Improving press performance through mounting; Proofing procedure. Press types – stack, CI, inline, narrow web, wide web, corrugated post print; Variations of press – coating, lamination, corrugated post printing; extruders, online digital printing; Printing station – fountain rollers, anilox rollers, doctor blades, plate cylinders, impression rollers;

UNIT IV WEB HANDLING AND CONVERTING 9

Web Handling - Infeed, Outfeed, web guiding, pneumatic shafts and chucks; Web treatment and processing - Film treating, Dryers, Cooling rollers, static electricity, substrate cleaning, varnishing; Web inspection systems, Press Mechanics; Drives- Gear, Servo; Pressroom Practices ; inline converting operations-coating, embossing, die cutting, slitting, perforating, bag making, filling, folding, pasting;

UNIT V QUALITY CONTROL 9

Plate Standardization, ISO 12647-6, Flexo QC targets, Flexographic Print Evaluation, Job specific print variables, Automatic viscosity controls; Colour Matching, Press Optimization, Fingerprinting, Troubleshooting, Case studies.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. State the factors influencing design for flexography.
2. Design and optimize the plate preparation process
3. Apprehend the steps in the image carrier preparation and mounting
4. Report about the working of flexographic press and its control.
5. Implement quality control in flexographic printing workflow

TEXT BOOKS:

1. Flexography : Principles & Practices, 6th Edition, Foundation of Flexographic Technical Association, 2014.
2. FIRST: Flexographic Image Reproduction Specifications &Tolerances 5.0, 5th Edition, Foundation of Flexographic **Technical Association, 2014.**

REFERENCES:

1. Anthony White, High Quality Flexography, Pira reviews of Printing, Pira International,1999.
2. Frederick R.Boyle, The Flexo Environment, Foundation of Flexographic Technical Association, 2002.
3. Helmut Kipphan, Handbook of Print Media, Springer-Verlag, 2001

CO's – PO's & PSO's MAPPING

	PO												PSO		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	3	-	2	1	-	-	-	2	-	1	3	3	2
2	3	3	3	2	2	-	-	-	2	2	-	3	1	2	2
3	3	2	3	-	-	3	2	2	2	2	2	3	3	3	2
4	3	2	2	2	-	-	-	-	2	-	2	-	1	2	1
5	3	3	1	3	3	3	3	1	2	-	2	3	2	1	3
Avg	**3**	**2.6**	**2.4**	**1.4**	**1.4**	**1.4**	**2.5**	**1.5**	**2**	**2**	**2**	**2.5**	**2**	**2.2**	**2**

PP23304 **PAPER AND PAPER BOARD** **L T P C**
3 0 2 4

OBJECTIVES:

- To appreciate paper manufacturing processes, the fibrous and non-fibrous processing
- To impart the knowledge about coating and coating techniques
- To learn the properties of paper and paper board and testing methods

UNIT I RAW MATERIALS & PROCESSING 9

Introduction to raw materials and processing, Sources, Kinds of cellulose fibres, De-barking, Pulping – Mechanical, Thermo-mechanical and Chemical processes –Bleaching techniques – Stock preparation – Beating & refining – Fillers, Sizing, Dyeing, bleaching –Non-fibrous additives, consistency and other raw materials.

UNIT II MANUFACTURING 9

Paper making machines, Head boxes and inlets, sheet formation, wet pressing and drying – mechanisms of drying, wires, felts, automation; Calendaring – types, winding process, Defects arising during the winding process, Board manufacturing – cylinder machines.

UNIT III COATING & CLASSIFICATION 9

Paper and board coating – Pigments, binders, additives. Coating – weightage, types/Techniques and metallization; Main classes of paper and board; paper and board sizes; paper requirements for different printing processes; paper handling, Case Studies;

UNIT IV PROPERTIES 9

Structural – Formation, 2-sidedness, grain direction; Physical – GSM, caliper, bulk, porosity, smoothness, dimensional stability, curl, moisture content and relative humidity, Cobb tester, Optical - Gloss, brightness, Whiteness, colour, opacity; Chemical – pH, ash content, Taint and odor neutrality; Mechanical – Tensile, burst, tear, internal bonding, fold endurance, stiffness, pick resistance, absorbency, surface structure, surface smoothness and surface strength.

UNIT V PAPER AND PAPER BOARD RELATED PROBLEMS IN PRINTING AND PACKAGING 9

Fluff, hickies, picking, piling, slurring and doubling, curl, chalking, set-off, mottle, poor ink drying, show through, strike through mis-register, static electricity, blistering, and web break. De-Inking-methods, recycling, paper properties, enduse; Environmental aspects and certification. Case studies;

TOTAL: 45 + 30 = 75 PERIODS

LIST OF EXPERIMENTS:

1. Determination of grammage, grain direction, caliper, bulk
2. Determination of moisture percentage, pH, ash content.
3. Determination of brightness, opacity, CIE whiteness, gloss, color, fluorescence
4. Determination of tensile and burst strength
5. Determination of plybond strength and bending stiffness
6. Determination of tear resistance and folding endurance
7. Determination of smoothness and porosity
8. Determination of water absorbency and COF
9. Determination of printability and drying time
10. Determination of rub resistance and mottling

OUTCOMES:

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

1. Summarize the various sources for pulping process
2. Portray the functions and working of paper and paperboards machine
3. Consolidate the need, importance of paper and paperboards in printing and packaging applications.
4. Appraise the various Properties and testing of papers and paper board.
5. Resolve the paper related problems in printing and packaging processess

TEXT BOOKS:

1. Lawrence H.Wilson, What the printer should know about paper, GATF Press, Third Edition, 2000.
2. Lothar Gottsching & Heikki Pakarinen, Papermaking Science andTechnology, Book7, Fapet Publishing, 2000

REFERENCES:

1. Bob Thompson, Printing Materials Science and Technology, PiraInternational Publications 2nd edition,2004.
2. Charles Finley, Printing Paper and Ink,DelmarPublisher,1997.
3. Christopher J. Biermann, Handbook of Pulping and Papermaking,1996.
4. Herbert Holik, Handbook of Paper and Board,Wiley–VCH,2006.
5. John Christopher Roberts, Paper Chemistry, Springer, 1996

CO's – PO's & PSO's MAPPING

	PO												PSO		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	3	-	2	-	-	-	-		-	-	3	3	2
2	3	3	2	-	-	-	-	-	-	2	-	3	1	2	2
3	3	2	3	-	-	3	2	2	2	2	2	3	3	3	2
4	2	2	2	2	-	-	-	-	2	-	2	-	1	2	1
5	3	3	1	3	3	3	3	1	2	-	2	3	2	1	3
Avg	2.8	2.4	2.2	2.5	2.5	3	2.5	1.5	1.2	2	1.2	3	2	2.2	2

PP23S01	GRAPHIC DESIGN LABORATORY	L T P C 0 0 4 2

OBJECTIVES:

- To familiarize the tools and features of pagination, bitmap and vector graphics design software.
- To learn formatting of text and concepts in bookwork.
- To impart knowledge on graphic design

Pagination Software

1. Text and paragraph formatting
2. Working with columns, text boxes, picture frames
3. Tab setting and table editing
4. Master pages and style sheets

Graphic Design Software

5. Creation of shapes & objects using drawing tools
6. Logo creation using object transformation tools
7. Design using gradients, transparency and blend
8. Working with layers

Image Editing Software

9. Introduction to Raster Graphics Software tools and Working with selection tools
10. Image designing using painting and transformation tools
11. Basic Image editing using brush tools and clone stamp tools
12. Creative image design using layers

Designing for Printed Products

13. Graphic design for printed products

TOTAL: 60 PERIODS

OUTCOMES:

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

1. Reproduce page designs by applying typographic principles.
2. Create bookwork using master page and style sheets.
3. Create graphic design for various applications.

ME23C12 **MECHATRONICS AND IOT** **L T P C**

3 0 2 4

COURSE OBJECTIVE:

To impart knowledge on the principles of sensors, actuators, micro-controllers, Programmable Logic control, Arduino, Raspberry Pi and IOT.

UNIT – I SENSORS AND ACTUATORS 9

Introduction to Mechatronics - Modular Approach, Sensors and Transducers: Static and Dynamic Characteristics, Transducers - Resistive, Capacitive, Inductive and Resonant, Optical Sensors – Photodetectors - Vision Systems – Laser - Fibre optic - Non-fibre Optic, Solid State Sensors, Piezoelectric and Ultrasonic Sensors. Actuators – Brushless Permanent Magnet DC Motor – PM, VR and Hybrid Stepper motors – DC and AC Servo Motors.

PRACTICALS

1. Modeling and Analysis of Hydraulic, Pneumatic, Electro-Hydraulic and Electro-Pneumatic Circuits by using simulation software.
2. Actuation of double acting cylinder by using Electro-Hydraulic and Electro-Pneumatic circuits.

UNIT – II SIGNAL CONDITIONING CIRCUITS AND PLC 9

Operational Amplifiers – Inverting and Non-Inverting Amplifier – Wheatstone bridge – Instrumentation Amplifier – PID Controller, Protection Circuits, Filtering Circuits, Multiplexer, Data Logger and Data Acquisition System, Switching Loads by Power Semiconductor Devices Circuits – Thyristors – TRIAC – Darlington Pair – MOSFET and Relays. PLC – Architecture – Input / Output Processing – Logic Ladder Programming – Functional Block Programming using Timers and Counters – Applications.

PRACTICALS

1. Data Acquisition System – Measurement of Physical Quantities
2. PLC Automation with Timers and Counters.

UNIT – III FUNDAMENTALS OF IoT AND EMBEDDED SYSTEMS 9

The Internet of Things (IoT) - Introduction to the IoT Framework – IoT Enabling Technologies- The Effective Implementation of IoT: The Detailed Procedure. Embedded Systems: An Introduction - Single-Chip Microcontroller Systems - Single- Board Microcontroller Systems - Single-Board Computer Systems - Embedded Systems: Peripherals - Software Considerations.

PRACTICALS

1. Automation of material handling application by Six-Axis Articulated Robot.

UNIT – IV ARDUINO AND RASPBERRY Pi 9

Arduino: The Arduino Boards - Arduino Peripherals- Arduino IDE – ESP8266 Wi-Fi module. Raspberry Pi: The Raspberry Pi Boards - The Raspberry Pi Peripherals - The Raspberry Pi Operating System. Interfacing and Controlling I/O devices by Arduino and Raspberry Pi: LEDs - Push buttons - Light intensity sensor - Ultrasonic distance sensor – Temperature sensor- Humidity sensor - Sensor and Actuator interactions

PRACTICALS

1. Automating the actuation of cylinder sequence by using Microcontroller.

2. Speed and Direction control of Stepper and Servo motors.
3. Speed and Direction control of DC and AC drives.

UNIT – V MECHATRONICS AND IoT CASE STUDIES 9

Mechatronics systems: Aerial drone actuation and Control - Autonomous Robot with Vision System, Automotive Mechatronics: Electronic Ignition System - ABS - EBD - Adaptive Cruise Control. IoT case studies: Remote Monitoring Systems- Remotely Operated Autonomous Systems - Centralized Water Management System - IoT Enabled Robotic Camera Dolly - Portable, Wireless, Interactive IoT Sensors for Agriculture - IoT Vehicle Management System with Network Selection.

PRACTICALS

1. Vision based image acquisition and processing technique for inspection and classification.
2. Remote data acquisition by using IoT.
3. IoT based Home Automation.
4. IoT enabled Robot.

TOTAL: 45L+ 30 P = 75 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to

1. Select suitable sensors and actuators to develop mechatronics systems
2. Devise proper signal conditioning circuit for mechatronics systems, and also able to implement PLC as a controller for an automated system.
3. Elucidate the fundamentals of IoT and Embedded Systems.
4. Implement Arduino and Raspberry Pi as controllers for automated systems.
5. Design and develop an apt mechatronics/IoT based system for the given real- time application.

TEXT BOOKS:

1. Bradley D.A., Burd N.C., Dawson D., Loader A.J., “Mechatronics: Electronics in Products and Processes”, Routledge, 2017.
2. Sami S.H and Kisheen Rao G, “The Internet of Mechanical Things: The IoT Framework for Mechanical Engineers”, CRC Press, 2022.

REFERENCES:

1. John Billingsley, “Essentials of Mechatronics”, Wiley, 2006.
2. David H., Gonzalo S., Patrick G.,Rob B. and Jerome H.,“IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, Pearson Education, 2018.
3. Nitin G and Sharad S, “Internet of Things: Robotic and Drone Technology”, CRC Press, 2022.
4. Newton C. Braga, “Mechatronics For The Evil Genius”, McGraw Hill, 2005.
5. Bell C., “Beginning Sensor Networks with Arduino and Raspberry Pi”, Apress, 2013.
6. Bolton W., “Mechatronics”, Pearson Education, 2019.

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	1	1	-	-	-	-	-	-	2	1	2	3
2	3	3	3	1	2	-	-	-	-	-	-	2	1	2	3
3	3	1	2	1	2	-	-	-	-	-	-	2	1	2	3
4	3	3	3	3	3	2	-	-	-	-	-	2	1	2	3
5	3	3	3	3	3	2	-	-	-	-	2	2	1	2	3
Avg	3	2.4	2.4	1.8	2.2	2	-	-	-	-	2	2	1	2	3

PP23401 **OFFSET PRINTING TECHNOLOGY** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the principles of offset printing plates, substrate feeding and control
- To familiarize various cylinder configurations and mechanisms of sheetfed offset printing machines
- To impart knowledge about materials and inline operations

UNIT I PRINCIPLES OF OFFSET PRINTING, PLATE CHEMISTRY & PROCESSING 9

Principles of lithography, wetting of a solid surface by a liquid before and after surface treatment. Base materials & properties – Aluminium, Stainless steel, Copper, Chromium, Nickel, Poly masters and paper masters; Graining – types; Contact angle and wettability; Anodisation – Process; Plate chemistry – Conventional plates, Photopolymer compounds, Digital Imaging Plates-Thermal sensitive, Silver halide, Silver hybrid plates; Plate exposing unit; Light source – Types– advantages, disadvantages, Plates for digital imaging-, sensitivity, chemistry, mechanism of image formation and processing. Processless plates. Desensitizing process, gum, developing inks, lacquers and asphaltum, Quality Control Aids.

UNIT II SHEET FEEDING AND CONTROL 9

Fundamental elements of offset printing machine. Sheet feeding requirements. Types of feeders, sheet controls, drives, suction head mechanism, double sheet and no sheet detectors, side lays and front lays. Non-stop feeders. Sheet insertion and transfer systems, working principle, relative merits. Web Feeding: Roll stands; Automatic pasters – Zero speed and Flying pasters; Web pre-conditioners, infeed units, dancing roller types, design, tension control systems.

UNIT III PRINTING UNIT CONFIGURATION 9

Various types of sheet and web printing configurations, cylinder design, requirements, plate and blanket clamping mechanisms. Gears, drives. Pressure setting, packing, print length variation, equal diameter, true rolling principles. Grippers, settings. Sheet transfer in multi colour presses, reversal systems for perfecting. Requirements of sheet delivery, quick delivery mechanisms. Anti set-off spray devices. Feeders, delivery and other system requirements for metal printing machines, Computerized offset machineries, Offset machine manufacturers - Major brands, Machine Formats, Technical comparison;

UNIT IV PRINTING BLANKETS, ROLLERS AND FOUNTAIN SOLUTION 9

Blanket types, requirements, manufacture, performance attributes. Rollers, types, properties, behavior. Emulsification of ink and fountain solution, fluid behavior in a nip. Basic inking and dampening system configuration. UV coaters and dryers; Fountain solution requirements, composition, re-circulation system and dosing units, Ink/water balance.

UNIT V PRINTING AND INLINE OPERATIONS 9

Make-ready operations, multi colour printing, automatic plate fixing, computer controls in printing, automatic blanket washing devices, roller washing solutions. Sheet coating systems, configuration spot coating and varnishing, numbering. Types of Dryers. Print problem identification and quality control strips, Test charts, ISO 12647-2. Emerging Trends - Automation, Print industry 4.0, Hybrid presses;

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Describe the principle of offset printing process and image carriers
2. Explain the substrate feeding mechanism
3. Infer the working principle of sheetfed offset machines

4. Identify the importance of blanket, rollers as influencing factors in print quality
5. Demonstrate the automatic press operating procedures and solve print problems.

REFERENCES:

1. Helmutt Kipphan, Handbook of Print Media, Springer, Heidelberg, 2001
2. Lloyd P. Dejidas, Thomas M. Destree, Sheetfed Offset Press Operating, GATF, 2005.
3. A.S.Porter, A Manual of Lithographic Press Operation, Lithographic Training Services, 1977
4. John MacPhee, Fundamentals of Lithographic Printing: Vol.I - Mechanics of Printing, GATF, 1998.
5. Thomas M. Destree, The PIA/GATF Guide to Troubleshooting for the Sheetfed Offset Press, GATF, 2005 W.R.Durrant. R.E. Witeworth and C.W.Meacock, Machine Printing, Focal Press, London, 1973

CO's – PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	-	-	2	-	-	-	-	-	-	3	2	3
2	3	3	2	-	2	-	-	-	2	-	-	-	3	3	1
3	3	3	3	-	-	-	-	-	-	-	-	-	3	3	1
4	3	3	2	2	-	2	-	-	-	-	-	3	2	2	2
5	3	2	1	2	2	1	-	-	2	3	-	2	3	3	3
Avg	3	2.6	1.8	2	2	0.8	-	-	2	3	-	2.5	2.8	2.6	2

PP23402	PREPRESS AND IMAGING TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the fundamental concepts of colour science, colour perception & measurement.
- To understand the principle of colour separation and colour reproduction

UNIT I IMAGE ACQUISITION 9

Originals - Types, Problems, Reproduction objectives, evaluation; Digital Image acquisition – Optical image formation, lens, aberrations; Image Sensors – Types (CCD, CMOS), Components, Principle, Sensor characteristics, Color image sensors; Scanner, Digital camera - Working Principle, Types; Image acquisition factors - Dynamic range, Spatial sampling, Tone value quantization; Image encoding and Compression - Lossy, Lossless; Digital Image Processing;

UNIT II COLOR SCIENCE AND MEASUREMENT 9

Colour Reproduction - Light and Colour, CIE Light sources, Colourant-illuminant interaction, Colour vision, Metamerism, Psyhophysics of colour, Colour attributes, Colorimetry - CIE Standard observer, Tristimulus values, Chromaticity diagram, CIELAB, CIELCH, Colour difference equations; Color tolerances; Colour measurement - Spectrophotometer, Colorimeter; ISO standards - Colour Viewing and Measurement.

UNIT III COLOUR REPRODUCTION 9

ICC Profiles – Function, Types, Structure; Profile creation - display, scanner, digital camera, press and proofer; Color space Conversion - Gamut mapping, influencing factors, Rendering Intent; UCR, GCR; CRPC; Device link profiles; Spot color printing; Extended Gamut Printing;

UNIT IV DIGITAL PREPRESS WORKFLOW 9

Digital Prepress Workflow: Page layout; Postscript; PDF – structure, versions; Pre-flighting, Trapping, Proofing, Imposition - Job planning considerations, Imposition schemes, Imposition sheet, Allowances, Software; Raster image processors - structure, functions; Workflow management, Archiving, Versioning; Management Information Systems - CIP4, JDF; AI applications in prepress

UNIT V IMAGING DEVICES 9

Digital Halftoning –Thresholding, Dithering, Clustered dots, Dispersed dots, Error diffusion, Selection; Digital Screening technologies - Rational Tangent, Supercell, Irrational, Output Device Resolution, Addressability, Gray levels; Output devices - Laser sources, Addressing Frequency; Modulation - Direct, Acousto-optic, Electro-Optic, Spatial; Platesetters - Principle, Types; Dotmeter - Components, Working principle; Quality control in platemaking; ISO standards

PRACTICALS

1. Image acquisition and analysis - Tonal adjustment, Histogram analysis and equalization
2. Monitor profiling, Colour management settings and options in Prepress Software
3. Colour correction
4. Generation and evaluation of digital proof
5. Colour measurement and evaluation
6. Output file preparation - File Packages, exporting file in various PDF Versions PDF – Preparation, normalization, pre-flighting, Analyzing files for print production
7. Imposition - Work and Turn, Tumble- Half sheet and Full Sheet work
8. Creating a digital imposition with machine allowances for offset and digital press – Book work, Multiple-Ups
9. Obtaining RIP output – Proofing, Plate and TVI curve setting
10. Exposure optimization and standardization

11. Colour reproduction evaluation - ISO standards

OUTCOMES:

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

1. Infer the steps in implementing colour management system and choose suitable device configuration for colour measurement following quality standards.
2. Create profiles for display, input and output devices.
3. Explain the gamut mapping concepts by applying boundary constraints
4. Design methodology to standardize the various printing processes as per ISO standards
5. Reproduce and match colour across various devices and software applications

TEXT BOOKS:

1. Abhay Sharma, Understanding Colour Management, Thomson Delmar, 2004.
2. Phil Green, Michael Kriss,Colour Management: Understanding and Using ICC profiles, The Wiley-IS&T Series in Imaging Science and Technology, 2010

REFERENCES:

1. Adams R.M. & Weisberg J.B., GATF Practical Guide to Colour Management, 2nd. Ed., GATF Press, 2000
2. Bruce Fraser, Chris Murphy, & Fred Bunting, Real World Colour Management, 2nd Edition, Peachpit Press
3. Mark D.Fairchild, Colour Appearance Models, Second Edition, John Wiley & Sons Ltd., 2005
4. Phil Green, Lindsay MacDonald, Colour Engineering, John Wiley & Sons Ltd., 2002

PP23S02 **PACKAGING TECHNIQUES AND PROCESSES** **L T P C**
3 0 0 3

OBJECTIVES:

- To comprehend the purpose and importance of packaging design.
- To explore various packaging processes and their applications.
- To develop an understanding of packaging testing methods and their role in ensuring product quality.

UNIT I PACKAGING FUNDAMENTALS **9**

Need for packaging, Evolution of packaging, Waste management and environmental issues, Packaging Industry, Functions of packaging- Contain, protect/preserve, transportation, Marketing; packaging hazards, interaction of package and contents, shelf life, Packaging materials selection criteria, Material free from hazardous substances like heavy metals, CMR(Carcinogenic, Mutagenic and Toxic to reproductivity) and Endocrine disruptor (ED), Materials and machine interface, lifecycle assessment.

UNIT II PACKAGE DESIGN **9**

Package design, Package specification Types of design, structural, graphics, Factors influencing design, fundamentals of graphic layout design, Package colour - Selection criteria - Applications, Structural design – cans, bottles, folding cartons, corrugated boxes, CAD applications; Package development process. Package decoration techniques-Foil stamping, embossing, Gloss coatings, reverse printing, laser marking.

UNIT III PACKAGING TYPES **9**

Folding box board/Corrugated box – board types, tube styles, tray styles, setup boxes, production process; Metal cans – types, protective coatings, production process; Glass bottles - manufacturing, Types, design features; Rigid polymer containers – Polymer types, Production; Flexible pouches – Materials, Laminates, Types, Printing, Sealing properties, Transmission properties; Closures – materials, types, speciality functions; Applied Packaging – Blister packs, susceptor packs, Antistatic packs. Food, Pharmaceutical, Medical Device FMCG, Industrial and Specialty packaging

UNIT IV PACKAGING MACHINERIES **9**

Form fill and sealing machines – Configuration; Liquid Filling system – straight –line and rotary systems, constant volume & constant level filling, vacuum filling; Dry powder filling – Volumetric cup filling, vacuum volumetric filling, augur filling; sealing machine – types and operation.

UNIT V PACKAGE TESTING **9**

Package Performance testing-test standards (ASTM D4169, ASTM D4332 and ISTA standards); drop test, inclined impact, horizontal impact, vibration testing, stacking and compression test, rolling test, climatic test, rain test and corrugated board testing.

TOTAL : 45 PERIODS

EXERCISES:

1. Introduction to CAD user interface
2. Parallel Tuck-in Carton layout preparation
3. Reverse Tuck-in carton layout preparation
4. Auto-lock bottom carton layout preparation
5. Snap-lock bottom carton layout preparation
6. Multiple-ups arrangement
7. Display carton layout preparation
8. Graphic design for folding carton boxes
    1. Pharma product
    2. Electronic product

9. Graphic design for Flexible pouches
    1. Food products
10. Graphic design for shrink sleeve labels
11. Integration and visualization of structural and graphic designs
12. Introduction to CAD/3D modeling software
13. Designing of simple packaging component in 3D
14. 3D designing of bottle

OUTCOMES:

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

1. Comprehend the fundamentals of packaging technology.
2. Apply various relevant concepts and design packages
3. Comprehend the concepts of food, Pharma and FMCG packaging
4. Comprehend the concepts and classify various packaging machineries
5. Analyze various test methods for package suitability

TEXT BOOKS:

1. Bill Stewart, Packaging Design Strategies, Pira International Ltd, 2nd Edition 2004
2. Walter Soroka, Fundamentals of Packaging Technology, Institute of packaging professionals, Fifth Edition,2014.

REFERENCES:

1. Arthur Hirsch, Flexible Food Packaging, Van Nostor and Reinhold, New York, 1991.
2. Aaron L.Brody & Kenneth S.Marsh, Encyclopedia of Packaging Technology, John Wiley Inter science Publication, II Edition,1997.
3. Paine, Packaging Development, PIRA International,1990.
4. Walter Stern, Handbook of Package Design Research, Wiley Interscience, 1981.

PP23403	PACKAGING MATERIALS I	L T P C 3 0 0 3

OBJECTIVES:

- To outline the types of glass, wood and metal packages.
- To impart knowledge on material properties, manufacturing processes and testing for glass, wood, and metal packages
- To provide knowledge on woven and nonwoven fabrics in packaging applications

UNIT I GLASS IN PACKAGING 9

Introduction; General Composition; Merits and Demerits; Applications; Physical Structure – Glass formers, Intermediates, Modifiers; Classification of glass: Composition, Properties, Applications; Testing: Internal Pressure Strength; Glass container – Nomenclature, design parameters, Specifications, decorations; Solubility – hydrolytic resistance, chemical stability; Thermal shock resistance; impact resistance; Vertical load resistance; Fragmentation; polariscope test; Spectral transmission; Brimful capacity; Recycling methods.

UNIT II GLASS CONTAINERS 9

Manufacturing: Molded containers – Raw materials, Melting, Gob formation, Container forming & Applications - Blow and Blow, Press and Blow (Wide Neck, Narrow Neck); Tubular containers – Tube forming (Danner Process, Vello Process), Tube feeding, Container Forming; Internal Fluorination Treatment; Surface Treatments – Hot end, Cold end; Annealing, inspection – dimensions, wall thickness, weight, damage detection; Defects; Emerging trends – Light weighting, unique shapes; surface textures; Indian and global standards; Case studies.

UNIT III METALS IN PACKAGING 9

Aluminium, Tinplate, Tin free steel (ECCS), Polymer coated steel, Stainless steel - Properties, Manufacturing, Applications; Aluminium foil – Hot rolling, cold rolling; Metallization of laminates; Corrosion - Factors, Types; Lacquers: Types – Internal, External, Decorative; Coating methods, Coating weight, properties, applications; Metal Printing – Surface Treatment, Printing Processes; Recycling.

UNIT IV METAL CONTAINERS 9

Materials, Types, Manufacturing, Applications, Defects, - Cans (3 piece, 2 piece - DRD, DWI), Aerosol containers, Collapsible tubes, Drums and pails, Bottles, Pouch, Caps and Closures, Metal Strapping/ Banding; Tests and standards – Dimension, capacity, drop, stacking strength, leakage, corrosion resistance, transit; Regulatory Aspects; Indian and global standards; Case Studies.

UNIT V TEXTILE AND WOOD 9

Textile: Materials – Natural and synthetic fibres, properties; Fabric Structures – woven, knitted, nonwoven; Coloration; Materials, Types, Manufacturing, Treatments, Closure– Woven Sacks, Leno Bags, Jute Bags, Flexible Intermediate Bulk Containers, Wrapping Fabrics, Soft luggage; Rope, tapes, strapping; Tests and standards – Dimension, Moisture, Tensile strength, Burst strength, Tear strength, Seam Strength, Permeability, Migration; Regulations, Recycling.

Wood: Types and properties - Plywood, Particleboard, Fiberboard; Pallets – Wood, Pallet types – one-way, two-way pallet, design/performance, Nails - types and holding capacity; Crates/Boxes/Bin Pallets, Wirebound Boxes; Wood treatment; Standards and Regulations, Case studies

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the student should be able to:

1. Enumerate the types of glass, properties and applications
2. Explain the stages in manufacturing of glass containers
3. Assess the properties of metals used in packaging, their corrosion and coatings
4. Summarize the manufacturing process and testing for metal containers
5. Select suitable wood/textile package by assessing requirements of a given product.

TEXT BOOKS:

1. Gordon L. Robertson, “Food Packaging: Principles and Practice”, 3rd Edition, CRC Press, 2013
2. L. Brody, K. S. Marsh, “The Wiley Encyclopedia of Packaging Technology”, 2nd Edition, Wiley,

REFERENCES:

1. Amit K. Jaiswal, Shiv Shankar, Food Packaging and Preservation: Antimicrobial Materials and Technologies, Academic Press, 2023
2. A. Richard Horrocks, Subhash C Anand, “Handbook of Technical Textiles, Volume 1, Second Edition, WoodHead Publishing, 2016.
3. Walter Soroka, “Fundamentals of packaging technology”, 3rd Edition, Institute of Packaging professionals, Naperville, Illinois, USA, 200

CO’s – PO’s MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1		2	2	3	3	3	3		3		3	3	3	3
2	3				3							2	3		
3	3	3			3								3	2	
4	3				3	3	3						3	3	
5	3	3	3	3	3	3	3		2				3	3	3
Avg	3	3	2.5	2.5	3	3	3	3	2	3		2.5	3	2.75	3

UC23U01 **UNIVERSAL HUMAN VALUES** **L T P C**

1 0 2 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, 3rd 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
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
CO1						1	1	1	3			3
CO2						1	1	1	3			3
CO3						3	3	2	3		1	3
CO4						3	3	2	3		1	3
CO5						3	3	3	3		2	3

PP23404 **PRINTING MACHINE LABORATORY** **L T P C**
0 0 4 2

OBJECTIVES:

- To understand the controls, settings and mechanisms of printing machines.
- To have hands on training in Semiautomatic and Automatic printing machine.
- To implement standard operating procedure for printing machines.

EXERCISES:

1. Study of controls, operations and specifications of printing machines.
2. Identification of different tools & equipment used in various printing process
3. Overview pre-make ready & make ready(Feeder setting and Plate fixing)
4. Single colour printing in semi-automatic offset machine.
5. Study of running & printing faults on different printing process machine.
6. Single colour printing in automatic printing machine.
7. Process colour printing in offset machine.
8. Print job production using screen printing.
9. 2D images of parts with different surfaces using pad printing.
10. Print quality control measurements based on quality control gadgets.

TOTAL: 60 PERIODS

OUTCOMES:

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

- Summarize the standard operating procedure.
- Operate a sheetfed offset printing press
- Identify various process control parameters
- Standardize the machine and evaluate print quality.
- Demonstrate the practical knowledge and skills

CO's – PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	-	3		3	-	-	-	2	-	3	-	2	-	3
2	2	3		3	-	-	-	-	-	-	-	3	2	2	2
3	3	2	2	2	-	-	-	-	-	3	-	-	3	3	2
4	2	-		3	-	3	-	-	-	-	2	-	3	3	3
5	3	3	3	3	-	-	3	-	-	2	3	-	3	2	1
Avg	3	3	3	3	3	0	3	0	0	2	3	3	3	2	1

PP23501 GRAVURE AND SCREEN PRINTING TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES

- To gain knowledge on gravure printing machines and image preparation techniques.
- To learn the types of screen printing machine and stencil preparation method.
- To know about the print problems and quality control techniques in gravure and screen printing process.

UNIT I GRAVURE PROCESS AND IMAGE CARRIER PREPARATION 9

Process characteristic; Products and markets; Workflow; cylinder construction – design, balancing, electro plating and polishing - copper, chrome, zinc; reuse of cylinder – methods, dechroming, copper and zinc removal; cylinder layout; Conventional cylinder engraving – cell configuration, direct and indirect techniques, chemical etching, etching bath, spray etching; Electromechanical engraving - cell configuration, cell volume, stylus angle, moire, engraving time, electromechanical engraver; Laser engraving - cylinder materials, laser sources, direct process, indirect process, cell structure, laser engraver; Electron beam engraving; Wrap around plates; Quality Control for cylinders, Cylinder inspection systems.

UNIT II GRAVURE PRINTING MACHINE 9

Machine components; Doctor blade assembly – material, doctor and back-up blades, holder, tip configuration, conventional, reverse angle, loading, positioning, oscillation; Impression rollers – types, loading, deflection; electrostatic assist impression system; inking system – types; dryer – types; Press design – types; Press configuration – Publication presses, Packaging presses, Flexible packaging presses, Label presses, Product Gravure and other Gravure presses; inline converting operations; in feed and out feed coating; lamination, inline solventless lamination; power transmission system; Case studies.

UNIT III SCREEN PRINTING COMPONENTS 9

Process characteristics; essential components; Screen fabrics – types, fabric terminology, fabric selection, fabric tension characteristics, tension measurement, tensioning devices; frames – types, frame profile, stretch and glue frame adhesives, frame size; squeegees – components, materials, variables, techniques, selection, blade sharpening, maintenance and storage; substrates and inks; screen printed products.

UNIT IV STENCIL PREPARATION AND PRESSES 9

Stencil variables, fabric preparation- abrading, degreasing; stencil films – types; stencil types – Indirect stencil method: Mechanical, Photographic, stencil preparation; Direct stencil method: Mechanical, Photographic, Electronic; Indirect/Indirect method, capillary film method: stencil exposure, stencil preparation; stencil selection; screen reclaiming; presses – graphic presses, textile presses, and container printing; screen printing techniques – types: duotone printing, gray scale printing, spot color printing, process color printing, halftone printing, simulated process printing; dryers – types.

UNIT V PRINT PROBLEMS AND QUALITY CONTROL 9

Print problems and remedies; quality control aids; maintenance; health and safety issues; waste disposal and environmental safeguards. Machine manufacturers - Major brands, Machine Formats, Technical comparison; ISO - 12647- 5, Case studies.

OUTCOMES:

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

1. Summarize the characteristics of gravure printing process and discuss about the methods of cylinder engraving.
2. Explain the components and operation of the different types of gravure presses
3. Analyze the process characteristics of screen printing technology and relate print quality with the selection of printing components.
4. Compare the stencil preparation techniques and select the type of screen printing press based on the application requirements.
5. Apply quality control concepts and solve print problems in gravure and screen printing processes

TEXT BOOKS:

1. Gravure: Process and Technology, Gravure Education Foundation, 2003
2. Kaj Johansson, Peter Lundberg, Robert Ruberg, A Guide to Graphic Print Production, Wiley, 2002

REFERENCES:

1. Harry B. Smith, Modern Gravure Technology, Pira reviews of Printing, Pira International,1994
2. Ingram, Samuel, Screen Printing Primer, GATF press, 2nd Edition, 1999.
3. NIIR Board, Screen Printing Technology Handbook, Asia Pacific Business Press Inc., 2004
4. Samuel B. Hoff, Screen Printing – A Contemporary Approach, Delmar Publishers,1997.
5. William Appleton, Screen Printing, PIRA International, 1994.

CO's – PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	2		3		1	1	3	1	1	2	3	3	3
2	3	2		3	2	1			3	1	2	2	3	3	3
3	3	2	2	2	3		1	1	3	1	2	2	3	3	3
4	3	2		3	3	1			3	1	2	2	3	3	3
5	3	2	2	3	2	3	1	2	2	3	1	3	3	3	3
Avg	3	2	2	2.8	2.6	1.7	1	1.3	2.8	1.4	1.6	2.2	3	3	3

PP23502 **PACKAGING MATERIALS II** **L T P C**
3 0 0 3

OBJECTIVES

- To introduce the knowledge in the different types of packaging materials
- To impart knowledge in conversion process of flexible and rigid packaging materials
- To describe the various characterization/testing and plastic recycling methods

UNIT I INTRODUCTION TO PLASTICS 9

Introduction to polymer, classification, type of polymerization - Addition, Condensation; Thermoset / Thermoplastic; Additives-antislip, antistatic, colorants, fillers, plasticizers; Properties (Molecular weight, Glass Transition, Melting, Thermal Degradation) Types, Applications -PE, PP, PS, PVC, PA, PET, PVDC, EVA, EVOH, PVOH, PLA, PEN, PEI

UNITII CONVERSION TECHNOLOGIES- I 9

Polymer properties and Processing Parameters; Injection Molding: - Fundamentals of injection molding-Mold design and considerations-Injection molding process parameters-Thin-wall molding for packaging applications. Extrusion-Basics of plastic extrusion-Types of extrusion processes: profile, film, and sheet extrusion –Screw design and extrusion die configurations- Co-extrusion for multi-layer films- extrusion and its applications in packaging; Packaging types – Bags, Pouches, Collapsible tubes, Bag-in-box, Flexible cans, sacks; case study

UNITIII CONVERSION TECHNOLOGIES- II 9

Blow Molding - Extrusion blow molding, Injection blow molding, Stretch blow molding, Multilayer; Thermoforming: Types-Drape, Vacuum and pressure forming; Twin Sheet; Rotational Molding, Compression and Transfer Molding; Comparison of molding techniques Applications, Advantages and Limitations; Packaging types - Plastic bottles, tubes, Plastic pallets, Drums, Barrels, Jerry cans and shipping containers

UNIT IV MATERIALTESTING 9

Mechanical – Tensile, Tear, Burst, Impact; Barrier properties - WVTR, OTR, Adhesion test, Optical – Gloss, haze and clarity; Chemical Resistance test – solvents and chemicals, Migration test, Plastic material identification test, solvent retention; Hardness and corrosion test for metals;, Standards – ISO, ASTM, BIS.

UNITV RECYCLING 9

Primary recycling methods – Granulators, Cryogenic grinding, Plunger and screw type stuffer, In-line recycling; Secondary Recycling - Mechanical reworking, Chemical modification, Co-extrusion and co-injection molding, Filler; Tertiary recycling – Pyrolysis, Hydrolysis, Glycolysis; Quaternary Recycling - Incineration

TOTAL:45PERIODS

LIST OF EXPERIMENTS:

1. Identification of polymers and laminate structures
2. Determination of mechanical properties – tensile strength, elongation impact resistance
3. Study of optical properties – Opacity, color, haze
4. Determination of surface energy andcontact Angle
5. Determination of WVTR
6. Determination of OTR
7. Determination of seal strength
8. Study of Blown film extruder
9. End use product tests for flexible packages
10. End use product tests for rigid packages

OUTCOMES

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

- Analyze the suitable plastic packaging material for various applications.
- Determine the appropriate conversion process for film packaging materials
- Describe the various conversion process for rigid packaging materials
- Categorize the suitable testing methods for packaging material.
- Effectively communicate the various methods of recycling for packaging materials

TEXTBOOKS

1. Cirillo, Giuseppe, Marek A. Kozlowski, and Umile Gianfranco Spizzirri, eds. Composites materials for food packaging. John Wiley & Sons, 2018.
2. S. Natarajan. M. Govindarajan, and B. Kumar Fundamental of Packaging Technology PHI, New Delhi, 2014
3. Walter Soroka, Fundamentals of Packaging Technology, Institute of packaging Professionals, Fourth Edition, 2010.

REFERENCES:

1. Bettine Boltres, “When Glass Meets Pharma :Insights about Glass as Primary Packaging Material”,Editio Cantor, 2015.
2. Gordon L. Robertson, “Food Packaging: Principles and Practice”, Third edition, CRC Press, 2016.
3. Selke, Susan EM, and John D. Culter. Plastics packaging : properties, processing, applications, and regulations. Carl Hanser Verlag GmbH Co KG, 2016.
4. Shah,V.(2007). Hand book of plastics testing and failure analysis (Vol.21).John Wiley &Sons.

CO’s – PO’s & PSO’s MAPPING

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

PP23503 **PRINT CONVERSION TECHNIQUES** **L T P C**
3 0 0 3

OBJECTIVES:

- To give an overview of print finishing and converting materials
- To provide knowledge on various print finishing operations
- To comprehend the use of lamination, coating and surface treatment

UNIT I BINDING AND FINISHING MATERIALS 9

Overview of binding and finishing; Print finishing – classification; securing materials; adhesives – types, manufacturing, theory of adhesion; Coating - Oil based, water based, UV and EB coatings; Nano emulsions, constituents and properties; prevention of deterioration; Production control, Network analysis and Quality control; trends and developments in finishing operations.

UNIT II CUTTING AND FOLDING 9

Joggers; cutting – overview, work preparation; cutting machine – parts, types of motion; Principles, operation and mechanism - single knife and three knife trimmers; operational procedure of sensors and hydraulic systems; various adjustments; maintenance of guillotines; problems and remedies during cutting. Folding – Principles; Types of folding for sheet and web, methods of feeding and delivery; folding production line, folding terminology, folding diagram, folding scheme; mechanism, operation and adjustment of folding machines; additional features – fold gluing, perforators, creasers and slitters.

UNIT III GATHERING AND SECURING OPERATION 9

Principles of gathering, types of gathering machines, feeders, delivery, inline production; Securing – types, characterization; stitching – wire and thread; adhesive binding; sewing – types, feeders and delivery; mechanical and loose leaf binding; styles, purpose of each method.

UNIT IV LAMINATION, COATING AND SURFACE TREATMENT 9

Surface finishing – objective; characteristics; techniques; Importance and Scope of surface modification; Surface Energy; Role of surface roughness; Methods – Chemical, Corona Treatment, Plasma Treatment, Laser assisted modification; Coating - Roller coatings and Hybrid coatings; Lamination – types; principles and operation of embossing; hot foil stamping – types.

UNIT V MISCELLANEOUS FINISHING OPERATION AND AUTOMATION IN BINDING 9

Die-cutting; In-Line Gluing Equipment; Automated Off-Line Kit Fulfillment, Integrated Off-Line Card and Label, Hybrid finishing formats and equipment, Off-Line Scoring, indexing, round cornering, poly-bagging, Shrink Wrapping, Edge treatment – characterization, edge staining, bookmark, rounding, backing, headband, edge treatment operation in production lines; case making – characterization, producing book covers, case making, casing in, inserting jackets; preventing transit marking; materials handling and mailing.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Outline and discuss the print finishing workflow
2. Explain the working principle and operations of cutting and folding machines
3. Understand the operations of gathering and securing machines
4. Summarize the working principle of lamination, coating and surface treater
5. Outline the various print finishing machineries

TEXT BOOKS:

1. A. G. Martin, Finishing Process in Printing, Focal press Ltd., Britain, 1980.
2. T. J. Tedesco, Binding, Finishing and Mailing: The Final World, GATF press, Pittsburgh, 2005.

REFERENCES:

1. Arthur W. Johnson, The practical guide to Craft Book Binding, Thames and Hudson, 1985
2. Arthur W. Johnson, Book Binding, Thames and Hudson, 1984
3. Helmutt Kipphan, Handbook of Print Media, Springer, Heidelberg, 2001
4. Ralph Lyman, Binding and finishing, GATF, 1993
5. T. M. Adams, D.D. Faux and L. T. Ricber, Printing Technology, Delmar Publications Inc., 1996.

PP23E01	ARTIFICAL INTELLIGENCE AND MACHINE LEARNING	L T P C 3 0 0 3

COURSE OBJECTIVES:

- Grasp the core concepts and history of Artificial Intelligence (AI).
- Master the fundamentals of Machine Learning.
- Explore core Supervised and unsupervised Learning algorithms.
- Explore Applications of Deep Learning.

UNIT I INTRODUCTION TO ARTIFICIAL INTELLIGENCE 9

History and evolution of AI- Definitions and scope of AI - Applications of AI in various fields-Intelligent agents - Agents and environments-Structure of intelligent agents, Types of agents: Simple reflex, model-based, goal-based, utility-based-Rationality-Task environments-Problem solving agents-Search strategies (uninformed and informed)

UNIT II MACHINE LEARNING BASICS 9

Definitions and key concepts- supervised learning- unsupervised learning- reinforcement learning- -Steps in data Preparation- Model Selection –Training- Model Evaluation- Parameter Tuning-Prediction- Implementation.

UNIT III SUPERVISED LEARNING 9

Simple and multiple linear regression-Assumptions, interpretation, and evaluationRegularization techniques: Ridge and Lasso regression-Polynomial regressionLogistic regression for binary classification- Introduction to Support Vector Machines (SVMs)- Support Vector Regression (SVR)-Support Vector Machines (SVM)- Introduction to SVM for classification-Kernel functions (linear, polynomial, RBF)- SVM for multi-class classification Boosting algorithms: AdaBoost, Gradient Boosting, XGBoost,- Bagging-(Random Forest) vs. Boosting.

UNIT IV UNSUPERVISED LEARNING 9

Basics of K-Means clustering-Choosing the number of clusters-Variations and improvements: K-Means++, Mini-Batch K-Means-Agglomerative vs. divisive clustering, Dendrograms and linkage criteria-DBSCAN (Density-Based Spatial Clustering of Applications with Noise)- OPTICS (Ordering Points To Identify the Clustering Structure)

UNIT V DEEP LEARNING 9

Limitations of traditional Machine Learning models-Introduction to Deep Learning- Artificial Neural Networks-Perceptrons, activation functions, gradient descent-Multilayer Perceptrons (MLPs), feed forward networks-Introduction to TENSOR, PYTORCH and KERAS- Convolutional Neural Networks (CNNs)-Convolution, pooling, filters-Applications- Recurrent Neural Networks (RNNs)-Unfolding through time, back propagation through time-Long Short-Term Memory (LSTM) networks-Applications.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

1. Grasp the fundamental concepts of Artificial Intelligence (AI), including its history, evolution, applications, and types of intelligent agents
2. Apply core Machine Learning techniques for supervised learning tasks, including linear regression models, logistic regression, and classification algorithms.
3. Implement and analyze unsupervised learning methods like K-Means clustering to uncover patterns in unlabeled data.
4. Understand the limitations of traditional machine learning and gain an introduction to Deep Learning concepts.
5. Use Modern Tools for implementation of AI and ML Algorithms.

TEXT BOOKS:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 3rd Edition, Pearson, 2010

REFERENCES:

1. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.
2. Aurelien Geron,Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, Third Edition,O.RELLIY,2022.
3. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning,The MIT Press, 2016.

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
1	3	2	1										2	2
2	3	2	1										2	2
3	3	2	1										2	2
4	3	2	1										2	2
5	3	2	1										2	2
Avg.	3	2	1										2	2

PP23504 **PRINT OPERATIONS MANAGEMENT** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the concepts of scheduling and its importance in the printing Industry.
- To acquire knowledge about the various applications of inventory and project management with respect to the printing Industry.

UNIT I INTRODUCTION **9**

Organization Structure – Sole Proprietor, Partnership, Limited Company, Administrative office routine, Forms used, Processing orders; Facility location decision making – Economic analysis – Qualitative factor Analysis – Layout of the factory – Analysis & selection; Human Factors - Consideration of man & machine, job design; Ergonomics – Working environment, Worker safety.

UNIT II SEQUENCING **9**

Gantt chart, Algorithms for solving sequencing problems – Processing of N jobs through 2 machines, n jobs through 3 machines, n jobs on K machines, Assignments and transportation algorithms, Production Line Balancing.

UNIT III INVENTORY MANAGEMENT **9**

Supply Chain – Fundamentals –Evolution – overview; Inventory management – EOQ- Managing inventory for short life - cycle products -multiple item -multiple location, inventory management.

UNIT IV ENTERPRISE RESOURCE PLANNING **9**

Overview of enterprise systems – Evolution - Risks and benefits - Fundamental technology - Issues to be consider in planning design and implementation of ERP systems, Overview of ERP software solutions- small and enterprise vendor solutions- Planning Evaluation and selection of ERP systems Implementation life cycle - ERP implementation, Methodology and Frame work - MRP and CRP.

UNIT V NETWORK MODELS **9**

Introduction, PERT & CPM models, Network construction, Problems, Resource analysis & allocation, Replacement analysis, Application & case studies.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Discuss the working of printing organization
2. Calculate ideal sequencing time using various algorithms and models
3. Solve inventory management problems
4. Discuss enterprise, materials and capacity requirement planning
5. Plan Network models for printing and packaging industries.

TEXT BOOKS:

1. Joseph G.Monks, “Operations Management – Theory and Problems”, Mc Graw Hill International Ltd., 2003.
2. N.D.Vohra, “Quantitative techniques in management”, Tata McGraw Hill Publishing Co.Ltd., 2003.

REFERENCE BOOK:

1. U.K.Srivastava, G.V.Shenory & S.C.Sharma, “Quantitative techniques for Managerial decisions”, New Age international (P) Ltd., Publishers – Formerly Wiley Eastern Ltd., 2001.

PP23U02 PRESPECTIVES OF SUSTAINABLE DEVELOPMENT

PRINTING AND PACKAGING **L T P C**

3 0 0 3

COURSE OBJECTIVES:

1. To impart knowledge on sustainable manufacturing polices
2. To introduce energy consumption and sustainability in machinery
3. To study the plastic waste disposal, recycling methodologies and circular economy

UNIT I SUSTAINABLE MANUFACTURING AND POLICIES **9**

Introduction to sustainable manufacturing - Origins of sustainable manufacturing - Sustainable manufacturing concepts - Indian/European/US environmental policies - Legislative, cultural, societal and political issues - Sustainable quality systems - Emission less manufacturing - Comparison between green, eco-manufacturing, eco- machining, clean manufacturing and sustainable manufacturing.

UNIT II SUSTAINABILITY MANUFACTURING BEST PRACTICES **9**

Introduction to best practices of sustainability manufacturing – Manufacturability issues in sustainable product design - Environmentally conscious design/manufacturing processes - Societal impact - Product functionality, serviceability, maintainability, upgradability - Innovative product/process designs for sustainability - Preservation of sustainable development.

UNIT III SUSTAINABLE MACHINERY AND ENERGY CONSUMPTION **9**

Selection of appropriate machine, materials, energy, resource utilisation for sustainability manufacturing – Performance evaluation of different machinery and its components in terms of energy consumption - Causes for inefficient operations of machinery – Scope for energy conservation - World energy consumption - Determination of power demand and consumption - Comparison of power generation cost using renewable and non- renewable sources.

UNIT IV PACKAGING WASTE MANAGEMENT **9**

Types of waste generated; non-degradable and biodegradable wastes, Solid waste storage and disposal methods – land filling, burial, incineration, recycling; Biological treatment of food, medical, consumer goods, pharmaceutical, industrial wastes, storage, and disposal of liquid and gaseous waste; legal aspects related to storage and disposal; environmental laws; pests and their control.

UNIT V CIRCULAR ECONOMY AND RECYCLING **9**

Plastics Manufacturing and Life cycle assessment, Plastic waste management, Life Cycle Analysis, Optimization of packaging materials, Sources-Reduce, Reuse and Recycling (3R's), 7R's of Packaging, Biodegradable materials, Case Studies, Recycling and waste management trends, Recycling and labelling, Waste - Collection, Sorting, Cleaning; Recycling; Recycling techniques/methods –Paper/Paperboard, Plastics, Metals, Glass.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course the student shall be able to:

1. Identify the best practices for sustainable manufacturing in industries.
2. Find the various policies for sustainability manufacturing.
3. Choose for selection of sustainable machinery with lower energy consumption.
4. Identify and categorize various plastics for plastic waste management
5. Provide facts about environmental pollution, circular economy and recycling

REFERENCES:

1. Ann-Christine Albertsson, “Degradable Polymer, Recycling Plastic Waste Management”, Taylor & Francis Group, 1995.
2. Herbert F.Lund, “McGraw-Hill Recycling Handbook”, 2nd Edition, 2001.
3. John Scheirs, “Polymer Recycling”, Wiley Series in Polymer Science, 1997.
4. Joseph P. Greene, “Sustainable Plastics: Environmental Assessments”, Wiley, 2014.
5. R.Mckinney, “Technology of paper Recycling”, Blackie Academic and professional, 1997.
6. Susan E.M. Selke, “Packaging and the environment : alternatives, trends, and solutions”, Technomic Publication, Revised Edition, 1994.
7. W.S. Allen/P.N.Baker, “Handbook of plastic Recycling”, Alkem Quality Edition, Alkem Publishing, 2009.

CO’s – PO’s & PSO’s MAPPING

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

PP23505 **PRINTING INKS** **L T P C**
3 0 0 3

OBJECTIVES:

- To study the raw materials for the preparation of printing inks
- To provide the knowledge on ink formulation and manufacturing methods
- To discuss the different specialty inks and drying mechanism.

UNIT I RAW MATERIALS 9

Colourants – Classification, preparation and properties; Inorganic – white and coloured, carbon black, metallic, ultramarine and fluorescent; organic - Diarylide yellow, Hansa yellow, Rhodamine, Lithol, Rubine; Dyestuffs and oils - Types, Preparation, Properties and uses; Varnishes-types, applications; Solvents - General properties; Solvents like Hydrocarbon, alcohols, glycols, ketones, esters and their properties; Resins – Natural Rosin and its derivatives and Gumarabic; Synthetic – Rosin modified fumaric, maleic and phenolic, alkyds, hydro carbons, polyamides, Polyvinyl, Epoxy resins, Acrylic resins, Ethyl Cellulose and Nitrocellulose; Additives–Properties and applications Driers, Waxes, Antioxidants, plasticizers, wetting agents, defoaming agents and Antiskinning agents.

UNIT II PASTE INK FORMULATION AND MANUFACTURING 9

Offset Inks – Properties, Paste Ink manufacturing, Ink dispersion, Ink rheology and variables; Ink formulation for sheet and web – Book printing, package printing, publication printing; Drying Mechanism – Types and significance.

UNIT III LIQUID INK FORMULATION AND MANUFACTURING 9

Flexography Inks – Properties, selection criteria, Ink rheology, Inks for paper, plastics and foil; Gravure Inks – Properties, Publication gravure inks, Packaging and product inks, rheology; Screen inks – Properties, Inks for paperboard, plastic containers, textile inks, impervious substrates and metallic substrates; Liquid Ink Manufacturing, Flowchart – mixing mill – equipment; Drying Mechanism -Types, Principles: Importance and Scope of surface modification.

UNIT IV SPECIALITY INKS 9

Metallic Inks, Fluorescent Inks, Fugitive, Penetrating, Magic Inks, Invisible Inks, Polybond Inks, Mellow Inks, Carbonising Inks, Organic and biodegradable inks; Radiation curable inks-IR, UV & EB–Raw materials, equipment used for drying; Security inks– Thermochromic and Photochromic; Nanoinks; Formulation and production; Regulatory issues- risk management in ink industry;

UNIT V SURFACE MODIFICATION, TEST AND MEASUREMENTS 9

Principles: Importance and Scope of surface modification, Surface Energy, Role of surface roughness, Methods – Chemical, Corona Treatment, Plasma Treatment, Laser assisted modification; Viscosity, Tack, Colour, Gloss, Rub resistance, Length, Drying Characteristic, and Fineness of grind gauge, light fastness, Effect of temperature and humidity; Standards on environmental concerns, end use applications, Ink problems related to printing processes – Trouble shooting.

. **TOTAL: 45 PERIODS**

OUTCOMES:

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

1. Select suitable raw material for ink preparation.
2. Comprehend the manufacturing process of Inks.
3. Recognize the suitable ink drying mechanism
4. Appraise the coating and surface modification methods.
5. Monitor the standards and rectify the problems used for testing of printing Inks.

TEXT BOOKS

1. Robert Leach, “The Printing Ink manual”, Springer, 2012.
2. Jeremy Ramsden, “Nanotechnology in Coatings, Inks and Adhesives”, Pira International Limited, 2004

REFERENCES

1. Hans-Joachim Streitberger, Artur Goldschmidt, “Basics of Coating Technology”, European Coatings Library, 2018.
2. Joanna Izdebska, Sabu Thomas, “Printing on Polymers”, Elsevier, 2016.
3. NIIR, “Modern Technology of Printing and Writing Inks”, Asian Pacific Business Press.
4. By Niir BoardSteven Abbott, Nigel Holmes, “Nanocoatings: Principles and Practice: From Research to Production”, DesTECH Publications, 2013.
5. Ernest W. Flick ·, “Printing Ink and Overprint Varnish Formulations “, Elsevier, 1999.

CO’s – PO’s & PSO’s MAPPING

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	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	1	3	-	-	-	-	-	-	-	-	-	3	3	2
2	3	3	2	-	-	-	-	-	-	2	-	3	1	2	2
3	3	2	3	-	-	3	2	2		2	-	3	3	3	2
4	2	1	2	-	-	-	-	-	-	-	-	-	1	2	1
5	2	3	1	-	3	3	3	1	-	-	-	3	2	1	3
Avg	2.6	2	2.2	-	3	3	2.5	1.5	-	2	-	3	2	2.2	2

PP23S03 **PRINT CONVERSION LABORATORY** **L T P C**
0 0 4 2

OBJECTIVES:

- Understand the print finishing workflow, including the processes and techniques involved in achieving the final presentation of printed materials.
- Illustrate the use of automatic and semi-automatic guillotine machines, showcasing their functions, features, and how they contribute to precise cutting and trimming of printed materials.
- Explore and demonstrate the case-making process for hardbound books, covering the steps and techniques involved in creating durable covers and bindings.

I STUDY OF VARIOUS CONTROLS, OPERATION AND MECHANISMS OF

1. Programmable Cutting Machine
2. Folding Machine
3. Perfect Binding Machine
4. Wire Stitching Machine

II MECHANICAL AND LOOSE LEAF BINDING

1. Comb binding
2. Spiral binding
3. Wire-o-binding
4. End Papers
5. Case preparation
6. Perfect binding
7. Thread sewn book block preparation
8. Saddle and Side stitch

III PRINT CONVERTED PRODUCTS

1. Envelop preparation
2. Greeting cards with designed slots
3. Laminated paper
4. Cold foiling

TOTAL: 60 PERIODS

OUTCOMES:

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

1. Outline and discuss the print finishing workflow
2. Examine and operate automatic and semi-automatic guillotine machines
3. Plan the sequences suitable for various types of securing operations
4. Design and construct hard case for book binding

Examine and operate various print finishing machineries

PP23E02 **DIGITAL PRINTING TECHNOLOGIES** **L T P C**
2 0 0 2

OBJECTIVES:

- To explain principle, construction and operation of digital printing machines
- To impart knowledge on process characteristics and applications of each technique
- To describe the standards for digital printing processes

UNIT I ELECTROPHOTOGRAPHY 6

Principle of Electrophotography, Photoconductors, Toners – Melting, Durability, Design, Charging, Adhesion; Charging - Ionization, corona devices, biased charge rolls; Exposure; Development - Discharged or Charged Area, Monocomponent, Development Curve; Transfer; Fusing; Cleaning; Process Control; Architecture; Yield; Toner Manufacturing – Composition, thermal properties, charge control agents, surface treatment, Melt pulverized toner, chemically prepared toners, shape, particle size, health and safety issues; Deinking; Printing System Configurations; Applications.

UNIT II INKJET PRINTING 6

Continuous Inkjet – binary deflection, multi-deflection; Drop on Demand – Piezoelectric, thermal, mechanical valve, acoustic, electrostatic; Droplet formation – Steps, Rayleigh plateau instability, satellite drops; Inkjet Printhead components; Structure of inkjet arrays; Printhead performance – throughput, image quality, reliability; Production - Single Pass, Multipass, drop size requirement, standoff, placement errors, integration; Printer architecture; Inks – properties, aqueous, solvent, latex, UV, hotmelt, ceramic, dye sublimation, metal nanoparticles, conductive; Substrates – types, Paper - porosity, physiochemical interactions, coatings; Printing System Configurations; Print Quality; Applications.

UNIT III NON IMPACT TECHNOLOGIES 6

Thermography - Technologies, Ink donor transfer and configuration, Thermal Transfer Printing Systems, Thermal Sublimation Printing Systems; Electrography; TonerJet Printing Technology; Elcography; Direct Imaging Printing Technology; Ionography, Magnetography – Principle, Imaging System, Printing Unit; Nanographic printing – Principle, Inks, Press configuration; examples of Applications/Printing Systems Assessment of New Types of NIP Technologies.

UNIT IV APPLICATIONS 6

Non-Impact Printing Technologies - Process characteristics, economics, job suitability; Digital Front Engine; Inline Print Finishing; Variable Data Printing; Print on Demand; Applications – Books, Labels, Proofer, Photography, Coding, Printed Electronics, Display and Signages, Textiles, Security Printing; Major manufacturers; Hybrid Printing Systems – Configuration, Integration; Case Studies

UNIT V STANDARDS 6

PDF/X – Overview, types, output intent, applications, ISO 15930, Compliance, Test targets, Validation; Variable data printing – PDF/VT, ISO 16612; Process Control – Steps, Test targets, Substrate, Print image quality, Drying, ISO 12647-8, G7, PSD; Recent trends; Case studies.

TOTAL: 45 PERIODS

PRACTICALS

1. Design of Variable data job
2. Imposition for digital printed products
3. Study of electrophotographic inkjet machine components, mechanism and controls
4. Study of inkjet printing machine components, mechanism and controls
5. Quality control for digital printing

OUTCOMES:

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

1. Outline the principle of electrophotographic printing process
2. Compare the types of inkjet printing technologies and their applications
3. Explain the working principles of other digital printing technologies
4. Select suitable digital printing technology and machine configuration based on application requirements
5. Assess the quality of digital printed product and explain the process control

TEXT BOOKS:

1. Michael Kriss, Handbook of Digital Imaging, John Wiley & Sons, 2015
2. Werner Zapka, Handbook of Industrial Inkjet Printing, Wiley-VCH, 2017

REFERENCE:

1. Helmut Kipphan, Handbook of Print Media, Springer Verlag, 2001.
2. Lawrence B. Schein, Electrophotography and Development Physics, Springer, 1992
3. https://fogra.org

UC23E01 ENGINEERING ENTREPRENEURSHIP DEVELOPMENT

L	T	P	C
2	0	2	3

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.

PP23701 COSTING AND ESTIMATING FOR PRINTING AND PACKAGING L T P C
3 0 0 3

OBJECTIVES:

- Understanding the basic concepts of costing/pricing and investment analysis
- To study the cost/price estimating methods for various print jobs
- To analyze the packaging, logistics and package machineries cost

UNIT I COSTING AND PRICING 9

Costingsystems-cost;profit;price;functionsofcosting;costingmodels; costing system, types of costing and problems. Profit & Loss statements, Balance sheet Interpretation. Budgeting- types of budgets, budgetary control and problems, sales forecasts and budgets for printing and allied industries; investment analysis.

UNIT II ESTIMATING 9

Cost estimating, price estimating, estimator needs and training; procedure for selling, estimating, pricing and quoting for printing; price list creation, print estimating methods – types, computerized estimating and production planning

UNIT III ESTIMATING MATERIALS FOR PROCESSES 9

Printing cost – Paper, sheet and web; ink; toners; pre-press; machine printing–sheet-fed offset, weboffset,flexography,gravure,screenprinting,digitalprinting;postpress; e- publishing. Packaging material cost analysis

UNIT IV COSTANALYSIS 9

Classification of cost; elements of cost; costing of direct materials; costing of manual operations; costing of machine operations – CMHR and BHR; costing–typesetting, scanning, plate-making, printing, binding and finishing operations.

UNITV ECONOMICS OF PACKAGING 9

Basic economics, elements of packaging costs. Classification of the costs - guidelines for Cost Effective Packaging. Packaging cost - Packaging Machinery Costs, Logistical Packaging Economics, Package Filling Economics, Package Disposal Economics. Case studies: Mono carton and flexible packaging.

TOTAL:45PERIODS

OUTCOMES:

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

1. Estimate the cost and investment analysis for printing
2. Identify the pricing, costing and budget system for printing
3. Apply the concepts of costing technique in Press, prepress and postpress
4. Calculate the composite machine hour rate(CMHR)and budgeted hour rate(BHR) for the machines used in printing
5. Analyzing the packaging, logistics and package machinery cost.

TEXT BOOKS:

1. Hugh Speirs, Print Estimator’s Handbook, 2ndedition, Pira International Ltd.,2004
2. Prasanna Chandra, Financial Management, Theory and Practice, Tata McGrawHill, NewDelhi, 6thEd., 2004.

REFERENCES:

1. Cost Accounting for Printers, Part I and Part II, British Printing Industries Federation,1982.
2. Dipl.-Ing.B.D.Mendiratta,Printer'sCostingandEstimating,PrintingIndiaPublications Pvt.Ltd.,1999.
3. Hugh M.Speirs, Print Estimators–The Handbook, BPIF,1996.
4. K.S. Venkataraman and K.S. Balaraman, Estimating Methods and Cost Analysis for Printers, Ramya FeaturesandPublications,1987,

CO's – PO's & PSO's MAPPING

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

PP23702 **ELECTRONIC PUBLISHING** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the basics of Online Publishing concepts and learn layout and design in areas of publishing
- To comprehend various software tools in designing e-publishing
- To Design and launch website for online publishing

UNIT I INTRODUCTION TO PUBLISHING 9

Internet, WWW, Web2.0, Broadband, Print On-demand, e-Book, e-Journals, e-Newspaper, internet advertising, Digital libraries, e-Readers – e-Ink, e-paper, Electronic Publishing- Advantages, Issues. Areas of publishing – Legal, STM, Catalog, Book Publishing – Manuscript, Anatomy of a book, Layout & Design, Journal Publishing, web Publishing and Handheld devices, Accessibility, usability, standards - Reference database – PUBMED, Index – author, volume, keyword; Social media publishing- Virtual and Augmented Reality assisted publishing.

UNIT II WORKFLOW 9

Conventional workflow, XML workflow, Authors, Publishers, e Publishing Companies; Workflow – Receiving Jobs (FTP), manuscript receipt, Review, Acceptance, Rejects, Pre-editing, Copy editing, Proof reading, Graphics, Pagination, Quality Control- iteration (author- Publisher), Publishing cost – cast-off, book shelf pricing, royalty. copyright and Trade mark etc., Output – Print, Proof, Web, Handheld devices (file formats).

UNIT III PRESENTATION TECHNOLOGY 9

Introduction to software- STM Typesetting, Pagination, Image manipulation software; Markup languages – fundamentals, Presentation technologies - HTML, CSS, **2D and 3D modelling**.

UNIT IV REPRESENTATION TOOLS 9

Representation technologies - XML, DTD, XSL, XML Schema; Transformation technologies - SAX, DOM, XSLT; Scripting languages - JS, PHP, C#; Unicode for non-English characters.

UNIT V PRODUCTION AND MAINTENANCE OF WEBSITE 9

Digital Business models in Internet, Marketing, Future publishing Models, Recent trends in e-publishing; Design and Construction – Testing, Launch and Handover – Maintenance – Review and Evaluation and Scripts, Develop Portfolios in the Form of Web Pages - uploaded in Free Public Domains.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Summarize the avenues of electronic publishing and Develop layouts for various digital gadgets.
2. Distinguish the functions of various modules of a workflow software.
3. Choose proper software for web presentation and transformation language.
4. Apply representation techniques in publishing.
5. Construct and launch a website for online publishing.

REFERENCES:

1. Peter K. Ryan, Careers in Electronic Publishing, The Rosen Publishing Group, 2013
2. Robert Campbell, Ed Pentz,, Ian Borthwick, Academic and Professional Publishing, Elsevier, 2012
3. Eric Ladd, Jim O' Donnel, Using HTML 4, XML and Java, Prentice Hall of India – QUE, 1999
4. Harold Henke, Electronic Books and e-Publishing: A Practical Guide for Authors, Springer Science & Business Media,2001

5. Rae A. Earnshaw, Huw Jones, John A. Vince, Digital Media and Electronic Publishing, Academic Press, 2007.
6. Richard Guthrie, Publishing: Principles and Practice, SAGE, 2011
7. Thomas A. Powell, —The Complete Reference–Web Designll, Tata McGraw Hill, Third Edition, 2003.

CO's – PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	-	-	1	-	1	1	2	-	1	1	-	3	3	1
2	3	3	1	1	-	2	1	1	-	2	2	-	3	3	1
3	3	3	3	2	3	-	1	-	-	-	-	2	3	3	1
4	3	3	3	2	3	-	1	-	-	-	-	2	3	3	1
5	3	1	3	3	3	2	3	-	3	3	3	2	3	3	1
Avg	3	2.5	2.5	1.8	3	1.6	1.4	1.5	3	2	2	2	3	3	1

PP23703 LOGISTICS AND SUPPLY CHAIN MANAGEMENT FOR PACKAGING L T P C
2 0 0 2

OBJECTIVES

- To understand the concepts of logistics and supply chain management
- To discuss various warehousing concepts in packaging supply chain
- To summarize the unitization techniques and transit regulations for logistics and SCM

UNIT I SUPPLY CHAIN MANAGEMENT 6

Fundamentals of Supply Chain Management, thrust areas of SCM, Models in logistics management, flows in supply chains, Global Supply Chain scenario and importance, Conventional Supply chains, Supply chain participants, Packaging and logistics-interaction, unit load, palletization, Export packaging

UNIT II LOGISTICS 6

Introduction to Logistics - Elements of Logistics - Distribution Channels - Product-Package Lifecycle - Significance of Modes of Transportation, Concept of Containerization - Classification of Containers - Storing, stowing & handling of cargos - Refrigerated Containers Packaging requirements for various transport modes, Package Markings and labeling

UNIT III WAREHOUSING 6

Definition- Warehousing, Need, types, merits and demerits. Warehouse Layout/design principles, Warehousing Operations, Distribution Centers; Economic/Service benefits, Packaging Materials Procurement, Factors Affecting Warehousing Cost, Warehouse information and management systems, RFID applications, warehouse safety protocol.

UNIT IV MATERIALS HANDLING 6

Materials Handling principles, Characteristics and Classification of Materials, load unitization process and handling methods, Types of Pallets –size and standards - Constructions - Pallet Treatment Techniques, stacking, storage; Package design requirements for materials handling system, Unit Load Handling Equipment – labeling, strapping, stretch wrapping, Robotic handling.

UNIT V TRANSIT REGULATIONS 6

Development in Software's for Unit Load Devices such as Palletization & Containerization International Regulations, IMDG Code - IATA - ADR - ACAO etc. Emerging trends and Case studies of Retail Supply chain; Automobile, Textile, FMCG Products and etc.

TOTAL: 30 PERIODS

OUTCOMES

Upon completion of the course the student will be able to:

1. Acquire knowledge on Supply chain activity in an organization
2. Provide knowledge on packaging logistics and containerization
3. Comprehend warehousing methods and warehouse design principles
4. Evaluate material handling devices in package line organization
5. Analyze various transit considerations and their importance in package transportation

REFERENCES:

1. Mats Johnsson, "Packaging Logistics: A Value Added Approach",Univ.,1998
2. Kerstin Gustafsson, Gunilla Jonson Kerstin, David Smith, Leigh Sparks, "Retailing
3. Madeleine Pullman, Zhaohui Wu, "Food Supply Chain Management: Economic, Social and Environmental Perspectives", Routledge, 2011
4. Daniel Hell strom, "Integrating Packaging and Logistics: Improving Supply Chain Logistics and Fresh Food Packaging: Managing Change in the Supply Chain", Kogan Page, 2009

5. Performance", VDM Verlag Dr. Muller Aktiengesellschaft& Co., 2008.

CO's – PO's & PSO's MAPPING

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

PP23001 **SECURITY PRINTING** **L T P C**
3 0 0 3

OBJECTIVES:

- Understand the need for security printing.
- Identify and explain types of security inks and substrates.
- Explore and explain security printing techniques and applications.

UNIT I SECURITY INKS **9**

Types of security printing Inks-Invisible ink, thermochromic ink, solvent sensitive ink, optically variable ink, magnetic ink, biometric ink, fugitive ink, secondary fluorescing ink, indelible inks, Invisible Phosphorescent inks, Water Resistant Inks, engraved pigment inks.

UNIT II SECURITY SUBSTRATES **9**

Security Fibres, Fluorescent Hilites, Iridescent coating, Security threads, Holographic foil, Colour centered paper, Chemical reactive, chemically void, toner fused paper, visible security fibers, invisible fluorescent fibers and other security papers.

UNIT III SECURITY PRINTING TECHNIQUES **9**

Water marking – Digital Watermark -Holograms, rainbow printing, micro lines, Micro-dot, nano text, hidden text, guilloches, numbering, Line-printing, stamp embossing, hot-foil-embossing, cold foiling, embossing / punching, hologram, Bar codes-Types, principles.

UNIT IV BANKING, REVENUE AND AUTHENTICATION APPLICATIONS **9**

CTS cheque design and print features, Currency notes – Design, print features, substrate; Business forms; Certificates- Passports – Revenue stamp paper; Packaging; Magnetic/RFID cards.

UNIT V SECURITY LABELS **9**

Substrates, content; Label authentication and protection- Logo, Adhesive types- low residue, high residue, self voiding, security cuts, security threads, Types of marking-on-asset marking, online authentication and item level traceablity.

OUTCOMES:

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

1. Understand security inks and their role in enhancing document and product security.
2. Analyze different security substrates for their durability and authentication features.
3. Demonstrate proficiency in security printing techniques, such as microprinting and holography.
4. Explore practical security applications in industries such as finance, pharmaceuticals, and government organisations.
5. Gain knowledge and skills in designing security labels with appropriate features and adherence to standards.

TEXT BOOKS:

1. Richard D. Warner, Richard M. Adams, “Introduction to Security Printing”, PIA/GATF Press, 2005

REFERENCES:

1. A.S. Bhaskar Raj, Barcode Technology and Implementation, McGraw Hill, 2007.
2. Developments in Security Labels and Tags, Rudie Lion, Pria International Ltd.
3. Martin Monestics, The Art of Paper Currency, Quarlet Books Ltd.,1983.

CO's – PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3				2	1	3	2	1			3	3	3
2	3	3	3	3	3		2	3	2	1		2	3	3	3
3	3	3	3	3	3	3	3	3	3	3	3	2	3	3	3
4	3	3	3	3	3	3		3	3	3	3	3	3	3	3
5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Avg	3	3	3	3	3	2.75	2.25	3	2.6	2.2	3	2.5	3	3	3

PP23002 WEB OFFSET PRINTING TECHNOLOGY L T P C
3 0 0 3

OBJECTIVE:

- To study and understand the web offset machine configuration with web feeding and controls
- To acquire knowledge on drying and chilling systems and familiarize on mailroom operations

UNIT I PRESS CLASSIFICATION AND INFEED UNITS 9

Development, Classification – blanket-to-blanket, in-line, common impression; Job suitability and factors to be considered for selection, presses – Full size, narrow web presses and continuous stationery; Roll stands; Automatic pasters – Zero speed and Flying pasters; Web pre-conditioners, infeed units, dancing roller types, design, tension control systems. Reel handling and storage; Requirements of paper-roll and web.

UNIT II PRINTING UNIT 9

Printing Unit – plate cylinder, blanket cylinder, lock-up mechanisms, cylinder pressure and timing, unit configuration, webbing up options; Automatic webbing up device, control of fan out using buzzle wheels and air guns; web aligner concepts; Web break detectors &Severers; Cylinder drives; Circumferential and lateral movement of plate cylinder; Automatic register control system, concepts and design; Shaft less drives, automation in closed loop controls.

UNIT III INKING & DAMPENING SYSTEMS 9

Inking system: requirements, design concepts, types of ink metering, roller train design, form rollers, heat generation, ghosting. Ink agitators, automatic ink pumping systems. Roller setting. Dampening system: requirements, types, metering methods, column control. Keyless inking, Alcohol damping, spray, brush dampeners. Test forms. Print quality, measurement and control systems, ISO 12647-3. Web offset printing problems, solutions and paper waste control.

UNIT IV DRYING, CHILLING, FOLDING AND SHEETING UNITS 9

Dryers: need, types, construction and working. Silicone coating, Chilling units, construction. Operational care and maintenance. Folders, types and delivery, Settings & Adjustments; Former and its adjustment, Balloon formers and insertions R.T.F., nip rollers, turner bars, bay windows, side and cut off margin controls. Inline finishing-gluers, paster wheels, pattern gluers, segmented gluers, envelope pattern gluers, backbone gluers. Kickers, markers, perforators, slitters, operation and maintenance. Sheeting device and mechanism, inline stitchers, Semi commercial – concepts, problems, challenges

UNIT V MAIL ROOM OPERATION 9

Products, sizes, formats, sections, Pagination, single/double/quadruple production, speed, time schedules, conveyor system, counter stackers, wrapping requirements, strapping requirements. bundle addressing, system and control, online trimmers, copy counting mechanisms, Programming and Telescopic conveyor for truck loading, copy storage system, Inserting, Diverters & Kickers Web Offset machine manufacturers - Major brands, Machine Formats, Technical comparison; Emerging Trends - Lean Production, VDP & Inkjet Integration, Value addition.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Analyze different configurations, components and mechanisms of a web offset machine
2. Identify and solve problems related to runnability and printability of substrates
3. Summarize the design concepts of inking and dampening system and devise methods to ensure conformance to quality standards.
4. Explain the construction of drying, chilling and folding units

5. Describe the components and product of mailroom system

REFERENCES:

1. David B. Crouse, Web Offset Press Troubles, GATF Press, 1984
2. Helmutt Kipphan, Handbook of Print Media, Springer, Heidelberg, 2001
3. John MacPhee, Fundamentals of Lithographic Printing Vol.I Mechanics of Printing, GATF Press, 1998
4. Daniel G. Wilson and GATF Staff, Web Offset Press Operating, Fifth edition, GATF Press, USA, 2000
5. W.R. Durrant, Web Control: A Handbook for the Web Printer, 1997.

CO's – PO's & PSO's MAPPING

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	1	1	-	-	-	-	1	-	1	-	3	3	2
2	3	3	3	2	2	3	-	2	1	-	2	-	2	3	3
3	3	3	2	2	1	-	2	2	2	2	3	-	3	3	3
4	3	2	3	1	-	2	2	-	2	2	2	-	3	2	2
5	2	2	2	1	-	-	-	-	3	-	1	-	2	2	2
Avg	2.8	2.6	2.2	1.4	1.5	2.5	2	2	1.8	2	1.8	-	2.6	2.6	2.4

PP23003 ADDITIVE MANUFACTURING FOR PRINT PROTOTYPING L T P C
3 0 0 3

OBJECTIVES:

- To develop a foundational understanding of additive manufacturing, including its basic principles and techniques.
- To explain the different technologies utilized in additive manufacturing, specifically inkjet and laser, including their underlying principles and how they are applied in the printing process.
- To explore and discuss various applications of additive manufacturing printing techniques across different industries, highlighting their impact and potential for innovation.

UNIT I ADDITIVE MANUFACTURING WORKFLOW 9

Introduction; Design considerations – Material, Size, Resolution, Process; Modelling and viewing - 3D; Scanning; Model preparation – Digital; Slicing; Software; File formats.

UNIT II MATERIALS FOR ADDITIVE MANUFACTURING 9

Processes – Extrusion, Wire, Granular, Lamination, Photopolymerisation; Materials - Paper, Plastics, Metals, Ceramics, Glass, Wood, Fiber, Sand, Biological Tissues, Hydrogels, Graphene; Material Selection - Processes, applications, limitations;

UNIT III INKJET TECHNOLOGY 9

Printer - Working Principle, Positioning System, Print head, Print bed, Frames, Motion control; Print head Considerations – Continuous Inkjet, Thermal Inkjet, Piezoelectric Drop-On-Demand; Material Formulation for jetting; Liquid based fabrication – Continous jet, Mulitjet; Powder based fabrication – Colourjet.

UNIT IV LASER TECHNOLOGY 9

Light Sources – Types, Characteristics; Optics – Deflection, Modulation; Material feeding and flow – Liquid, powder; Printing machines – Types, Working Principle, Build Platform, Print bed Movement, Support structures;

UNIT V PACKAGING APPLICATIONS 9

3D product dimensioning, Product Models, manufacturing – Printed electronics, Biopolymers, Packaging-Healthcare, Food, Medical, Displays; Future trends; Case studies.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Understand the additive manufacturing workflow and its stages.
2. Analyze materials for additive manufacturing and their impact on printed objects.
3. Explain inkjet technology and its applications in additive manufacturing.
4. Explain laser technology and its applications in additive manufacturing.
5. Explore packaging applications of additive manufacturing.

TEXT BOOKS:

1. Christopher Barnatt, 3D Printing: The Next Industrial Revolution, CreateSpace Independent Publishing Platform, 2013.
2. Ian M. Hutchings, Graham D. Martin, Inkjet Technology for Digital Fabrication, John Wiley & Sons, 2013.

REFERENCES:

1. Chua, C.K., Leong K.F. and Lim C.S., Rapid prototyping: Principles and applications, second edition, World Scientific Publishers, 2010
2. Ibrahim Zeid, Mastering CAD CAM Tata McGraw-Hill Publishing Co., 2007
3. Joan Horvath, Mastering 3D Printing, APress, 2014.

CO's – PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	3	3	3	3	3	3	2	1	1	3	3	3
2	3	3	3	3	3	3	3		3	3		1	3	3	3
3	3	3	3	3	3				1	2		1	3	3	3
4	3	3	3	3	3				1	2		1	3	3	3
5	3	3	3	3	3				1	2		1	3	3	3
Avg	3	3	3	3	3	3	3	3	1.8	2.2	1	1	3	3	3

PP23004 **PRINTED ELECTRONICS** **L T P C**
3 0 0 3

OBJECTIVES:

- Explain the basics of printed electronics and its applications
- Provide overview of inks and substrates for printed electronic products
- To list and outline the materials used for printed electronics

UNIT I INTRODUCTION **9**

Printed Electronics Technology, Benefits, Products and Trends, Applications - Lighting, Organic/Inorganic Photovoltaics, Displays, Integrated Smart Systems, RFID, Other Electronics and Components; Printing Technology – Printing Parameters, Surface treatment, Printing processes, Merits, Demerits, Applications, Post treatment processes, Embossing, Nano imprinting.

UNIT II INKS **9**

Inorganic materials - Metallic materials, Transparent Oxides, Carbon nanotubes, Graphene, Silicon. Germanium, Metal Chalcogenides semiconductor, Quantum Dots, Nanoparticle/Polymer Dielectric composites; Organic materials – Characteristics, Conductive polymers, semiconductors, insulating materials; Conductive Adhesives.

UNIT III SUBSTRATES AND ENCAPSULATION **9**

Substrates – Glass, polymer, Paper, Ceramics, Metal; Aging – Characteristics, Mechanisms, Requirements; Principle of Encapsulation; Thin film encapsulation – Single layer, multilayer, thin film deposition, Flexibility, Applications, Trends.

UNIT IV APPLICATIONS **9**

Solar cells – Working Principle, Materials, Fabrication Methods, Trends; Organic Light Emission and Display – Mechanism, Structures and materials, White lighting, Fabrication, Trends; Thin Film Transistors – Types, Working Principle, Structure, Materials, Fabrication, Trends.

UNIT V CHARACTERISATION AND STANDARDS **9**

Substrate properties – Surface, Mechanical, Optical, Chemical, Electrical, Thermal, Flammability; Conductive ink properties – Physical, Electrical, Mechanical, Optical; Standards-ISO, IEC, IEE, IPC; Current trends and research.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Compare and contrast the suitability of printing processes for various electronic products
2. Outline the materials used as inks for printed electronics
3. Summarize the substrate types and encapsulation techniques
4. Explain the working principle, materials and fabrication methods of solar cells, OLED and TFT
5. Outline and restate characterization techniques and standards in printed electronics

TEXT BOOKS:

1. Zheng Cui, Printed Electronic: Materials, Technologies and Application Wiley, 2016
2. Katsuaki Suganuma 'Introduction to Printed Electronics', Springer, 2014

REFERENCES:

1. Colin Tong, Advanced Materials for Printed Flexible Electronics, Springer, 2022
2. John Birkenshaw, 'Printed Electronics' Pira International, 2004 Jutta E. M Rasp 'Flexible and Printed Electronics Explained: Technology andCommercial Applications', John Wiley & Sons, Limited, 2011.
3. https://webstore.iec.ch/publication

CO's – PO's & PSO's MAPPING

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

PP23005 **SPECIALTY PRINTING** **L T P C**
3 0 0 3

OBJECTIVES:

- To discuss the advanced reproduction techniques in printing.
- To describe and explain the various aspects of aesthetic improvement
- To explain specialty printing finishing operation.

UNIT I INTRODUCTION **9**

Different types of specialty printing, Functions, Anti- counterfeiting features, Currency printing, Intaglio printing, Postage Stamp printing, Map printing, MICR, Hologram, Semiconductor lithography, Advance printing techniques; Speciality Design - Graphic design concept, logo, page, product, brand, label and advanced concepts; Digital printing techniques; prototypes

UNIT II TEXTILE PRINTING **9**

Textile fabric types, products; Inks for textile printing – pigments and dyes, mordants, additives, color matching, functional properties, testing; Printing – Screen printing machine configurations, mechanisms; Digital printing configurations, mechanisms;

UNIT III MISCELANIOUS PRINTING TECHNIQUES **9**

Concepts, techniques and applications - Pad printing, tissue paper printing; printed electronics - solar cell, talking book, visiting cards; POD, direct mailers, thermography, lenticular printing, Braille printing; security printing- overt and covert printing, Water transfer printing, 3D printing, Decals,

UNIT IV VALUE ADDITION PROCESSES **9**

UV coating - matt, gloss, cold, textured, metallic coating, applications; varnishes- types, selection, blind emboss, de-bossing; laminations – types, materials, techniques; Foiling - Hot, cold;

UNIT V SPECIALITY FINISHING OPERATIONS **9**

Menu card printing and folding, value added features- mailer, z-bind, greeting card with special fold, reception cards- valley and mountain fold, duplexing, perforation, brochures; Die cut - Hugo Boss, etched and laser, kiss cut cards – security features. Premium packages.

TOTAL : 45 PERIODS

OUTCOMES:

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

1. Outline the basic concepts of specialty printing and conceptualize innovative products
2. Select suitable materials and machine for screen printing process
3. Compare and contrast various types of specialty printing processes
4. Plan and compose value addition to existing print design
5. Compare and contrast various specialty print finishing operations

TEXT BOOKS:

1. Megan Fishpool,” Hybrid Prints Printmaking Handbooks ”, A&C Black, 2009
2. Poppy Evans, Aaris Sherin, Irina Lee,” The Graphic Design Reference & Specification Book: Everything Graphic Designers Need to Know Every Day ”, Rockport Publishers, 2013.

REFERENCES:

1. Helmut Kipphan, "Handbook of Print Media", GATF, 2001
2. Samuel B. Hoff, Screen Printing – A Contemporary Approach, Delmar Publishers,1997.
3. William Appleton, Screen Printing, PIRA International, 1994.
4. Jutta E. M Rasp, "Flexible and Printed Electronics Explained: Technology andCommercial Applications", John Wiley & Sons, Limited, 2015.

5. John Dawson, “The Complete guide to prints and printmaking: techniques and materials”, Excalibur Books, 1981, digitized Jun 2010.

CO’s – PO’s & PSO’s MAPPING

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

PP23006 **PRINTING MACHINERY MAINTENANCE** **L T P C**
3 0 0 3

OBJECTIVES:

- To provide an knowledge on maintenance management, maintenance activities & its schedule.
- To understand the procedures involved in erection and techniques to evaluate machine condition.
- To comprehend the factors to be considered for replacement and reconditioning.

UNIT I MAINTENANCE MANAGEMENT PERSPECTIVE 9

System components, documentation, facility register, records, safety related issues. Spare parts management. Maintenance methods, Criticality determination, Maintenance schedules and control system. Total Productive Maintenance - Six big losses, measuring the losses. Evaluating equipment effectiveness.

UNIT III PRINTING MACHINE MAINTENANCE 9

Press and press room maintenance. Electrical components maintenance: Motors, Electric switches and brake system. Mechanical components maintenance: transformation of power - gears, belt and chain drives, cams, levers, Bearings, Clutches. Control system for feeding, printing and delivery sections. Inspection and lubrication, purpose, lubricants, lubricating systems.

UNIT II PACKAGING MACHINE MAINTENANCE 9

Maintenance of cartooning machineries, case handling machineries, coding and making machineries. Maintenance of filling machineries - VFFS/HFFS (vertical and Horizontal form-fill-seal), Thermoform – fill-seal, Wrapping machines. Line maintenance – conveyors, control system and detection/inspection.

UNIT IV MACHINE ERECTION AND TESTING 9

Foundation requirements, Erection, Commissioning, Testing; Condition based maintenance: Condition monitoring, Techniques, Vibration analysis, Thermography, Nondestructive testing methods and diagnostic instruments.

UNIT V RECONDITIONING AND REPLACEMENT THEORY 9

Repairs and reconditioning methods for various parts, roller coppering, re-rubberizing. Replacement models - Replacement policy, replacement of items, Determination of average life.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Analyze the basic concepts of maintenance management
2. Create a maintenance schedule based on criticality and economics
3. Evaluate equipment effectiveness
4. Identify the stages of machine erection and testing
5. Suggest and comment on replacement of various parts of a machine

CO's – PO's & PSO's MAPPING

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

PP23007	PACKAGE DESIGN AND STANDARDS	L T P C
		3 0 0 3

OBJECTIVES:

- To discuss about the basics of packaging and merchandising
- To discuss on the basic concepts in package designing, design considerations and design workflow.
- To discuss and illustrate the components of package graphic designs
- To discuss and illustrate the components of package structural designs
- To discuss about the package designing and performance simulation software

UNIT I INTRODUCTION 9

Packaging and Modern Merchandising, Marketing Requirements, Brand Management, Product Lifecycle, planning for change, Basic considerations of package development –structural development, packaging coordination, graphics, packaging line engineering, cost of development; Economic considerations: package cost vs. product cost.

UNIT II PACKAGE DEVELOPMENT 9

Managing the Packaging Function, Project Scope, Consumer Research, Behavioral Measures, Eye Tracking and the features of a package, Optimizing Package Design, Package Development Process, Specifications, Benchmarks, Package Designer's, Checklist, Introduction of testing and evaluation methods.

UNIT III GRAPHIC DESIGN 9

Demographics and Psychographics, The Retail Environment, Fundamental Messages, Equity and Brand Names, Role of Graphics, Text, Colour, Graphic Design Basics, Package Design and Marketing Studies, Package Aesthetics, Decoration Aspects, Layout and Feature Selection.

UNIT IV STRUCTURAL DESIGN 9

Structural Design – folding cartons FEFCO, ECMA standard templates, cans, glass containers, plastic containers, bags and pouches; Role of Structure, Die-making, Drawing, Moulds, Prototypes, Samples, Design Standards. Predicting package performance ITC, ASTM.

UNIT V SOFTWARES FOR DESIGNING 9

CAD software for Package Designing, drafting, mould design; Simulation software for package performance and manufacturing.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, the student will be able to:-

1. Discuss and interpret the functionality, durability, sustainability, and legal/regulatory compliance for effective package design.
2. Apply the stages of package development proces for packaging design.
3. Create designs using graphic design principles in packaging for visually appeal.
4. Create functional, protective, and aesthetically pleasing packaging using various materials and assembly methods.
5. Design, construct and analyse packages using software tools.

TEXT BOOKS

1. Marianne R. Klimchuk and Sandra A. Krasovec, “Packaging Design: Successful Product Branding from Concept to Shelf”, Wiley, 2006,
2. Walter Soroka, “Fundamentals of packaging technology”, 3rd Edition, Institute of packaging professionals, Naperville, Illinois, USA, 2002

REFERENCES

1. Aaron L. Brody and Kenneth S. Marsh, “The Wiley Encyclopedia of Packaging Technology”, 1997
2. Giles Calver, “What is Packaging Design?: Essential design handbook”, Rotovision, 2004
3. Steven DuPuis, John Silva,”Package Design Workbook: The Art and Science of Successful Packaging”, Rockport Publishers, 2008

CO’s – PO’s & PSO’s MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3			3	3	3			2		2	3	3	3
2	3	3	3	3	3	2	2		3	2	2		3	3	3
3	1	2	2		3				3	3	3	1	3	3	3
4	3	3	3	3	3	2	2		3	2	2	1	3	3	3
5	3	3	3	3	3	2		3	3	2	1	1	3	3	3
Avg	2.6	2.8	2.75	3	3	2.25	2.3	3	3	2.2	2	1.25	3	3	3

PP23008 **CONSUMER GOODS PACKAGING** **L T P C**
3 0 0 3

OBJECTIVES:

- To provide basic knowledge of food and agricultural packaging, its shelf life and package developments.
- To summarize about agricultural commodities and FMCG and cosmetics packaging and its emerging trends
- To explore various packaging techniques for automotive and bulk packaging materials

UNIT I FOOD PACKAGING

Food deterioration, Food Preservation, Shelf life testing methods, packaging materials d techniques for: Meat, Seafood, Horticultural products, Dairy products, Food grains, Oils, Beverages, Snack food and Bakery items; Ready to eat Food Packaging; Emerging Trends.

UNIT II AGRICULTURAL PACKAGING

Agricultural product characteristics and package requirement, Selection of materials for Cereals and legumes, Cooking oils and essences, Horticultural products, Animal products and Honey/syrups. Packaging - Forms, Machinery and methods for fresh produce. Good Agricultural Practices (GAP)

UNIT III FMCG AND COSMETIC PACKAGING

Packaging of FMCG products: Cosmetics, Textile, Footwear, Toiletries, Jewellery, Household, Glassware, Consumer electronics, Hardware packaging, Electrostatic Discharge Protective Packaging; Packaging for e-commerce; Innovations, Emerging Trends.

UNIT IV AUTOMOTIVE PACKAGING

Packaging of Automotive parts- electrical, mechanical components, Theory of corrosion - Corrosion preventive methods – Desiccants types/verities/properties/ selection criteria and quantity determination and mode of application – Vapour corrosion inhibitors (VCI) types/ varities /properties and selection criteria and mode of application.

UNIT V BULK PACKAGING

Bulk packaging requirements, types; FIBC, Industrial packaging - Steel containers, Fibre Drums, Plastic Drums, Corrugated boxes, Crates - Wooden crates, Steel crates, Sacks, Export packaging, Hazardous materials packaging.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Describe the basic concept of food packaging, shelf life and its package development
- Choose a packaging material and machineries for agricultural commodities
- Summarize the types of FMCG and cosmetics packaging and their emerging trends.
- Effectively communicates about automotive packaging and its corrosion control.
- Identify and categorize the bulk packaging materials and their consideration

CO's – PO's & PSO's MAPPING

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

PP23009 **HEALTHCARE PACKAGING** **L T P C**
3 0 0 3

OBJECTIVES:

To gain a comprehensive understanding of pharmaceutical products, including their characteristics, classifications, and manufacturing processes.

- To explore different types of pharmaceutical packaging materials, including their properties, suitability for various products, and considerations for maintaining product integrity.
- To examine essential aspects of pharmaceutical packaging, such as sterilization techniques, types of closures, label types, their requirements, and the importance of adhering to relevant standards and quality systems.

UNIT I INTRODUCTION TO HEALTHCARE & COSMETICS PRODUCTS 9

Drugs – Introduction, Drugs and cosmetics act 1940 - definition of drug and cosmetic products, types, forms; Drug spoilage mechanism – chemical, thermal, moisture, oxygen, light. Drug requirements – sterility, drug physiology; Biological products – drugs, vaccines, whole blood, Blood derivatives; Medical Food – Composition, types; Medical devices – types, Classification; Good Manufacturing Practices.

UNIT II PHARMACEUTICAL PACKAGING MATERIALS 9

Glass- Composition, types; Metals-Tinplate, Coatings, Aluminium, Polymers – Properties of Polyethylene polymers, Ethyl vinyl acetate, ethylene acrylic acid, ionomers, ethylene vinyl alcohol, polyvinyl alcohol, polypropylene, polyvinyl chloride, polyvinylidene chloride, fluoropolymers, polystyrene, polyamides, polyesters, polyethylene terephthalate, polyethylene naphthalate, polycarbonate, polyurethane, acrylonitrile polymers, rubbers and elastomers, bio polymers; Types of packaging.

UNIT III STERILISATION TECHNIQUES 9

Heat sterilisation - steam, pressure, boiling, dry heat, flaming, incineration; Chemical sterilisation - Ethylene oxide, Chlorine, Hydrogen peroxide, Peracetic acid, ozone, formaldehyde, glutaraldehyde; Radiation sterilisation-γ rays, X rays, UV light.

UNIT IV CLOSURES AND LABELLING 9

Closure – need, functions, types; Stoppers, spray and pump dispensers, closure liners; Child resistant closures – types, design features; Sealing of capsules; Labels – Types, Requirements as per Drugs and Cosmetics act 1940, Barcodes – Types, Printing requirements; Inspection of labels.

UNIT V STANDARDS AND QUALITY SYSTEMS 9

Overview of Indian standards – IS 3692, IS 1108, IS 16011, IS 9833, IS 7803, IS 14233, IS 13601; Overview of medical device Quality System - ISO 13485, ISO 11607, ISO 15223 Transport Simulation tests as per ASTM D 4169, ASTM D4332, ASTM F 1980

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Demonstrate a comprehensive understanding of pharmaceutical products, including their characteristics, classifications, and manufacturing processes.
2. Evaluate and analyze different types of pharmaceutical packaging materials, considering their properties, suitability for specific products, and their impact on maintaining product integrity.
3. Apply knowledge of sterilization techniques to ensure the safety and sterility of pharmaceutical packaging, considering factors such as materials, equipment, and regulatory requirements.
4. Assess and compare various types of closures used in pharmaceutical packaging, understanding their functions, compatibility with different products, and the importance of proper sealing and integrity.
5. Identify and interpret various standards and medical devices quality systems.

REFERENCES:

1. Pharmaceutical Packaging Handbook, Edward Bauer, CRC Press
2. Medical Device Packaging Handbook, 2nd edition Revised and Expanded; Max Sherman
3. Drugs and Cosmetics Act, 1940
4. Drugs Rules, 1945
5. Cosmetics Rules, 2020
6. Medical devices rules, 2017
7. Indian standards IS 3692, IS 1108, IS 16011, IS 9833, IS 7803, IS 14233, IS 13601
8. ISO 13485- Medical Device – Quality Management Systems Requirements for regulatory purposes
9. ISO 11607- 1 & 2: Packaging for Terminally sterilized Medical Devices
10. ISO 15223: Medical Devices – Symbols to be used medical devices labels, Labeling and information to be supplied
11. ASTM D 4169: Standard Practice for Performance Testing of Shipping Containers and Systems
12. ASTM F 1980: Standard Guide for Accelerated Aging of Sterile Barrier Systems for Medical Devices

CO's – PO's & PSO's MAPPING

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	2			2	2	2		1	1	2	3	3	3
2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3	3	3	1	2	2	1	3	1				2	3	3	3
4	3	3	3	3	3		2	1	2			1	3	3	3
5	3	1		1		2		1	2	2		1	3	3	3
Avg	3	2.4	2.25	2.25	2.67	2	2.5	1.6	2.33	2	2	1.8	3	3	3

PP23010 QUALITY CONTROL IN PRINTING AND PACKAGING L T P C
3 0 0 3

OBJECTIVES:

- To impart knowledge about principles of quality and basic process control tools and sampling
- To design test chart and learn control procedures in various stages of printing and monitoring checklist for print standards

UNIT I FUNDAMENTALS OF QUALITY 9

Fundamental concepts of Quality, Quality Cost, Specification of Quality, Quality inspection, Quality Challenges in printing; Records - types, maintenance; Pre press quality control; Quality of originals, Input Resolution, File-formats, Linearization, Calibration and Profile creation, Image editing, anti-aliasing, trapping, image mixing, Pre-flight Check, Proofing, RIP, Simulation of Proof to-Press, Output/Imaging.

UNIT II STATISTICAL PROCESS CONTROL 9

Introduction to Statistical Process Control, Statistical Quality Control tools; Types of Variation, Control charts for Variable and attribute data, Acceptance sampling for attributes, Acceptance sampling for variables, Operation Characteristics curve, Selection and collection of data, Interpretation of data and statistical inference, Data analysis using statistical software like Minitab, SPSS, SAS.

UNIT III PACKAGING MATERIAL'S QUALITY CONTROL 9

Quality control procedure and practices used in receiving inventory - inventory management - Paper and board, Glass, Metals, Plastic and wood, Testing of printability - surface properties, optical properties, ink characteristics, press performance and post print performance testing, Aspects of suitability of packaging material for various packaging applications – performance testing - Physical, chemical and biological characteristics

UNIT IV PACKAGE PRINTING QUALITY CONTROL 9

Process variability and measures of variability, Process inspection and control procedures for every production department, waste and spoilage reduction, Press Characterization (finger printing) and standardization, Various test forms used for standardization; Quality control in conversion process.

UNIT V STANDARDS 9

Principles of print standards, Types of Standards such as ISO/PSO, TAPPI, CGATS, CIE, ICC, Media Standard, DIN, ASTM, ANSI developing of quality monitoring checklists for all processes, checklists of definable and measurable attributes of products

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Implement ISO standards in prepress
2. Apply statistical quality control tools and quality standards
3. Evaluate quality of incoming packaging materials and outgoing products
4. Identify instruments required for implementing print quality
5. Analyze the Print standards and establish process control checklist

REFERENCES:

1. Apfelberg, H.L., Apfelberg, M.J., Implementing Quality Management in Graphic A
2. Brian Rothery, ISO 9000, Productivity & Quality, Publishing Private Ltd., 1992
3. Douglas C. Montgomery, Introduction to Statistical Quality Control, John Wiley, 1985
4. Kelvin Tritton, Colour Control for Lithography, PIRA International, 1992
5. Ken Holmes, Implementing ISO 9000, 2nd edition, PIRA International, 1995
6. Mortimer, A., Colour Reproduction in Printing Industry, PIRA International, 1991. 103
7. Phil Green, (1992), Quality Control for Print Buyers, Blue Print.
8. Ronald E. Todd, Printing Inks – Formulation Principles, Manufacture and Quality Control Testing Procedures, PIRA International,1994
9. Joseph M. Juran, Joseph A. De Feo, Juran's Quality Handbook, Tata McGraw Hill Publication, 6th edition, 2010.
10. Miles Southworth & Donna Southworth, Quality and Productivity in the Graphic Arts, Graphic Arts Publishing Company, 1990.

CO's – PO's & PSO's MAPPING

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	1	3	-	1	2	3	3	-	1	2	2	2	3	3
2	3	3	3	3	2	2	2	1	3	-	2	2	2	3	3
3	3	3	3	3	2	2	2	1	-	2	2	3	2	3	3
4	3	3	3	3	2	2	1	1	3	2	2	2	1	3	3
5	3	3	3	3	3	2	3	2	3	-	2	3	3	3	3
Avg	3	2.6	3	3	2	2	2.2	1.6	3	1 .6	2	2.4	2	3	3

PP23011	INDUSTRIAL PACKAGING	L T P C
		3 0 0 3

UNIT I INDUSTRIAL PACKAGING 9

Industrial Packaging- Introduction, Bulk packaging requirements, types; FIBC, Industrial packaging - Steel containers, Fibre Drums, Plastic Drums, Corrugated boxes, Crates - Wooden crates, Steel crates, Sacks, Export packaging, Hazardous materials packaging.

UNIT II CUSHIONING SYSTEM 9

Package Distribution Hazards; Cushioning Basics, Cushioning materials - types, properties, selection; Cushion curves theory; Cushion design - steps, shapes, positioning, economics; Cushion Performance Evaluation; Interior Packaging Design - Isolation and Deflection, Void Fill, Blocking, Partitions, Pad and Liners, Surface Protection; Steps in Design of protective packaging; Testing and Standards;

UNIT III AUTOMOTIVE PACKAGING 9

Packaging of Automotive parts- electrical, mechanical components, Theory of corrosion - Corrosion preventive methods – Desiccants types/verities/properties/ selection criteria and quantity determination and mode of application – Vapour corrosion inhibitors (VCI) types/varities/properties and selection criteria and mode of application.

UNIT IV HAZARDOUS MATERIAL PACKAGING 9

Dangerous Goods, UN Listing, Hazard Communication Standards; Code for designating types of packagings, Package Markings, Consignment Procedures – General Provisions, Marking and labelling, Placarding and marking, documentation, special provisions; Packing instructions – Chemicals, Aerosol dispensers, Packages for infectious substances, Radioactive materials packaging and standards; Standards for hazardous materials. ISTA

UNIT V HANDLING, STORAGE AND DELIVERY 9

Handling- pallets, packaging equipment, electronic equipment, fragile materials; Product arrangement on pallets; Storage-warehouse and cold storage,area designation, receipt and dispatch, stock condition assessment; Returnable packaging; Trends – Automation, IOT, AI;

COURSE OUTCOMES (COs)

Explain the various instrumentation basic measurement system

1. Explain the various instrumentation basic measurement system
2. Ability to compare instruments used for measurement of force, torque, speed, acceleration, vibration, density and level.
3. Describe the principle of temperature measuring instruments.
4. Elaborate the type and working of pressure measuring instruments.
5. Design and select instruments according to the application.

TEXT BOOKS:

1. Brandenburg, Richard K., Lee, Julian June-Ling, “Fundamentals of Packaging Dynamics”, 4th ed., L.A.B. Equipment, 2001
2. Daniel Goodwin, Dennis Young, "Protective Packaging for Distribution: Design and Development", DEStech Publications, Inc., 2010
3. Joseph F. Hanlon, Robert J. Kelsey, Hallie Forcinio, “Handbook of Packaging Engineering”, 3rd edition, CRC Press, 1998
4. Russel, P G, and Daum, M P, "Product Protection Test Book", IoPP
5. Sek M. and Kirkpatrick J, “Corrugated Cushion Design Handbook”, VUT, 2001

REFERENCE BOOKS:

1. Liptak, B.G., “Instrumentation Engineers Handbook (Measurement)”, CRC Press, 4th Edition, 2012.
2. Jones. B.E., “Jones”s Instrument Technology”, Vol.2, Butterworth-Heinemann, 4thEdition, Elsevier, 2016.
3. Eckman D.P., “Industrial Instrumentation”, Wiley Eastern Limited, 2016.
4. Singh,S.K., “Industrial Instrumentation and Control”, Tata Mc-Graw-Hill Education Pvt. Ltd., 3rd Edition, New Delhi, 2010.

CO’s – PO’s & PSO’s MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	1	3	-	1	2	3	3	-	1	2	2	2	3	3
2	3	3	3	3	2	2	2	1	3	-	2	2	2	3	3
3	3	3	3	3	2	2	2	1	-	2	2	3	2	3	3
4	3	3	3	3	2	2	1	1	3	2	2	2	1	3	3
5	3	3	3	3	3	2	3	2	3	-	2	3	3	3	3
Avg	3	2.6	3	3	2	2	2.2	1.6	3	1 .6	2	2.4	2	3	3

PP23012	PACKAGING LAWS AND REGULATIONS	L T P C
		3 0 0 3

OBJECTIVES:

- To understand the various rules and regulations with respect to packaging in India
- To comprehend the International laws with relation to various forms of Packaging

UNIT I INDIAN REGULATORYSYSTEM 9

Introduction, The Standard so weights and Measures Act (SWMA), Standard Units, Laws, Regulations and Ministries involved, Essential Commodities Act, Agricultural Produce (Grading and Marketing) Act, Prevention of Food Adulteration Act, Codex Standard Act, Export (Quality Control and Inspection) Act, Bureau of Indian Standards. Voluntary standards vs Mandatory standards.

UNIT II DECLARATIONS ON PACKAGED COMMODITIES 9

Declarations for Interstate Trade and Commerce, Standard Packages, Maximum Permissible Error, Label Declarations, Standard Quantity specifications for various products, Symbols and Units Used.

UNIT III INTERNATIONAL LAWS AND REGULATIONS 9

Uniform Weights and Measures Law, Uniform Packaging and Labeling Regulation (UPLR), Uniform Unit Pricing Regulation (UPR), pharmaceutical and healthcare regulation, Details of Violations, offences, Penalties under various sections, EUREACH Regulations in packaging; Intellectual Property Rights. Gulf Organisation for Standards (GSO), Saudi Standards metrology and quality (SASO) CODEX standards.

UNIT IV SUSTAINABLE PACKAGING AND REGULATIONS 9

Sustainable Development & Processes, Three Pillars of Sustainability & their effects on sustainable growth – Relation with environment waste management Relevance of Sustainable Development in Packaging Sector – Traditional Packaging vs. Sustainable Packaging, Sustainable Economics & CSR Activities for Sustainable Development Environmental Compliance: National & International Legislations – Cost Factors & their implications – Sustainable Development Policies – Corporate Social Responsibility & Key Performance Indicators (KPIs). LCA and Waste Management - Methodology, LCA studies and its importance, Waste Management – various techniques and description, mechanical recycling, feedstock recovery, incineration, landfills, alternative material to reduce waste

UNIT V PACKAGING REQUIREMENTS AND REGULATIONS 9

Packaging requirements under PFA, FSSAI, Declaration and Labeling, Specification of Display panels, Statutory Requirements on Packages, PFA Enforcement methods, Fruit Products Order (FPO) Meat Food Products Order (MFPO) Agricultural Grading and Marking Rules (AGMARK), Edible Oil Packaging (Regulatory) Order, HACCP handling norms.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course the student will be able to:

1. Outline the various Acts of the Indian Regulatory system
2. Discuss the different declarations on Packages
3. Explain the various International laws, including violations and penalties
4. Illustrate the various Package storage requirements
5. Interpret the various packaging requirements under Food and Pharmaceutical Packaging.

REFERENES

1. A practical guide to food laws and regulations paperback – sep 2016

2. GC P Range Rao," Modern Food Packaging, Packaging Laws and Regulations", CFTRI Mysore, IP Publications, 2005 Safe food handling & Hygiene Booklet for Food Handlers by FSSAI, 2017.
3. The Standards of Weight sand Measures act, (1976) & Standards of Weight sand Measures (Packaged Commodities) Rules (1977), Rule Book, Govt. Of India. BIS Rule Book, Govt. Of India.

CO's – PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	3	3	2	3		2	2	2	2	3	3	3
2	3	3			3	2	2		2	1			3	3	3
3	3		2		2	2	1		2	1			3	3	3
4	3		2		2	2	1		2	1			3	3	3
5	3	3			3	2	2		2	1			3	3	3
Avg	3	3	2.3	3	2.6	2	1.8	-	2	1	2	2	3	3	3

PP23013 PUBLISHING WORKFLOW AND PROCESSES L T P C
3 0 0 3

OBJECTIVES:

- To outline and discuss publishing workflow, organization structure.
- To discuss the basic concepts of publishing management systems.

UNIT I PUBLISHING ORGANISATION 9

Areas of publishing – General publishing, educational publishing, Professional publishing, Reference publishing, publishing textbooks for children, Major Reference Works - eg., Dictionary, Encyclopedia etc., Product Specifics - eg., user manuals, terms & conditions etc.; Classification - Content creation, Content Aggregation, Content Deployment; Publishing house role – Commissioning editor, Desk editor, Designer, Production manager, Sales/Marketing manager, Role of Publishing manager. Copy editing, Page makeup, Proofs; Book editor – Multipurpose functions; Discussion with author, editing educational material, Decision making role; Editorial technique – Style sheet, Reference aids; Author and his manuscript – Unsolicited manuscripts; Author – Publisher relationship, Professional guides and Societies, Literary agency

UNIT II WORKFLOW AND COSTING 9

Pre-production planning, manuscript, layout & design, imposition, composition, anatomy of books; Printing techniques; Production process; Technical aspects of production; Quality control – proofing stage; Finishing operations; Financial aspects; First copy cost, manufacturing cost, overheads; Economics of publishing – net book, non-net book, variation in price, published price of the book.

UNIT III PUBLISHING MANAGEMENT SYSTEM 9

Publication representation; Publication environments; Publication node structure; Version Management; Content objects & processing objects; Publication naming; Information sharing Hypertext and its principle. Deployment channels - deliveries for PDF for Print, PDF for web, ePub, Kindle formats; Addressing Piracy challenges, Digital Signature; Archiving techniques for repurpose requirements.

UNIT IV PROMOTION CHANNELS, DISTRIBUTION OUTLETS AND SALES TECHNIQUES 9

Direct promotion techniques, mail order advertising, subscription books, direct mail promotion, library purchases, export and import of books, publishers and book sellers catalogues, publicity campaign, paperback distribution, the central book clearing house, economics of distribution, the role of booksellers, book marketing council, book development council.

UNIT V DIGITAL PUBLISHING AND LEGAL ASPECTS OF BOOK PUBLISHING 9

Software needs, manuscript formats and file management, editing tools, web design and publishing; copy right, types of agreement between author and publishers, agreement of sale of translation rights, illustration and artwork agreement, the outright sale of the copyright, profit sharing agreement, the royalty system, commission agreement.

OUTCOMES:

Upon completion of the course the student will be able to:

1. Identify the responsibilities and functions of different publishing methods.
2. Classify and order the various stages of publishing workflow
3. Appreciate the significance of publishing management system
4. Analyze the functions of promotion channels and sales.
5. Analyze digital distribution and copyright agreements.

REFERENCES:

1. Giles Clark and Angus Phillips, Inside Book Publishing, Routledge, Fifth Edition, 2014
2. D Richard Guthrie, Publishing Principle and Practice, Fifth Edition, 2011

3. G.S.Jolly, Book Publishing Management, Har-Anand Publication, First Edition, 2009
4. Frania Hall, The business of Digital Publishing, Routledge, Fifth Edition, 2013
5. Lynette Owen, Clark's Publishing Agreements: A Book of Precedents, Bloombury Publications, Ninth Edition, 2013
6. Adrain Bullock, Book Production, Routledge, First Edition, 2012.

CO's – PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	1	-	1	1	2	-	1	1	-	3	3	3
2	3	3	1	1	-	2	1	1	-	2	2	-	3	3	2
3	3	3	3	2	3	-	1	-	-	-	-	2	3	3	2
4	3	3	3	2	3	-	1	-	-	-	-	2	3	3	2
5	3	1	3	3	3	2	3	-	3	3	3	2	3	3	2
Avg	3	2 .4	2 .2	1.8	3	1.6	1.4	1.5	3	2	2	2	3	3	2.2

PP23014	DIGITAL MEDIA MANAGEMENT	L T P C
		3 0 0 3

OBJECTIVES:

- To list and explain various content protection techniques of digital media.
- To explain the digital rights management method and understand current issues and developments

UNIT I DIGITAL MEDIA 9

Overview of multimedia contents, Content acquisition & development, Product development & design-Designing Publications, Designing content Components, Digital Media Storage, Marketing (Circulation management, Single copy sales), Pricing, Distribution – crossmedia, file download security and sharing.

UNIT II DIGITAL ASSET MANAGEMENT 9

DAM Components, Functions, Relationships with other systems, including ERP, DCM, ECM, DMM, WCM, CMS, CRM and DRM, Metadata, cataloguing, indexing and retrieval- standards forproduction and content description, Accounting for Authors, Accounting for Acquisition sources.

UNIT III CONTENT PROTECTION TECHNIQUES 9

Encryption, stegnography, watermarking, robustness and implementation, considerations, examples of media protection schemes, CCS, CGMS, HDCP, Type of contents, copyrights, patents, trade marks, trade secrets, licensing agreements, web posting policies, copyright and patent laws, fair uses, privacy regulations, piracy, DMCA, ISP obligations and liabilities,

UNIT IV DIGITAL RIGHTS MANAGEMENT 9

Digital right models, transactions, types of rights and licenses, DRM system architecture, content server, license server, secure platform. Digital Millennium Copyright Act

UNIT V CURRENT ISSUES AND DEVELOPMENT 9

Copyright laws, balance between rights enforcement and fair uses, changing landscape in content distributions, recent enforcement cases. Security Aspects -OS, Network, Web page,Online transactions.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Explain the contents and principles of digital media dissemination and distribution process.
2. Apply the concepts of Content Management System.
3. Describe the intricacies in digital content protection techniques
4. Restate the concepts of intellectual property rights for digital content.
5. Analyze current issues and development aspects of digital media management

TEXT BOOK:

1. Curtis Poole, Janette Bradley," Reference Developer's Digital Media Reference: New Tools,New Methods", Taylor & Francis, 2013
2. Dr Andreas Mauthe, Dr Peter Thomas, "Professional Content Management Systems: Handling Digital Media Assets", John Wiley & Sons, 2005.

REFERENCES:

1. John Rice and Brian Mckerman (Editors), Peter Bergman, Creating Digital Content,McGraw-Hill, USA, 2010.

CO's – PO's & PSO's MAPPING

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

PP23015 **UI & UX Design** **L T P C**

3 0 0 3

OBJECTIVES

- To identify the users and learn various methods to collect user behavior data.
- To develop a deep understanding of business-centered design.
- To create efficient prototype to communicate and validate the design definition.

UNIT I INTRODUCTION TO UX, UI **9**

Introduction to UI, UX, it's importance and future, Elements of UX, Fundamental of User Experience (UX), Customer Experience (CX), Customer Digital Touch Points, User InterfaceDesign (UI), Interaction Design (IxD), Human computer interaction (HCI), Design Process. The UXD Ecosystem: Identify the project parameters, Brand presence, Marketing campaign, Content source, ecommerce applications, Social networking applications, Responsive considerations. UXD Design Principles: Visual design, Unity and variety, Focal point, Economy of elements, Balance and proportion Interaction, Association and affordance, Economy of motion, Responsive design, Psychology, The effects of good UXD design, Flow and Interaction, Guiding principles

UNIT II USER RESEARCH METHODS **9**

User interview, Contextual enquiry, Heuristic Review, Survey, Empathy Map, Focus group, Research basics, User group definitions, Research techniques, Research analysis. Information Architecture Types of Navigation, Card sorting, Reverse card sorting, Sorting Tools, Use Cases and User Flow, Information Architecture

UNIT III WIRE FRAMING AND PROTOTYPING **9**

Wireframe & Prototyping: Low fidelity wireframes, Hi fidelity wireframes, Wireframes tool (Balsamiq/Sketch) , Prototype tool (Adobe XD, InvisionApp), Annotating essentials, Wireframing essentials, Toolkits, Wireframing 101, Sample processing, Sketching, Digital wireframes, Visual design, Responsive design, Wireframes vs Prototypes.

UNIT IV USER TESTING **9**

Design User Testing: Preparation for Usability test (Screeners, Scenario), How to create a Test Plan, Testing Tools, Usability Testing, Remote Usability Testing, Usability Metrics, How to capture data & Prepare Test Report, Visual design mockups exploration, Choosing a design testingapproach, Qualitative and quantitative research, In-person and remote research, Moderated and automated techniques, Usability testing, Research, Logistics, Facilitation, Analyzing results, Crafting recommendations.

UNIT V UX FOR MOBILE AND WEB **9**

Mobile Design approach: Mobile device platforms, screen sizes, Designing for Native Applications, Hybrid Applications, Designing for Android and iOS, Design Guidelines (Android and iOS), Mobile Design Patterns (Navigation, Forms, Tables, Search, Sort & Filter, etc.) Web Design approach: Mobile first approach (design guideline), Responsive design, Global standards for Color, fonts, Style Guide & Assets.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Understand the UX and differentiate between business- centered design anduser-centered design.
2. Learn the prototyping for mobile and small screen devices.
3. Design and develop content for multiple mobile resolutions.
4. Gain skills to require to create an Information Architecture document for awebsite
5. Establish requirements for User Experience design concepts using creativetechniques

TEXT BOOKS

1. Christian Kraft. User Experience Innovation: User Centred Design that Works, Apress, 2012.
2. Craig Grannell, “The Essential Guide to CSS and HTML web design(Essentials)”, Friends ofED Publishers. 2008.

REFERENCES

1. Dan Saffer, Designing for interaction, New Riders publications, 2010.
2. Don Norman, The Design of Everyday Things, Basic Books, 2013.
3. Steve Krug, Don’t Make Me Think! A Common Sense Approach to Web Usability, SecondEdition, New Riders publications, 2006.
4. Tom Tullis and Bill Albert. Measuring the User Experience: Collecting, Analyzing, andPresenting Usability Metrics, Morgan Kaufmann Publishers, 2008.

CO’s – PO’s & PSO’s MAPPING

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

PP23016 SOFTWARE TESTING FOR GRAPHIC APPLICATIONS L T P C
3 0 0 3

COURSE OBJECTIVES:

- To provide knowledge about fundamentals of software testing and software quality
- To understand, compare and choose from various software project assessment methods

UNIT I MODELS OF SOFTWARE TESTING 9

Software attributes, Failures, Testing Process, Some Terminologies, Limitations of Testing, Software Development Life Cycle Models- The V Shaped software life cycle model, Levels, types - Software Test Design Techniques.

UNIT II SOFTWARE VERIFICATION 9

Verification Methods, SRS document verification, SDD document verification, Source code reviews, User documentation verification, Software project audit Creating test cases from SRS and Use cases: Use Case Diagram and Use Cases, Generation of test cases from use cases, Guidelines for generating validity checks, strategies for data validity, Database testing.

UNIT III REGRESSION TESTING AND MEASUREMENT 9

Regression Test cases selection, Reducing the number of test cases, Risk analysis, Code coverage prioritization techniques Object oriented testing: Path testing, State based testing, Class testing Metrics and Models in Software testing: Software Metrics, Categories of Metrics, Object oriented Metrics used in testing, testing factors, Software Quality attributes prediction models.

UNIT IV SOFTWARE QUALITY ASSESSMENT 9

Measuring Internal Product Attribute Size: Aspects of software size, Length, Reuse, Functionality Measuring External Product Attributes: Modeling software quality, measuring aspects of software quality.

UNIT V TESTING WEB APPLICATIONS 9

Functional testing, UI testing, Usability testing, configurations and compatibility testing, security testing, performance testing, database testing, post deployment testing, web metrics. Automated Test data generation: Automated Test Data generation, Approaches to test data generation, Test data generation tools.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Explain the different models and principles of software testing.
2. Apply the concepts of software verification System.
3. Restate the intricacies in regression testing techniques
4. Describe the concepts of software quality assessment.
5. Analyze current issues and development aspects of security testing

REFERENCES:

1) Aditya P. Mathur, “Foundations of Software Testing _ Fundamental Algorithms and Techniques”, Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008.
2) Ron Patton, “Software Testing”, Second Edition, Sams Publishing, Pearson Education, 2007.
3) Mordechai Ben-Menachem, Garry S. Marliss, Software Quality, BS Publications, 1997.
4) Yogesh Singh, Software testing: Cambridge University Press, First Edition 2013
5) Norman E. Fenton, Shari Lawrence Pfleeger, Software Metrics – A Rigorous & Practical approach: 2nd Edition (Thomson Press) ,1997
6) Jeff Tian, Software Quality Engineering, Wiley India Ltd. 2006.

CO's – PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	1	1	-	1	-	-	-	2	3	-	2	3	3	2
2	3	3	2	2	3	-	-	-	2	-	2	2	3	3	2
3	3	2	2	2	3	-	-	-	1	3	2	2	3	3	3
4	3	2	2	3	3	-	-	-	1	3	2	2	3	3	3
5	3	3	2	2	3	-	-	-	2	-	2	2	3	3	2
Avg	3	2.2	1.8	2.3	2.6	-	-	-	1.6	3	2	2	3	3	2.4

PP23017 **DATA SCIENCE AND MACHINE LEARNING** **L T P C**
3 0 0 3

OBJECTIVES

- Study about uninformed and Heuristic search techniques.
- Learn techniques for reasoning under uncertainty
- Introduce Machine Learning and supervised learning algorithms

UNIT I INTRODUCTION **9**

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, Types of Data, Types of Variables, Describing Data with Tables and Graphs, Describing Data withAverages, Describing Variability, Normal Distributions and Standard (z) Scores

UNIT II DATA MINING **9**

Data Mining, Data Warehousing, Basic Statistical descriptions of Data. Describing Relationships, Correlation; Data visualization techniques; use cases.

UNIT III MACHINE LEARNING **9**

Objectives of machine learning, Human learning/ Machine learning, Types of Machine learning - Supervised Learning, Unsupervised learning, Regression, Classification, The Machine Learning Process - Data Collection and Preparation, Feature Selection, Algorithm Choice, Parameter and Model Selection, Training, Evaluation, Bias-Variance Tradeoff, Under fitting and Over Fitting Problems

UNIT IV SUPERVISED LEARNING **9**

Linearly separable and nonlinearly separable populations, K-Nearest Neighbor, Logistic Regression, Radial Basis Function Network, Support Vector Machines, Kernels, Risk and Loss Functions, Support Vector Machine, Algorithm – Multi Class Classification, Support Vector Regression, Case studies in Printing and Packaging

UNIT V CLUSTERING AND UNSUPERVISED LEARNING **9**

Introduction, Clustering, Partitioning Methods, K-means algorithm, Mean Shift Clustering, Hierarchical clustering, Clustering using Gaussian Mixture Models, Clustering High-Dimensional Data, Challenges, Case studies in Printing and Packaging

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

1. Understand data science fundamental and applications
2. Understand different types of data description for data science process
3. Explain the fundamentals of machine learning
4. Understand a wide variety of supervised learning algorithms
5. Understand a wide variety of unsupervised learning algorithms

TEXTBOOKS

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016
2. Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017.
3. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, An Introduction to Statistical Learning with Applications in R, Springer Texts in Statistics, 2013

REFERENCE:

1. Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press,2014
2. Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, Third Edition, 2014.
3. Christopher Bishop, “Pattern Recognition and Machine Learning” Springer, 2007

CO’s – PO’s & PSO’s MAPPING

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

PP23018 CLOUD COMPUTING AND CYBER SECURITY L T P C
3 0 0 3

OBJECTIVES

- To understand the principles of cloud architecture, models and infrastructure.
- To learn about the security issues in the cloud environment.

UNIT I INTRODUCTION 9

Introduction- Historical Development – Cloud Computing Architecture – The Cloud Reference Model – Cloud Characteristics –Cloud Deployment Models: Public, Private, Community, Hybrid Clouds- Cloud Delivery Models: IaaS, PaaS, SaaS – Open Source Private Cloud Software: Eucalyptus, Open Nebula, Open Stack.

UNIT III VIRTUALIZATION 9

Data Center Technology – Virtualization – Characteristics of Virtualized Environments - Taxonomy of Virtualization Techniques – Virtualization and Cloud Computing – Pros and Cons of Virtualization – Implementation Levels of Virtualization – Tools and Mechanisms: Xen, VMWare, Microsoft Hyper-V, KVM, Virtual Box.

UNIT III CLOUD COMPUTING MECHANISM 9

Cloud Infrastructure-Cloud server types, Mechanism: Cloud Storage, Cloud Usage Monitor, Resource Replication – Specialized Cloud Mechanism: Load Balancer, SLA Monitor, Pay-per-use Monitor, Audit Monitor, Failover System, Hypervisor, Resource Cluster, Multi Device Broker, State Management Database – Cloud Management Mechanism: Remote Administration System, Resource Management System, SLA Management System, Billing Management System.

UNIT IV CYBER SECURITY 9

Need for Cyber Security, Cryptography algorithms – DES, RSA – Classification of Cybercrimes – Cyber Laws – The Indian IT Act - OSWAP; Malicious Attack Threats and Vulnerabilities: Scope of Cyber-Attacks – Security Breach – Types of Malicious Attacks – Malicious Software – Common Attack Vectors – Social engineering Attack – Wireless Network Attack – Web Application Attack – Attack Tools – Countermeasures.

UNIT V INTRUSION DETECTION AND PREVENTION 9

Host -Based Intrusion Detection – Network -Based Intrusion Detection – Distributed or Hybrid Intrusion Detection – Firewalls and Intrusion Prevention Systems: Need for Firewalls – Firewall Characteristics and Access Policy – Types of Firewalls – Firewall Basing – Firewall Location and Configurations – Intrusion Prevention Systems – Example Unified Threat Management Products.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

1. Articulate the concepts of cloud computing.
2. Identify the architecture, infrastructure and delivery models of cloud computing.
3. Explain the core issues of cloud computing such as security, privacy and interoperabil.
4. Enumerate the types of cyber attacks.
5. Explain the principle of intrusion detection and firewalls

TEXT BOOKS

1. Thomas Erl, Zaigham Mahood, Ricardo Puttini, “Cloud Computing, Concept, Technology & Architecture”, Prentice Hall, 2013.
2. David Kim and Michael G. Solomon, Fundamentals of Information Systems Security, Third Edition Transition Guide, Jones &Bartlett Learning, 2018.

REFERENCES

1. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, “Mastering Cloud Computing”, Tata McGraw-Hill,2013.
2. Toby Velte, Anthony Velte, Robert C. Elsenpeter, “Cloud Computing, A Practical Approach”, Tata McGraw-Hill Edition, 2010.
3. Thomas A. Johnson Cyber Security- Protecting Critical Infrastructures from Cyber Attack and Cyber Warfare, CRC Press, 2015.
4. Peter Trim and Yang Im Lee, Cyber Security Management- A Governance, Risk and Compliance Framework, Gower Publishing, England 2014.

CO’s – PO’s & PSO’s MAPPING

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

PP23019 **PRINT MARKETING MANAGEMENT** **L T P C**
3 0 0 3

OBJECTIVES:

- To provide the basic concepts in marketing, Prospects and Challenges.
- Explaining the various buying behaviour methods and product pricing concepts.
- Analyzing the various marketing planning principles, strategies, trends of advertising and sales promotion methods.

UNIT I INTRODUCTION **9**

Definition, Conceptual frame work – Marketing environment, Marketing Process, Dynamics, Needs, Wants and Demands, Marketing Concepts, Environment, Mix, Types, Philosophies, Selling vs Marketing, Consumer Goods, Industrial Goods, Marketing in global environment – Prospects and Challenges.

UNIT II BUYING BEHAVIOUR AND MARKET SEGMENTATION **9**

Understanding industrial and individual buyer behavior - Influencing factors – Buyer Behaviour Models – Online buyer behavior, Buying Decisions, Segmentation factors, Demographic, Psycho graphic and Geographic Segmentation, Process, Patterns, Customer relationships management – Customer acquisition, Retaining, Defection.

UNIT III PRODUCT, PRICE AND MARKETING RESEARCH **9**

Product – Advertising – Promotion – Consumer Behaviour – Retail research, Product Life Cycle, New product development, Branding. Price: Objectives, Pricing Decisions and Pricing Methods, Pricing Management, Marketing - Research Process – Concepts and applications, Online marketing trends.

UNIT IV MARKETING STRATEGY **9**

Marketing strategy formulations – Key Drivers of Marketing Strategies - Strategies for Industrial Marketing – Consumer Marketing –– Services marketing – Competitor analysis - Analysis of consumer and industrial markets – Strategic Marketing Mix components.

UNIT V ADVERTISING, SALES PROMOTION AND DISTRIBUTION **9**

Advertising-Characteristics, Impact, Goals, Types, Sales Promotion – Point of purchase, Unique Selling Propositions, Characteristics, Wholesaling, Retailing, Channel Design, Logistics, Modern, Trends in Retailing, Modern Trends, e-Marketing. Digital Marketing

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

1. Understanding the basic concepts in marketing.
2. Understanding the various buying behavior methods.
3. Analyze the various product pricing concepts.
4. Analyze the various marketing planning principles and its strategies.
5. Describe the trends of advertising, sales promotion methods.

REFERENCES:

1. Adrain palmer, “Introduction to marketing theory and practice”, Oxford university press IE 2004.
2. Czinkota&Kotabe, “Marketing management”, Thomson learning, Indian edition 2007.
3. Donald S. Tull and Hawkins, “Marketing Research”, Prentice Hall of Inida-1997.
4. Philip Kotler and Gary Armstrong “Principles of Marketing” Prentice Hall of India, XII Edn, 2000.
5. Ramasamy and Namakumari, “Marketing Management: Planning, Implementation and Control, Macmillan and Company”, 2002.
6. Govindarajan. M, “Marketing management – concepts, cases, challenges and trends”, Prentice hall of India, second edition, 2007.
7. Philip Kolter& Keller, “Marketing Management”, Prentice Hall of India, XII edition, 2006

CO’s – PO’s & PSO’s MAPPING

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

PP23020 ELEMENTS OF FINANCIAL MANAGEMENT L T P C
3 0 0 3

LEARNING OBJECTIVES

1. To acquire knowledge of the decision areas in finance.
2. To learn the various sources of Finance
3. To describe capital budgeting and cost of capital.
4. To discuss how to construct a robust capital structure and dividend policy
5. To develop an understanding of tools for Working Capital Management.

UNIT I INTRODUCTION TO FINANCIAL MANAGEMENT 9

Definition and Scope of Finance Functions - Objectives of Financial Management - Profit Maximization and Wealth Maximization - Time Value of money- Risk and Return concepts.

UNIT II SOURCES OF FINANCE 9

Long-term sources of Finance - Equity Shares – Debentures - Preferred Stock – Term Loans - Retained earnings - Features – Merits and Demerits. Short-term sources - Bank Sources, Trade Credit, Overdrafts, Commercial Papers, Certificate of Deposits, Money market mutual funds, etc.

UNIT III INVESTMENT DECISIONS 9

Investment Decisions: Capital Budgeting – Need and Importance – Techniques of Capital Budgeting – Payback - ARR – NPV – IRR – Profitability Index. Cost of Capital - Cost of Specific Sources of Capital - Equity - Preference - Debt - Reserves - Concept and measurement of cost of capital - Weighted Average Cost of Capital.

UNIT IV FINANCING AND DIVIDEND DECISION 9

Operating Leverage and Financial Leverage - EBIT-EPS analysis. Capital Structure – Determinants of Capital Structure - Designing an Optimum capital structure. Dividend policy - Aspects of dividend policy - Practical consideration - Forms of dividend policy - Determinants of Dividend Policy.

UNIT V WORKING CAPITAL DECISION 9

Working Capital Management: Working Capital Management - concepts - importance -Determinants of Working capital. Cash Management: Motives for holding cash – Objectives and Strategies of Cash Management. Receivables Management: Objectives - Credit policies. Contemporary topics in finance

TOTAL: 45 PERIODS

COURSE OUTCOMES:

1. Understand the fundamentals of financial management and estimate the time value of money and risk and return of securities.
2. Recall and compare the various long-term and short-term sources of finance
3. Recall and apply the capital budgeting techniques for taking investment decisions
4. Recall and apply the techniques of financing and dividend decisions using capital structure and leverage analysis
5. Remember, analyse and evaluate the decision of capital structure and distribution of dividend
6. Understand the concept of Working Capital and estimate working capital.

REFERENCES:

1. M.Y. Khan and P.K. Jain, Financial Management, Text, Problems, and Cases, Tata McGraw Hill, 8th Edition, 2018
2. I M. Pandey, Financial Management, Pearson, 12th Edition, 2021
3. James C. Vanhorne, Fundamentals of Financial Management, Pearson, 13th Edition, 2015.
4. Prasanna Chandra, Financial Management, McGraw Hill Education, 11th Edition 2023.

5. Srivatsava, Mishra, Financial Management, Oxford University Press, 2011

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P11	P12
CO 1		2		2					1	1	3	
CO 2		3		2					1	1	3	
CO 3		3		2					1	1	3	
CO 4		2		2					1	1	3	
CO 5		2		2					1	1	3	

PP23021 **PROFESSIONAL ETHICS IN ENGINEERING** **L T P C**
3 0 0 3

OBJECTIVES

- Identify the core values that shape the ethical behavior of an engineer.
- Utilize opportunities to explore one's own values in ethical issues.
- Become aware of ethical concerns and conflicts.
- Enhance familiarity with codes of conduct.
- Increase the ability to recognize and resolve ethical dilemmas.

UNIT I ENGINEERING ETHICS **9**

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Professions and Professionalism - Professional Ideals and Virtues – Uses of Ethical Theories.

UNIT II ENGINEERING AS SOCIAL EXPERIMENTATION **9**

Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics - Codes of Ethics - Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study

UNIT III ENGINEER'S RESPONSIBILITY FOR SAFETY **9**

Safety and Risk – Assessment of Safety and Risk – Risk Analysis – Reducing Risk – The Government Regulator's Approach to Risk - l Case Studies Chernoby and Bhopal

UNIT IV RESPONSIBILITIES AND RIGHTS **9**

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

UNIT V GLOBAL ISSUES **9**

Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers –Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students should be able to:
CO1: Use ethical theories in the professional life
CO2: Do social experimentation with engineering approaches CO3: Follow safety norms in the engineering practices
CO4: Confidence in their approaches and claim their rights
CO5: Take moral leadership with the knowledge in global practices

TEXT BOOKS

1. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics Concepts and Cases", Cengage Learning., Belmont, 2009, ISBN-13: 978-0-495-50279-1 ISBN-10: 0-495-50279-0.
2. Mike Martin and Roland Schinzinger, "Introduction to Engineering Ethics", 2nd Edition McGraw Hill., New York, 2010, ISBN 978-0-07-248311-6—ISBN 0-07-248311-3.

REFERENCES

1. Charles D Fleddermann, “Engineering Ethics”, 4th edition, Prentice Hall., New
2. Mexico, Newjersey, 1999, ISBN-13: 978-0-13-214521-3, ISBN-10: 0-13-214521-9
3. David Ermann and Michele S Shauf, “Computers, Ethics and Society”, Oxford University Press,United Kingdom , 2002, ISBN: 9780195143027.
4. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, 1st edition, Oxford University Press, United Kingdom, 2000, ISBN-13: 978- 0195134889, ISBN-10: 0195134885
5. John R Boatright, “Ethics and the Conduct of Business”, 8th edition Pearson Education, Boston, 2017, ISBN-10:9789352862306, ISBN-13:978-9352862306
6. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, “Business Ethics – An Indian Perspective”, Wiley, 2004, ISBN-10: 8177221671 ISBN -13: 9788177221671.

CO’s	PO’s												PSO’s			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
1	3	2	-	1	2	-	-	-	-	-	3	1	3	1	1	3
2	3	3	3	2	2	-	-	-	-	-	3	1	3	1	1	3
3	3	3	3	3	2	-	-	-	-	-	3	1	3	1	1	3
4	3	3	3	2	2	-	--	-	-	-	3	1	3	1	1	3
5	3	3	3	2	2	-	-	-	-	-	3	1	3	1	1	3
Avg.	3	2.8	3	2	2	-	-	-	-	-	3	1	3	1	1	3

PP23022 HUMAN RESOURCE MANAGEMENT FOR ENTREPRENEURS L T P C
3 0 0 3

OBJECTIVES:

- To introduce the basic concepts, structure and functions of human resource management for entrepreneurs and imparting the awareness of the roles, functions, the methods and techniques followed by Human Resource Management practitioners.

UNIT I INTRODUCTION TO HRM 9

Concept, Definition, Objectives- Nature and Scope of HRM - Evolution of HRM - HR Manager Roles- Skills - Personnel Management Vs. HRM - Human Resource Policies - HR Accounting - HR Audit - Challenges in HRM.

UNIT II HUMAN RESOURCE PLANNING 9

HR Planning - Definition - Factors- Tools - Methods and Techniques - Job analysis- Job rotation- Job Description - Career Planning - Succession Planning - HRIS - Computer Applications in HR - Recent Trends

UNIT III RECRUITMENT AND SELECTION 9

Sources of recruitment- Internal Vs. External - Domestic Vs. Global Sources -eRecruitment - Selection Process- Selection techniques -eSelection- Interview Types- Employee Engagement.

UNIT IV TRAINING AND EMPLOYEE DEVELOPMENT 9

Types of Training - On-The-Job, Off-The-Job - Training Needs Analysis – Induction and Socialisation Process - Employee Compensation - Wages and Salary Administration – Health and Social Security Measures- Green HRM Practices

UNIT V CONTROLLING HUMAN RESOURCES 9

Performance Appraisal – Types - Methods - Collective Bargaining - Grievances Redressal Methods – Employee Discipline – Promotion – Demotion - Transfer – Dismissal - Retrenchment - Union Management Relationship - Recent Trends

TOTAL 45 : PERIODS

COURSE OUTCOMES:

Upon completion of this course the learners will be able:

CO 1 To understand the Evolution of HRM and Challenges faced by HR Managers
CO 2 To learn about the HR Planning Methods and practices.
CO 3 To acquaint about the Recruitment and Selection Techniques followed in Industries.
CO 4 To known about the methods of Training and Employee Development.
CO 5 To comprehend the techniques of controlling human resources in organisations.

REFERENCES

1) Ashwathappa,K.,Human Resource Management, 9th Edition, TataMcGraw-HillEducation Pvt. Ltd., 2021.
2) Ivanecevich, J.M., Human Resource Management, 12th Edition, Tata McGraw-Hill Education Pvt. Ltd.,2020.
3) Gary Dessler & Biju Varrkey, HumanResourceManagement,16th Edition, Pearson India Pvt. Ltd., 2020.
4) DeCenzo,D.A., Robbins S.P., Susan L Verhulst, Human Resource Management, 14thEdition, Wiley India Pvt. Ltd., 2021.
5) Leigh Thompson, Making the team, A guide for Managers, Pearson, 6thEdition 2019.
6) Gary Dessler, Fundamentals of Human Resource Management, Pearson, 4thEdition 2017.
7) Gupta CB ,Human Resource Management ,Text and Cases, ,Sultan Chand & Sons,2023.

CO's - PO's MAPPING

CO	PO							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1	3	3	2	3	3	2	2	1
2	3	3	1	2	2	3	2	1
3	3	3	3	3	3	2	2	2
4	3	3	2	2	3	2	1	1
5	3	3	3	2	3	2	2	2
Avg.	**3**	**3**	**2.2**	**2.4**	**2.8**	**2.2**	**1.8**	**1.4**

IE23C07	TOTAL QUALITY MANAGEMENT	L T P C
		3 0 0 3

COURSE OBJECTIVES:

- Understand and apply the basic principles and tools of quality management in work

UNIT I INTRODUCTION TO TQM 9

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality – Definition of TQM - Basic concepts of TQM - Gurus of TQM (Brief introduction) -- TQM Framework - Barriers to TQM – Benefits of TQM.

UNIT II TQM PRINCIPLES 9

Leadership - Deming Philosophy, Quality Council, Quality statements and Strategic planning Customer Satisfaction – Service Quality - Kano Model and Customer retention Employee involvement – Motivation, Empowerment, Teamwork, Recognition and Reward - Performance Appraisal Continuous process improvement – Juran Trilogy - PDSA cycle - 5S - Kaizen.

UNIT III TQM TOOLS & TECHNIQUES I 9

The seven traditional tools of quality - New management tools - Six-sigma - Process Capability Bench marking - Reasons to benchmark, Benchmarking process, Understanding current performance, Planning, Studying others, Learning from the data, Using the findings, Pitfalls and Criticisms of benchmarking FMEA - Design FMEA and Process FMEA – Steps in performing FMEA

UNIT IV TQM TOOLS & TECHNIQUES II 9

Quality circles – Quality function deployment (QFD) - Total Productive Maintenance – Concepts, improvement needs – Performance measures Cost of Quality – Taguchi quality loss function Business Process Re-engineering

UNIT V QUALITY MANAGEMENT SYSTEM 9

Introduction - Benefits of ISO Registration - ISO 9000 Series of Standards – ISO 9001 Requirements implementation – Documentation - Internal Audits – Registration Environmental Management System: Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001 - Benefits of EMS. Supplier partnership – Partnering, Supplier selection, Supplier Rating and Relationship development

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Explain the evolution of Quality Management and its impact on organizations
CO2: Apply TQM concepts and principles in an enterprise.
CO3: Understand and apply TQM tools and techniques in a given situation.
CO4: Understand how to operationalise the concept of quality using QFD and TPM.
CO5: Understand the challenges and benefits of applying QMS and EMS in an organization.

REFERENCES

1. Joel. E. Ross, Total Quality Management – Text and Cases, Routledge, 2017
2. Dale H. Besterfiled, Carol B. Michna, Glen H. Besterfield, Mary B. Sacre, Hemant Urdhwareshe and Rashmi Urdhwareshe, Total Quality Management, Pearson Education Asia, Revised 3rd Edition, Indian Reprint, 2013.
3. Kiran. D. R, Total Quality Management: Key concepts and case studies, Butterworth – Heinemann Ltd, 2016.
4. Oakland, J.S. “TQM – Text with Cases”, Butterworth – Heinemann Ltd., Oxford, Third Edition, 2003.
5. Suganthi,L and Anand Samuel, “Total Quality Management”, Prentice Hall (India) Pvt. Ltd., 2006 .

CO's – PO's MAPPING

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

PP23023 CREATIVITY AND INNOVATION IN PRINTING AND PACKAGING L T P C
3 0 0 3

OBJECTIVES:

- Understand the nuances involved in Creativity & Innovation.
- Describe the applications of thinking and visualization in printing and packaging
- Get hands on experience in applying creativity in problem solving.
- Produce creative ideas using Brainstorming
- Explain the various methods of innovation in the Printing and packaging industry

UNIT I INTRODUCTION 9

Need for Creative and innovative thinking for quality, components of Creativity, Methodologies and approaches, individual and group creativity, organizational role in creativity, types of innovation, barriers to innovation, innovation process, establishing criterion for assessment of creativity & innovation.

UNIT II THINKING AND VISUALIZATION 9

Definitions and theory of functioning of mind heuristics and models: attitudes, Approaches and Actions that support creative thinking - Advanced study of visual elements and principles- line, plane, shape, form, pattern, texture gradation, colour psychology & symmetry. Techniques to enhance – provocation, cross fertilize, mastermind, OPV, Brain gym, Reverse thinking, BOD Creative thinking.

UNIT III CREATIVITY 9

Methods and tools for Directed Creativity – Basic Principles – Tools that prepare the mind for creative thought – stimulation – creativity techniques in Package design– Inspiration, Clarification, Distillation, Perspiration, Evaluation and Incubation – Creativity and Motivation.

UNIT IV CREATIVE PROBLEM SOLVING 9

Generating and acquiring new ideas, product design, service design – case studies and hands- on exercises, stimulation tools and approaches, six thinking hats, lateral thinking – Individual activity, group activity, Brainstorming, Mind Mapping, Design thinking in Printing and Packaging.

UNIT V INNOVATION 9

Achieving Innovation - the essential factors – Innovator's solution – creating and sustaining successful growth – Disruptive Innovation models – Patents, IPR methods laws and regulations

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the student should be able to:

1. Overcome barriers and blocks in creative thinking process
2. Combine the different techniques in creative thinking and its applications
3. Discover creative ways of designing packages
4. Design new products in Printing and packaging using creativity tools
5. Discuss innovation and the ways and means of obtaining patents

TEXT BOOKS :

1. Think!: Before It's Too Late by Edward de Bono, Random House books, 2017
2. Mastering the Dynamics of Innovation by James M. Utterback, Harvard Business School Papper back 2017

REFERENCES:

1. The Creative Mind: Myths and Mechanisms by Margaret A. Boden, Routlege Publishers London, 2018
2. Creative Cognition: Theory, Research, and Applications by Ronald A. Finke, Thomas B. Ward, and Steven M. Smith, MIT Press Papaerback edition, 2018
3. The Accidental Creative: How to Be Brilliant at a Moment's Notice By, Todd Henry, Penguin Publishers, 2017.

CO's – PO's & PSO's MAPPING

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

PP23024 **MASS COMMUNICATION** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the concepts of verbal and non-verbal communication
- To learn and practice news reporting and editing
- To gain knowledge about the process of writing articles
- To understand the concepts of broadcast journalism
- To appraise the applications of Audio and video communication

UNIT I INTRODUCTION **9**

Communication and its types, History and evolution of communication, Communication theories, Verbal and non-verbal communication, formal and informal communication, Role of mass media in society. Current trends in communication.

UNIT II NEWS REPORTING AND EDITING **9**

Fundamentals of reporting, news gathering, evaluation, news writing & newsroom procedures, Depth reporting, Trend reporting, Investigative reporting, Economic and Science reporting, Preparation of news copy for publication, Copy reading, Rewriting, Proof reading, Page making, Typography, Picture editing, Press Laws, Society & Democracy Constitutional Safeguards to Freedom of Press Press Commissions & their recommendations.

UNIT III WRITING **9**

Newspaper feature and magazine, non-fiction writing, writing editorials, analytical articles, reviews, columns, commentaries & analysis.

UNIT IV BROADCAST JOURNALISM **9**

Gathering & reporting news for radio & television. The structure, functions and administration of a news and public affairs department in a broadcast station. Radio/TV station management.

UNIT V AUDIO-VISUAL COMMUNICATION **9**

Audio-visual aids & techniques, use of non-projected and projected aids as black boards, Charts, Graphs, Film appreciation, principles and techniques of various types of communication research. Definition, Meaning, scope and importance of multimedia, Emergence and advantage of multimedia, DTH, Cable.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Understand and Apply communication theories in Mass Media
2. Gather news and convert it into a news report for publishing
3. Develop content for different media
4. Analyze the functionary of Radio and Television Media
5. Use the various tools and techniques for audio visual communication

TEXT BOOKS

1. Keval J. Kumar, Mass Communication in India, Jaico Publishing, 2014
2. Nick Couldry, Media, Society, World: Social Theory and Digital Media Practice, Wadsworth Publishing, 2015.

REFERENCES:

1. Arthur Asa Berger, Essentials of Mass Communications Theory, SAGE Publications, 1995.
2. Denis McQualil, Mass Communication Theory; An Introduction to Theories of Mass Communication, 5th Edition, Melvin L.DeFluer, Sandra Bale-Rokeach, Sage Publications, 1999.
3. Jennings Bryant, Dolfzillmann, Media Effects; Advances in Theory and search, 2nd Edition, Lea Publishers, 2002.
4. Melvin L. Deflear, Sandra Bale-Rokeach, Theories of Mass Communication, 5th Edition, Allyn and Bacon Publishers, 1999.
5. Stanley J.Baran, Dennis K.Davis, Mass Communication Theory Foundations, Ferment and Future, 3rd Edition, Wadsworth Publishing, 2002.

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

PP23025	BOOK PUBLISHING	L T P C
		3 0 0 3

OBJECTIVES:

- To impart knowledge on areas of publishing, editorial process, production management, distribution methods and legal aspects involved in book publishing.
- To promote the basic understanding of sales techniques, promotion channels and distribution.

UNIT I PUBLISHING ORGANISATION 9

Areas of publishing – General publishing, Educational publishing, Professional publishing, Reference publishing, Publishing text books for children, Publishing house role – Commissioning editor, Desk editor, Designer, Production manager, Sales/Marketing manager, Publishing manager.

UNIT II EDITORIAL PROCESS AND DEVELOPMENT 9

Copy editing, Page makeup, Proofs; Book editor – Multipurpose functions; Discussion with author; Editing educational material, Decision making role; Editorial technique – Style sheet. Reference aids; Author and his manuscript – Unsolicited manuscripts; Author – Publisher relationship, Professional guides and Societies, Literary agency.

UNIT III PRODUCTION & ESTIMATING IN BOOK PUBLISHING 9

Pre-production planning, manuscript, layout & design, imposition, composition, anatomy of books; Printing techniques; Production process; Technical aspects of production; Quality control – proofing stage; Finishing operations; Financial aspects; First copy cost, manufacturing cost, overheads; Economics of publishing – net book, non-net book, variation in price, published price of the book.

UNIT IV PROMOTION CHANNELS, DISTRIBUTION OUTLETS AND SALES TECHNIQUES 9

Direct promotion techniques, mail order advertising, subscription books, direct mail promotion, library purchases, export and import of books, publishers and booksellers catalogues, publicity campaign, paperback distribution, the central book clearing house, economics of distribution, the role of booksellers, book marketing council, book development council.

UNIT V DIGITAL PUBLISHING AND LEGAL ASPECTS OF BOOK PUBLISHING 9

Software needs, manuscript formats and file management, editing tools, web design and publishing; copy right, types of agreement between author and publishers, agreement of sale of translation rights, illustration and artwork agreement, the outright sale of the copyright, profit sharing agreement, the royalty system, commission agreement.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the student should be able to:

1. Identify the responsibilities and functions of publishing house.
2. Analyze the author publisher relationship and editor’s functions.
3. Analyze book distribution and copyright agreements.
4. Select and classify the suitable promotion channels
5. Apply different leagal aspects of book publishing.

REFERENCES:

1. Adrain Bullock, Book Production, Routledge, First Edition, 2012
2. Frania Hall, The business of Digital Publishing, Routledge, Fifth Edition, 2013
3. G.S.Jolly, Book Publishing Management, Har-Anand Publication, First Edition, 2009.
4. Lynette Owen, Clark's Publishing Agreements: A Book of Precedents, Bloombury Publications, Ninth Edition, 2013
5. Giles Clark and Angus Phillips, Inside Book Publishing, Routledge, Fifth Edition, 2014
6. D Richard Guthrie, Publishing Principle and Practice, Fifth Edition, 2011
7. Pete Masterson, Book Design and Production, Aeonix Publishing, Second Edition, 2007.

CO's – PO's & PSO's MAPPING

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

PP23026 NEWSPAPER AND PERIODICAL PUBLISHING L T P C
3 0 0 3

OBJECTIVES:

- To provide detailed knowledge on the operations of newspaper and magazine companies.
- To impart knowledge on editorial process, production workflows and legal issues

UNIT I NEWSPAPER ORGANISATION & MANAGEMENT 9

Organizational structure & functions - Owner, editorial organization, management, Incoming materials, financial aspects, Production, advertising, distribution and promotion. Role of copy editors, city editors, news editors, editorial cartoonist, artists, Sunday editor, sports editor, business editor, journalist & reports; editorial responsibilities.

UNIT II NEWS AND EDITING 9

Basic determinants of News; Impact, unusual and prominent; Additional determinants of news; Conflict, proximity, timeliness, currency, gathering the news, sources of news; Beat system, interviewing, wire services, syndicate, news writing, copy preparation, features & reviews, editorial and opinion column, sports, photo production; Editing - manuscript editing, creative and substantive editing, technical editing.

UNIT III PERIODICAL PUBLISHING 9

Types of magazines, Difference between writing for a magazine & newspaper, structure of a magazine's editorial department & roles, Designing a layout for magazine, story design, page design, web design; Redesigning.

UNIT IV PRODUCTION & WORKFLOW 9

Manuscript from editorial organization: Layout & design, composition; Advertisements, Digital Newsroom, Archival of news; Press & web publishing workflows, RSS, Distributed production workflow; Press, Paper, Finishing; Off-prints and re-prints.

UNIT V LEGAL ASPECTS 9

The press and the law liabilities, defense against libel, mitigation & damages, Digital Rights Management, Watermarking, Readership strategies & trends, Distribution model for newspapers & magazines, Future developments.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the student should be able to:

1. Comprehend the operations of newspaper and magazine companies and their organizational structure
2. Scrutinize the concepts on news and editing
3. Analyze the concepts on magazines and periodicals
4. Assess the production and workflow of newspaper and magazine organization
5. Develop suitable legal aspects for publication.

REFERENCES:

1. Helmut Kiphhan, Handbook of Print Media, Springer Verlag, 2001
2. James E. Pollard, Principles Of Newspaper Management, Mcgraw-Hill Book Company, Inc, 1937
3. Melvin Mencher, Basic News Writing, Wm.C.Brown Company Publishers, Dubuque, Iowa, 1983.
4. Robert H.Bohle, From News to Newsprint, Prentice Hall Inc., 1992
5. Carter Nancy M. ,The Computerization of Newspaper Organizations, University Press of America , 2002
6. Daryl R. Moen, Newspaper Layout & Design: A Team Approach ,Iowa State Press, 2000
7. William L. Rivers, Magazine Editing in the 80's, Wadsworth Publishing Company, Belmont, California, 1983.
8. William L.Rivers, News Editing in the 80's, Wadsworth Publishing Company, Belmont, California, 1983.

CO's – PO's & PSO's MAPPING

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

PP23027 **ADVERTISING TECHNIQUES** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the concepts of Advertising and the role of the media
- To discuss about advertising production, planning and business in detail

UNIT I INTRODUCTION **9**

Advertising concept, development and scope of advertising, economic and Social roles of advertising, legal aspects of advertising, major institutions Involved in advertising. Meaning of consumer behavior. How marketing firms use consumer behavior, characteristics of advertising communications, achieving desired responses, stimulating attention and facilitating retention, human needs as a basis for appeals. Role of printing presses in advertising.

UNIT II ADVERTISING PLANNING **9**

Factors involved in advertising planning decision making, basis for advertising Objectives, Methods of Measuring Advertising Effectiveness.

UNIT III ADVERTISING MEDIA AND MEDIA PLANNING **9**

Media concept, structure of media, media characteristics, publication media, TV and Ratio, direct mail and POP, out of home advertising. Media planning concept, media decision tools, media plan, media plan strategy, media buying and scheduling. Internet and Mobile Phone Advertising.

UNIT IV ADVERTISING PRODUCTION **9**

Various Digital channels, Search Engine Optimization, Search Engine Marketing Email marketing – Cost per email open (CPO), Cost per email sent (CPS), Cost per Visit, Cost per click, cost per transaction, cost per form fill or cost per lead (CPL) Targeting and Remarketing , Mobile advertising (WAP & APP) Types of social media : FB, Twitter, Instagram, Snapchat, Digital Media Buying : Buying Digital Advertising: Paid media, Owned media and Earned media, Direct buys from the websites, Programmatic Buying: DSP (Demand side platform) or RTB (Real time bidding), Cost per action (CPA), pay per action (PPA), cost per conversion, Revenue sharing

UNIT V ADVERTISING BUSINESS AND COORDINATION **9**

Copy concept, copy structure, essentials of a copy, creative approaches and styles, copy testing criteria, types of copy testing, validity and reliability of copy test. Advertising design, layout, visualization, principles of advertising design, contribution of visual elements, what to picture, how to choose colour, test of a good layout, production of print advertising, production of TV/Radio commercials. Advertising campaign concept, planning and execution of campaign, evaluation of the campaign.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. State the concepts and the importance of advertising.
2. Analyze the planning aspects of advertising
3. Explain the functioning of advertising in the various media
4. Discuss various advertising production methods
5. Develop advertising campaigns.

TEXT BOOKS:

1. David A.Aaker, Rajeev Batra, John G.Myers, “Advertising Management”, Prentice Hall Inc., 1999.
2. Maurice I.Mandell, “Advertising”, Prentice Hall Inc., 1999

REFERENCES:

1. Leon G.Schiffman and Leslie Lajar Konar, “Consumer Behaviour”, Prentice Hall Inc., 1996. Loudon, Della Bitta, “Consumer Behaviour concepts and application”, McGraw Hill, 1996.
2. Wells, Burnett and Moriarty, “Advertising; Principles & Practice”, Prentice Hall Inc., 2002.

CO’s – PO’s & PSO’s MAPPING

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

PP23028	VISUAL COMMUNICATION	L T P C
		3 0 0 3

OBJECTIVES:

- To infer the basic concepts in creating visual images
- To be aware of fundamentals in film making process

UNIT I INTRODUCTION **9**

Visual arts history from cave drawings to video painting, identifying and analyzing hidden languages in various media and cultures, Need and importance of Communication, Communication theories and models.

UNIT II PRINCIPLES OF VISUAL COMMUNICATION **9**

Psychology of human vision, How the eye and brain process image, Visual grammar, Colour form, Depth and movement, Visual theories, Perception, Semiotics, Visual story creation; Principles of Design – The applications of design principles in creating visual images.

UNIT III VISUAL ANALYSIS **9**

Principles of Visual and other Sensory Perceptions. Image processing by eye and brain, Colour psychology, Optical and Visual Illusions Various stages of design process- problem identification, search for solution refinement, analysis, decision making, and implementation.

UNIT IV BASICS OF FILMMAKING **9**

Planning, pre-production- Concept / Story development, Scripting / Screen play writing, Budgeting, Casting, Locations, Financing. Production-Shooting, Direction & Cinematography. Post production- Editing, Sound recording, Dubbing, Special effects, Graphics & Final mixing. Distribution & Exhibition.

UNIT V APPLICATION OF VISUAL COMMUNICATION **9**

Overview of print, Photography, Video and audio media, Study of techniques and methods of applying visual communication in newspapers, magazines, video, internet, advertising and public relations. Analysis of a visual event–film, TV, photo exhibit, advertisements, Case studies, Standard observer.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Apply the principles of visual communication to various media.
2. Design using the various visual communication theories.
3. Analyze images and visual arts effectively
4. Understand various processes involved in film making
5. Develop Visual Communications in day to day usage.

TEXT BOOKS:

1. Bo Bergström, Essentials of Visual Communication, Laurence King Publishing, 2012
2. Rick Williams, Julianne Newton, Visual Communication: Integrating Media, Art, and Science, Routledge, 2014

REFERENCES:

1. Gregg Beryman, Notes on Graphic Design & Visual Communication, Crisp Publications, 1990.
2. Gunther R.Krers, Theo Van Ceeuwen, Routledge, Gunther R.Grers, Reading Images –The Grammar of Visual Design, Routledge Publishers, 1995.
3. Horn, Robert, Visual Language, Macro UV Publishers, 1999.

4. Kosternics, Charles and David Roberts, Designing Visual Language,2ndEdition, Allyn & Bacon, 1999
5. Lucienne Roberts, Jonathan Baldwin, Visual Communication: From Theory to Practice, AVA Publishing, 2012
6. Paul Martin Lester, Visual Communication; Images with Messages, 3rd Edition, Thomson/Wadsworth, Belmont, California, 2003.

CO's – PO's & PSO's MAPPING

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

MF23C03 ERGONOMICS AND HUMAN FACTORS ENGINEERING L T P C

3 0 0 3

COURSE OBJECTIVES:

- To familiarize students with the Concept of ergonomics and human anatomy interactions in work places
- To train students with the concept of work place design.
- To identify various work environment and perform method and work study and develop design for workplace with sustainability

UNIT I INTRODUCTION TO ERGONOMICS AND HUMAN FACTORS 9

Introduction to Ergonomics- History, Needs and importance- Scientific Management and work study- Human relations and occupational psychology, socio technical systems theory-Industrial ergonomics programs.

UNIT II HUMAN BODY AND WORKPLACE 9

Human body mechanics, Human Sensorimotor systems, stimulus dimensions, human information processing, noise and theory of signal detection (TSD); Quantitative and qualitative visual displays; human factors associated with speech communication; Introduction to biomechanics and engineering aspects of human motor activity, human decision making- Tolerances for human interactions, measurement of muscular forces in work place.

UNIT III ANTHROPOMETRY, WORK STATION AND FACILITIES DESIGN 9

Anthropometry-definition, types and surveys – scaling techniques- constraints on product dimensions Performance of body members in making different types of movements; Energy expenditure in physical activities; Spatial movements and conceptual relationships of stimuli and responses; Continuous control systems; Types of control functions, tools and related control devices. Design of work place and work components; Applied anthropometry, activity analysis; -effective workstation design for various works (standing, sitting etc..)- static and dynamic work postures- repetitive jobs, risks assessment and task design- Understanding organizational work- system integration, workers involvement in Human factors improvement

UNIT IV WORK PLACE DESIGN AND WORK STUDY 9

Design of Work Place- Visual environment-lighting design considerations, Human performance under heat, cold, illumination, vibration, noise, pollution, static and dynamic conditions. Application of results from human factors data and analysis in work study; Work design; method Study and Work Measurement Techniques, Designing displays and controls- Tools and techniques for ergonomics- Cognitive Ergonomics- Interactive devices- Accident prevention and safety management.

UNIT V WORK SYSTEM STABILITY AND SUSTAINABILITY 9

System stability, evolution, surveying, levels of sustainability, Assessing reality and validity- Design of experiments in field surveys- survey design - Economic growth and environmental concerns

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Explain the various aspects of human sensory, motor, and cognitive attributes that influence human performance in the operation of aviation and space systems.

CO2: Identify and analyze sources of human and organizational error in aviation and space accidents.

CO3: Formulate principled hypotheses for human-system design improvement.

CO4: Test hypotheses in human settings and assess the validity of proposed designs on human workload, situation awareness, and mission performance.
CO5: Communicate interpretation of statistical analysis and design results, both written and orally.

TEXT BOOKS:

1. Bridger, Robert S. (2009). Introduction to Ergonomics, 3rd edition, CRC Press, Taylor & Francis Group (ISBN- 978-0849373060).
2. Phillips, C. A. (1999). Human Factors Engineering, 1st edition, Wiley (ISBN- 9780471240891)
3. Human Factors Engineering by M S Sanders and McCormick, TMH

REFERENCES:

1. Proctor, R. W., and T. Van Zandt. Human Factors in Simple and Complex Systems. 2nd ed. CRC Press, 2008.
2. Dismukes, R. K., B. A. Berman, and L. D. Loukopoulous. The Limits of Expertise: Rethinking Pilot Error and the Causes of Airline Accidents. Ashgate Publishing, 2007. ISBN: 9780754649656. [Preview with Google Books]
3. Bluman, A. G. Elementary Statistics: A Step-by-Step Approach. 5th ed. McGraw-Hill, 2004. ISBN: 9780072549072.
4. Handbook of Human Factors and Ergonomics Methods, Alan Hedge, Hal W. Hendrick, Karel Anton Brookhuis, Neville A. Stanton, CRC Press
   A Guide to Human Factors and Ergonomics, Martin Helander, 2nd edition, CRC Press

CO's	PO's											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	2	2	2	2	2	2		-	-	-	-	1
2	2	2	2	2	2	2		-	-	-	-	1
3	2	2	2	3	3	3		-	-	-	-	1
4	2	2	2	3	3	3		-	-	-	-	1
5	2	2	2	3	3	3		-	-	-	-	1
Avg	2	2	2	2.6	2.6	2.6						1

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

IE23C09	SAFETY ENGINEERING AND MANAGEMENT	L T P C
		3 0 0 3

COURSE OBJECTIVES:

1. To understand unsafe conditions and recognize unsafe alerts.
2. To interpret the rules and regulations for safety operations.
3. To evaluate the health and hygiene of industries.
4. To apply the safety system analysis to prevent accidents.
5. To understand the regulatory bodies and to collaborate and modify processes / procedures for safety.

UNIT I INTRODUCTION 9

Need for safety - Safety and productivity - Accident, Injury, Unsafe act, Unsafe Condition - Dangerous Occurrence - Reportable accidents. Theories of accident causation. Safety organization- objectives, types, functions. Risk and Hazard - Mechanical hazards – Boilers, Pressure vessels, Electrical Exposure.

UNIT II CHEMICAL HAZARDS AND ENVIRONMENTAL CONTROL 9

Chemical exposure – Toxic materials – Radiation Ionizing and Non-ionizing Radiation - Industrial Hygiene – Industrial Toxicology. Environmental Control – Industrial Noise - Noise measuring instruments, Control of Noise, Vibration, Industrial Lighting, Ventilation and Heat control - Personal Protection.

UNIT III INDUSTRIAL HYGIENE AND OCCUPATIONAL HEALTH 9

Industrial Hygiene - Importance of hygiene in industry, domestic hygiene and industrial hygiene - Air sampling, the concept of threshold limits, personal monitoring - risk management at work places, emergency control measures - Industrial physiology, classification of workload, work capacity and man-job alignment, fatigue and rest allowances, physiological list in occupational health assessment – Occupational Hazard – Occupational Health audit and survey.

UNIT IV HAZARD ANALYSIS 9

System Safety Analysis – Material Safety Data Sheets (MSDS) - Techniques – Fault Tree Analysis (FTA), Failure Modes and Effects Analysis (FMEA), HAZOP analysis, and Risk Assessment – methodology, criticality analysis, corrective action and follow-up.

UNIT V SAFETY REGULATIONS 9

Explosions – Disaster management – catastrophe control, hazard control - Safety Laws and Regulations – Relevant Provisions of Factories Act and Rules, Indian Electricity Act and Rules, Explosive Act and Rules, Gas Cylinders Rules – Safety Regulatory Authorities – Functions and processes of regulatory body of safety - Product safety – case studies.

TOTAL:45PERIODS

COURSE OUTCOMES:

The students will be able to

CO1. Identify and prevent chemical, environmental, mechanical, fire hazard.

CO2. Collect, analyze and interpret the accidents data based on various safety techniques.

CO3. Develop proper safety hygiene’s on industries and its employees.

CO4. Construct to perform hazard analysis.

CO5. Express to design the system with environmental consciousness by implementing safety regulation.

TEXT BOOKS:

1. John V.Grimaldi, “Safety Management”, AITB S Publishers, 2003.
2. R.K Jain (2000) Industrial Safety, Health and Environment management systems, Khanna Publications.
3. Krishnan, N.V. (1997). Safety management in Industry. Jaico Publishing House, New Delhi.

REFERENCES:

1. David L.Goetsch, “Occupational Safety and Health for Technologists”, Engineers and Managers, Pearson Education Ltd. 5th Edition, 2005.
2. Deshmukh L M, “Industrial Safety Management”, Tata McGraw-Hill Publishing Company Ltd., 2005.
3. Safety Manual, “EDEL Engineering Consultancy”, 2000.

CO’s-PO’s&PSO’sMAPPING

CO’s	PO’s											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	2	2	-	-	-	2	2	2	-	-	-	1
2	2	1	2	-	1	1	1	1	-	-	-	1
3	2	2	2	-	1	1	1	1	1	1	-	1
4	2	2	2	-	1	1	1	1	1	1	-	1
5	2	2	2	1	1	1	1	1	1	1	-	1
Avg.	2	1.8	2	1	1	1.2	1.2	1.2	1	1	-	1

IE23C03 LEAN MANUFACTURING AND SIX SIGMA L T P C

3 0 0 3

COURSE OBJECTIVES:

- To know the basics of Lean and Six Sigma.
- To analyse the process of integrating Lean and Six sigma
- To identify and select the resources required for LSS Projects and selection of projects including Team building.
- To infer the DMAIC process and study the various tools for undertaking LSS projects.
- To relate how to institutionalize the LSS efforts.

UNIT I INTRODUCTION TO LEAN AND SIX SIGMA 9

Introduction to Lean- Definition, Purpose, Features of Lean; Top seven wastes, Need for Lean management, The philosophy of lean management, Creating a lean enterprise, Elements of Lean, Lean principles, the lean metric, Hidden time traps. Introduction to quality, Definition of six sigma, origin of six sigma, Six sigma concept and Critical success factors for six sigma; Case analysis.

UNIT II INTEGRATION OF LEAN AND SIX SIGMA 9

Evolution of lean six sigma, the synergy of Lean and six sigma, Definition of lean six sigma, the principles of lean six sigma, Scope for lean six sigma, Features of lean six sigma. The laws of lean six sigma, Key elements of LSS, the LSS model and the benefits of lean six sigma. Initiation - Top management commitment – Infrastructure and deployment planning, Process focus, organizational structures, Measures – Rewards and recognition, Infrastructure tools, structure of transforming event and Launch preparation; Case study presentations.

UNIT III PROJECT SELECTION AND TEAM BUILDING 9

Resource and project selection, Selection of Black belts, Training of Black belts and Champions, Identification of potential projects, top down (Balanced score card) and Bottom up approach – Methods of selecting projects – Benefit/Effort graph, Process mapping, value stream mapping, Predicting and improving team performance, Nine team roles and Team leadership; Case study presentations.

UNIT IV THE DMAIC PROCESS AND TOOLS 9

The DMAIC process – Toll gate reviews; The DMAIC tools; Define tools – Project definition form, SIPOC diagram; Measure tools – Process mapping, Lead time/cycle time, Pareto chart, Cause and Effect matrix, FMEA; Idea – generating and organizing tools – Brainstorming, Nominal group technique, Multi-voting and Cause and effect diagram, Data collection and accuracy tools- Check sheet, Gauge R&R; Understanding and eliminating variation- run charts, control charts and process capability analysis; Analyze tools - Scatter plots, ANOVA, Regression analysis, Time trap analysis; Improve tools – Mistake proofing, Kaizen, set up time reduction (SMED), TPM, DOE and the pull system. Control tools – statistical process control

UNIT V INSTITUTIONALIZING AND DESIGN FOR LSS 9

Institutionalizing lean six sigma – improving design velocity, creating cycle time base line, valuing projects, gating the projects, reducing product line complexity, Design for lean six sigma, QFD, Theory of Inventive Problem solving (TRIZ), Robust design; Case study presentations.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The students will be able to

CO1. understand what is Lean and Six sigma and their importance in the globalised competitive world.

CO2. Understand the importance of integrating Lean and Six sigma and also the process of their integration.

CO3. Plan the Resources required to undertake the LSS projects and also acquire how to select the suitable projects and the teams.

CO4. Apply DMAIC methodology to execute LSS projects and in this regard they will be acquainted with various LSS tools

CO5. Understand the process of institutionalizing the LSS effort and also understand the Design for LSS.

TEXT BOOKS:

1. Michael L.George, David Rownalds, Bill Kastle, What is Lean Six Sigma, McGraw – Hill 2003
2. James P. Womack, Daniel T.Jones, Lean Thinking, Free Press Business, 2003

REFERENCES:

1. Thomas Pyzdek, The Six Sigma Handbook, McGraw-Hill,2000
2. Fred Soleimannejed , Six Sigma, Basic Steps and Implementation, AuthorHouse, 2004
3. Forrest W. Breyfogle, III, James M. Cupello, Becki Meadows, Managing Six Sigma:A Practical Guide to Understanding, Assessing, and Implementing the Strategy That Yields Bottom-Line Success, John Wiley & Sons, 2000

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

CO's	PO's											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	3	3	3	3	3	1	1	-	-	-	-	2
2	3	3	3	3	3	2	2	-	-	-	-	3
3	3	3	3	3	3	2	2	-	-	-	-	2
4	3	3	3	3	3	2	2	-	-	-	-	2
5	3	3	3	3	3	3	3	-	-	-	-	3
Avg.	3	3	3	3	3	2	2	-	-	-	-	2.4

PP23029	SMART MANUFACTURING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce about Industry 4.0, smart factories and Digital Twin
- To be acquainted with Internet of Things and AI & ML
- To impart knowledge on CPS and its various elements

UNIT I PRINCIPLE OF INDUSTRY 4.0 & SMART FACTORY **9**

Industry 4.0 — Definition, principles, Introduction to Industry 4.0: Industry 4.0: Globalization and Emerging Issues, Smart and Connected Business Perspective, Smart Factories, Industry 4.0: Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artificial Intelligence, Big Data and Advanced Analysis Industrial Revolutions, Benefits of Industry 4.0, challenges in Industry 4.0, Smart manufacturing, Internet of Things, Industrial Gateways, Basics of Communication requirements. Application of Industry 4.0 in process & discrete industries.

UNIT II CYBER PHYSICAL SYSTEMS **9**

Cyber Physical Systems in Real world, Basic Principle of Cyber Physical Systems, CPS Design Recommendations, CPS system requirements, Cyber Physical System Application, Case study of Cyber Physical Systems, Hardware platforms for Cyber Physical Systems (Sensors/Actuators, Microprocessor/Microcontrollers), Wireless Technologies for Cyber Physical Systems, Continuous Dynamics, Discrete dynamics, Hybrid Systems, Structure of Models, Synchronous Reactive models, Dataflow models of computation, Timed models of computation. Security and Privacy Issues in CPSs, Local Network Security for CPSs, Internet-Wide Secure Communication, Security and Privacy for Cloud-Interconnected CPSs, Case Study: Cybersecurity in Digital Manufacturing/Industry 4.0

UNIT III DIGITAL TWIN IN MANUFACTURING **9**

Digital twin - Definition, types of Industry & its key requirements, Importance, Application of Digital Twin in process, product, service industries. Real time use of Digital Twin, Benefits, impact and challenges, Features and Implementation of Digital Twins, Types of Digital Twins, Digital Twin use cases, Applications for digital twins in Manufacturing

UNIT IV AI / ML IN MANUFACTURING **9**

Machine Learning Application, Basics of Machine Learning, The Machine Learning Process, Machine Learning working cycle, Preparing Data, Running Experiments, Finding the Model, Training the Model, Deploying and using a Model, Machine Learning in practice (examples of existing or future applications in the field of manufacturing)

UNIT V CPS BUSINESS MODELS **9**

Cyber-Physical Systems and new Business Models, How CPS can induce new Business Models, The Role of horizontal and vertical value streams, New Business Models for the Smart Factory, Characteristics of Business Models within the Smart Factory, Examples of new Business Models - Business Model: Service provider - Business Model: Data provider - Business Model: Technology provider - Business Model: Platform provider

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course, the students shall be able to:

CO1: Acquire knowledge on Industry 4.0 & smart factory

CO2: Understand various elements of cyber physical systems
CO3: Support and value digital twin in process and discrete industry.
CO4: Support and value AI / ML in manufacturing
CO5: Describe the CPS business models

TEXT BOOKS:

1. Alp Ustundag and Emre Cevikcan, "Industry 4.0: Managing The Digital Transformation", Springer Series in Advanced Manufacturing., Switzerland, 2017
2. Principles of Cyber Physical Systems, Rajeev Alur, MIT Press, 2015
3. E. A. Lee, Sanjit Seshia , "Introduction to Embedded Systems – A Cyber–Physical Systems Approach", Second Edition, MIT Press, 2017

REFERENCES:

1. Andrew Yeh Chris Nee, Fei Tao, and Meng Zhang, "Digital Twin Driven Smart Manufacturing", Elsevier Science., United States, 2019
2. Introduction to Industrial Internet of Things and Industry 4.0, Sudip Misra, Chandana Roy, Anandarup Mukherjee, CRC Press, 2020.
3. Ïnternet of Things - A Hands on Approach, Vijay Madisetti, Arshdeep Bahga, University Press.
4. Introduction to Internet of Things: A practical Approach, Dr. SRN Reddy, Rachit Thukral and Manasi Mishra, ETI Labs.
5. The Internet of Things: Enabling Technologies, Platforms, and Use Cases, Pethuru Raj and Anupama C. Raman, CRC Press. 5. Designing the Internet of Things, Adrian McEwen, Wiley
6. Alasdair Gilchrist , "Industry 4.0: The Industrial Internet of Things", Apress., United States ,2015.
7. Christoph Jan Bartodziej, “The Concept Industry 4.0 An Empirical Analysis of Technologies and Applications in Production Logistics”, Springer Gambler., Germany, 2017.

CO’s	PO’s											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	3	1	2	2	-	1	2	-	-	2	-	3
2	3	2	1	2	-	1	1	-	-	2	-	3
3	3	2	1	2	-	1	1	-	-	2	-	3
4	3	1	1	1	2	1	1	-	-	2	-	3
5	3	1	1	1	2	1	1	-	-	2	-	3
Avg.	3	1.4	1.2	1.6	2	1	1.2	-	-	2	-	3

MF23C05	SUSTAINABLE MANUFACTURING	L T P C
		3 0 0 3

COURSE OBJECTIVE:

To enable the students to

1. Understand the concept of sustainable manufacturing and its significance in modern manufacturing engineering.
2. Explore the principles and strategies of sustainable manufacturing, including eco-design, energy efficiency, waste management, and life cycle assessment.
3. Get familiarize students with the application of sustainable manufacturing practices in different industry sectors, such as automotive, electronics, and textiles.

UNIT I INTRODUCTION TO SUSTAINABLE MANUFACTURING, DESIGN AND PRODUCT DEVELOPMENT **9**

Definition and scope of sustainable manufacturing - Environmental, social, and economic aspects of sustainability - Sustainability performance indicators - - Eco-design principles and strategies - Design for disassembly and recycling - Life cycle assessment and eco-labeling - Sustainable building design and construction - Energy-efficient lighting and HVAC systems - Green Buildings and Facilities.

UNIT II ENERGY EFFICIENCY IN MANUFACTURING, WASTE MANAGEMENT AND CIRCULAR ECONOMY **9**

Energy management and optimization - Renewable energy applications in manufacturing - Energy-efficient process design - Waste management in manufacturing facilities - Waste reduction and recycling strategies - Industrial symbiosis and resource sharing - Closed-loop and cradle-to-cradle approaches - carbon footprint: calculation, need to reduce the carbon footprint of manufacturing Operations, Carbon trading and offsetting.

UNIT III SOCIAL RESPONSIBILITY IN MANUFACTURING **9**

Worker safety and well-being - Human rights and labor standards - Community engagement and social impact assessment - Corporate Social Responsibility (CSR)

UNIT IV SUSTAINABLE MANUFACTURING PRACTICES IN INDUSTRY SECTORS **9**

Case studies and best practices in automotive manufacturing, electronics manufacturing and textiles and apparel manufacturing - Clean and green manufacturing technologies - Advanced process monitoring and control systems - Digitalization and Industry 4.0 in sustainable manufacturing - Sustainable material selection - Green supply chain management - Responsible sourcing and ethical considerations.

UNIT V REGULATORY AND POLICY FRAMEWORKS, FUTURE TRENDS AND CHALLENGES IN SUSTAINABLE MANUFACTURING **9**

Environmental regulations and compliance - International standards for sustainable manufacturing - Governmental regulations for Sustainability: GRI, ISO 26000, ISO 14001- Government policies and incentives - Emerging technologies and innovations - Circular economy and zero waste concepts - Sustainable manufacturing in the era of climate change**.**

TOTAL: 45 PERIODS

COURSE OUTCOME:

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

CO1: Demonstrate a deep understanding of the concepts and principles of sustainable manufacturing and their significance in modern industrial practices.

CO2: Analyze and interpret data related to carbon footprint, water consumption, and ecological impact, to support decision-making in manufacturing operations.

CO3: Apply knowledge of sustainable manufacturing tools and techniques to evaluate and improve the social performance of manufacturing systems.

CO4: Design sustainable manufacturing processes by considering factors like green supply chain, material selection through case studies.

CO5: Understand the sustainability regulations and circular economy.

TEXT BOOKS

1. Joseph Fiksel, Design for Environment, Second Edition: A Guide to Sustainable Product Development, McGraw-Hill Education, 2018
2. Fahimnia, B. & Bell, Michael & Hensher, David & Sarkis, Joseph. (2015). Green Logistics and Transportation: A Sustainable Supply Chain Perspective

REFERENCE BOOKS

1. Davim J.P., “Sustainable Manufacturing”, John Wiley & Sons., United States, 2010, ISBN: 978-1-848-21212-1.
2. Ibrahim Garbie, “Sustainability in Manufacturing Enterprises Concepts, Analyses and Assessments for Industry 4.0”, Springer International Publishing., United States, 2016, ISBN-13: 978-3319293042.
3. Jovane F., Ęmper, W.E. and Williams, D.J., “The ManuFuture Road: Towards Competitive and Sustainable High-Adding-Value Manufacturing”, Springer,2009, United States, ISBN 978-3-540-77011-4.
4. Kutz M., “Environmentally Conscious Mechanical Design”, John Wiley & Sons., United States, 2007, ISBN: 978-0-471-72636-
5. Seliger G., “Sustainable Manufacturing: Shaping Global Value Creation”, Springer, United States, 2012, ISBN 978-3-642-27289-9.

CO’s- PO’s & PSO’s MAPPING

CO’s	PO’s											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	3	3	2									
2	3	3	3									
3	3	3	2									
4	3	3	3									
5	3	3	3									
Avg	3	3	2.6									

ME23C06

DESIGN THINKING **L T P C**

3 0 0 3

COURSE OBJECTIVES:

1. Understand the concepts of design thinking approaches.
2. Create design thinking teams and conduct design thinking sessions
3. Apply both critical thinking and design thinking in parallel to solve problems
4. Apply some design thinking concepts to their daily work
5. Conceive, conceptualize, design and demonstrate innovative ideas using prototypes.

UNIT I INTRODUCTION TO DESIGN THINKING 9

Introduction to elements and principles of Design, Introduction to design thinking, history and need of design thinking. 7 characteristics that define design thinking, comparison of design thinking to other ways of thinking, 5 characteristics of action plan. Problem statement.

UNIT II DESIGN THINKING PROCESS AND TOOLS 9

Design Thinking process empathize, analyze, ideate, prototype & Test. Implementing the process in driving inventions, design thinking in social innovations. Tools of Design Thinking - Ask 5x why, 5W+H questions, Empathy map, persona, costumer journey map for solving problems in user centric way.

UNIT III METHODS AND TOOLS IMPLEMENTATION 9

Brain storming - How might we -question, Storytelling. Critical Function Prototype (CFP). Testing sheet, Feedback, Powerful questions in experience testing, Road map for implementation.Product Design: problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications, Product development.\

UNIT IV PRODUCT STRATEGIC INNOVATION 9

Innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Innovative Products by applying Lateral-Divergent and Convergent Thinking. Implementing design thinking for better process.

UNIT V DESIGN THINKING IN VARIOUS SECTORS 9

Design thinking for Startups. Double Dimond method - discover, define, develop and deliver. Case studies in Information Technology, Finance, Education and Management.

TOTAL:45PERIODS

COURSE OUTCOMES:

The students will be able to

CO1. Identify the Principles and Elements of Design; gain knowledge of the Need and characteristics of Design Thinking.

CO2. Apply the Design Thinking process and use tools like Persona, Empathy Map for solving problems in user centric way.

CO3. Develop skills in Brainstorming, prototype, testing and implementation for Product Design and Development.

CO4. Create the Innovative Products by applying Lateral - Divergent and Convergent Thinking. Implementing design thinking for better process

CO5. Apply the Design thinking Techniques for solving problems in various sectors like Education , Information Technology, Finance and Management

TEXT BOOKS:

1. Daniel Ling “Complete Design Thinking Guide for Successful Professionals”, Emerge Creatives Group LLP, Print ISBN: 978-981-09-5564-9.
2. A.K. Chitale and R.C. Gupta, “ Product Design and Manufacturing”, Prentice Hall
3. Michael Lewrick, Patrick Link, Larry Leifer, “The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems”, John Wiley & Sons, 2020.

REFERENCES:

1. Michael G. Luchs, Scott Swan, Abbie Griffin , “Design Thinking: New Product Development Essentials from the PDMA”, ISBN-13 : 978-1118971802
2. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, HarperCollins e-books, 2009
3. Beverly Rudkin Ingle, “Design Thinking for Entrepreneurs and Small Businesses”, Apress, ISBN: 9781430261827
4. Jose Betancur “The Art of Design Thinking: Make More of Your Design Thinking Workshops”, ISBN: 9781522095378

CO’s	PO’s											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	3	3	2	-	-	-	-	-	-	-	2
2	3	3	3	-	-	-	-	-	-	-	-	-
3	3	3	3	2	-	-	-	-	-	-	-	2
4	3	3	3	-	-	-	-	-	-	-	-	-
5	3	3	3	-	-	-	-	-	-	-	-	-
Avg.	3	3	3	2	-	-	-	-	-	-	-	2

CO’s-PO’s & PSO’s MAPPING

PP23030 COMPUTER AIDED PACKAGE MODELLING AND DIE DESIGN **L T P C**
2 0 2 3

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Applying the fundamental concepts of computer graphics and its tools in a generic framework.
2. Creating and manipulating geometric models using curves, surfaces and solids.
3. Applying concept of CAD systems for 3D modeling and visual realism.
4. Creating and adding geometric tolerances in assembly modeling.
5. Applying CAD standard practices in engineering design.

UNIT I FUNDAMENTALS OF COMPUTER GRAPHICS **9**

Product cycle- Design process – Computer Aided Design – Computer graphics – co-ordinate Systems- 2D and 3D transformations- homogeneous coordinates – graphic primitives (point, line, Circle drawing algorithms) – Clipping- viewing transformation.

UNIT II GEOMETRIC MODELING **9**

Representation of curves – Hermite cubic spline curve, Bezier curve, B-spline curves, Surface Modeling – Surface Entities, Representation of Surface, Bezier Surface, B-Spline Surface and Coons Surface. Solid Modeling – Solid Entities, Solid Representation, Boundary Representation (B-Rep), Sweeps Representation, Constructive Solid Geometry (CSG).

UNIT III PART ASSEMBLY **9**

Mass properties – Assembly modeling – Inference of position and orientation – Geometric Dimensioning and Tolerancing – Functional importance of various types of fits, Geometrical Dimensioning and Tolerancing, Tolerance stacking – types and remedies.

UNIT IV TOOLING ASPECTS **9**

Quality and economy-tooling aspects on product design-process variables and product Design-product design appraisal. Product design limitations-shrinkage and tolerance-Minimum wall thickness mechanical properties-creep properties-end use requirements with Case studies. Prototype development – rapid prototyping techniques – stereolithography.

UNIT V DIE REQUIREMENTS **9**

Effect of product design on mould design. Mold component -Runner system, cooling system, ejector system mood venting system. Types of Steel- prehardening, carburizing, mold cavity surface finish. Types of injection moulds. Cavity limitations, injector nozzle.

TOTAL:45PERIODS

TEXT BOOKS:

1. Ibrahim Zeid “Mastering CAD CAM” Tata McGraw-Hill Publishing Co.2007.
2. Robert A. Malloy, “Plastic Part Design for Injection Moulding”, Hanser Publishers, Munich, Vienna, New York, 1994.
3. Paul A. Tres, “Designing Plastic Parts for Assembly”, 2nd Revised Edition, Hanser Publishers, Munich Vienna New York, 1994.
4. P. N. Rao, CAD/CAM: Principles and Applications, Tata McGraw Hill, 2006.

REFERENCES:

1. Groover, M. P., CAD/CAM: Computer-Aided Design and Manufacturing, Pearson Education, 2008.
2. Chris McMahon and Jimmie Browne “CAD/CAM Principles, practice and manufacturing management “Pearson education Asia, 2001.

3. Donald Hearn and M. Pauline Baker “Computer Graphics”’. Prentice Hall, Inc, 1992.
4. Foley, Wan Dam, Feiner and Hughes – “Computer graphics principles & practice”, Pearson Education – 2003.
5. William M Neumann and Robert F.Sproul “Principles of Computer Graphics”, McGraw Hill Book Co. Singapore, 1989.

PP23031	PACKAGE SIMULATION	L T P C 1 0 4 3

UNIT I INTRODUCTION 8

Review of various approximate methods – Raleigh Ritz's, Galerkin and finite difference Methods- Governing equation and convergence criteria of finite element method.

UNIT II DISCRETE ELEMENTS 10

Bar elements, uniform sections, mechanical and thermal loading, varying section, truss Analysis, Beam element- problems for various loadings and boundary conditions –Longitudinal and lateral vibration – use of local and natural coordinates.

UNIT III CONTINUUM ELEMENTS 8

Plane stress, plane strain and axisymmetric problems. Derivation of element matrices for Constant and linear strain triangular elements and axisymmetric elements.

UNIT IV ISOPARAMETRIC ELEMENTS 9

Definitions, shape function for 4,8 nodal quadrilateral elements, stiffness matrix and Consistent load vector, Gaussian integration.

UNIT V NON LINEAR ANALYSIS 9

Elastomers- Elastic material model correlation-Terminology-Types of FEA models-Model Building- Non linear material behavior- Boundary conditions-Applications-case studies

TEXT BOOKS:

1. Rao, S.S., "The Finite Element Method in Engineering", 6th Edition, Butterworth-Heinemann, 2018.
2. Reddy,J.N. "Introduction to the Finite Element Method", 4thEdition, Tata McGrawHill,2018.

REFERENCES:

1. David Hutton, "Fundamentals of Finite Element Analysis", Tata McGrawHill, 2005
2. Dhanaraj. R and Prabhakaran Nair. K, "Finite Element Analysis", Oxford Publications, 2015.
3. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, "Concepts and Applications of Finite Element Analysis", 4th Edition, Wiley Student Edition, 2004.
4. Seshu.P, "Text Book of Finite Element Analysis", PHI Learning Pvt. Ltd., NewDelhi, 2012.
5. TirupathiR.Chandrupatla and Ashok D.Belegundu, "Introduction to Finite Elements in Engineering", International Edition, Pearson Education Limited, 2014.

PP23032 **INDUSTRIAL INSTRUMENTATION** **L T P C**
3 0 0 3

OBJECTIVES

- To impart the fundamental concepts and characteristics of measurement and errors
- To introduce the various measuring techniques for speed, acceleration, vibration, density and level,.
- To understand the construction, working principle, application and selection of various transducers used for the measurement of speed temperature and pressure.

UNIT I MEASUREMENTS **9**

Instruments: classification, applications – Elements of a generalized measurement system - Static and dynamic characteristics - Errors in measurement -Statistical evaluation of measurement data. Different types of load cells: Hydraulic, Pneumatic, Strain gauge, Magneto-elastic and Piezoelectric load cells - Different methods of torque measurement: Strain gauge, Relative angular twist. Speed measurement: Capacitive tacho, Drag cup type tacho, D.C and A.C tacho generators - Stroboscope.

UNIT II MEASUREMENT OF ACCELERATION, VIBRATION AND DENSITY **9**

Accelerometers: LVDT, Piezoelectric, Strain gauge and Variable reluctance type accelerometers – Mechanical type vibration instruments – Seismic instruments as accelerometer – Vibration sensor – Calibration of vibration pickups – Units of density and specific gravity – Baume scale and API scale – Densitometers: Pressure type densitometers, Float type densitometers, Ultrasonic densitometer and gas densitometer.

UNIT III TEMPERATURE MEASUREMENT **9**

Definitions and standards – Primary and secondary fixed points – Different types of filled in system thermometers – Sources of errors in filled in systems and their compensation – Bimetallic thermometers – IC sensors – Thermocouples: Laws of thermocouple, Fabrication of industrial thermocouples, Response of thermocouple, Special techniques for measuring high temperature using thermocouple – Thermal conductivity gauge, lionization gauges.

UNIT IV PRESSURE MEASUREMENT **9**

Definitions and standards –Units of pressure – Manometers: Different types, Elastic type pressure gauges: Bourdon tube, Bellows, Diaphragms and Capsules – Electrical methods: Elastic elements with LVDT and strain gauges – Capacitive type pressure gauge – Piezo resistive pressure sensor-Resonator pressure sensor – Measurement of vacuum: McLeod gauge.

UNIT V TRANSDUCERS FOR MEASUREMENT OF NON- ELECTRICAL PARAMETERS **9**

Classification of transducers – Measurement of pressure, temperature, displacement, flow, angular velocity – Digital transducers – Smart Sensors; Data Loggers – Basics of PLC programming and Introduction to Virtual Instrumentation.

TOTAL: 45 PERIODS

COURSE OUTCOMES (COs)

Explain the various instrumentation basic measurement system

1. Explain the various instrumentation basic measurement system
2. Ability to compare instruments used for measurement of force, torque, speed, acceleration, vibration, density and level.
3. Describe the principle of temperature measuring instruments.
4. Elaborate the type and working of pressure measuring instruments.
5. Design and select instruments according to the application.

TEXT BOOKS:

1. Patranabis, D., “Principles of Industrial Instrumentation”, 3rd Edition, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2017.
2. H.S. Kalsi, ‘Electronic Instrumentation’, Tata McGraw-Hill, New Delhi, 2010

REFERENCE BOOKS:

1. Liptak, B.G., “Instrumentation Engineers Handbook (Measurement)”, CRC Press, 4th Edition, 2012.
2. Jones. B.E., “Jones”s Instrument Technology”, Vol.2, Butterworth-Heinemann, 4thEdition, Elsevier, 2016.
3. Eckman D.P., “Industrial Instrumentation”, Wiley Eastern Limited, 2016.
4. Singh,S.K., “Industrial Instrumentation and Control”, Tata Mc-Graw-Hill Education Pvt. Ltd., 3rd Edition, New Delhi, 2010.

CO’s – PO’s & PSO’s MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	1	3	-	1	2	3	3	-	1	2	2	2	3	3
2	3	3	3	3	2	2	2	1	3	-	2	2	2	3	3
3	3	3	3	3	2	2	2	1	-	2	2	3	2	3	3
4	3	3	3	3	2	2	1	1	3	2	2	2	1	3	3
5	3	3	3	3	3	2	3	2	3	-	2	3	3	3	3
Avg	3	2.6	3	3	2	2	2.2	1.6	3	1 .6	2	2.4	2	3	3

PP23033 **COLOR MANAGEMENT** **L T P C**

2 0 2 3

OBJECTIVES:

- To familiarize about press standardization and comprehend issues in colour conversion
- To gain knowledge about colour management workflows

UNIT I COLOR MEASUREMENT 6

Color Appearance Models, Color Difference – Geometry, Ellipses and ellipsoids, Weighted Color Difference Formulae, Uniform Color difference spaces, Determining Color Tolerance Magnitude; Colour and Material Appearance Measurement – Geometries, Precision, Accuracy, Spectral Imaging, Fluorescence, Gloss, Microstructure (BRDF), Macrostructure, Sparkle and Graininess; Colour data Exchange Format (CxF) – scanner, output target, spot color; ISO standards; Case studies.

UNIT II COLOR MANAGEMENT 6

Profile - structure, Lookup table construction; CMM - functions, static, dynamic; Gamut boundaries, Gamut mapping – influencing factors, algorithms, Rendering Intent, ICC limitations; Black point compensation; Black channel preservation; Optimization of colour transforms; Device link profiles; ICCMax – spectral transform, BRDF, calculator transform; Brand/Spot colour matching – gamut limitations, substrate considerations

UNIT III PREPRESS AND PROOFING 6

Colour features and Settings – Operating system, Prepress software, Press (RIP), Print driver; Intermediate colour spaces; Embedded profiles; Grayscale profile; Proofing - Soft Proofing, Digital proofing, ISO standards; Spot colour workflow and colour matching; Production workflows - Data format, Configurations, Colour conversions; Internet workflow; Case studies

UNIT IV PROCESS CONTROL 6

Variables in printing process, Test forms, Press standardization, Optimization - Gravure, Flexography, Offset, Screen, Digital; ISO standards; Press Certifications – G7, PSO, Japan Colour, FOGRA; Colour conformance software

UNIT V INK FORMULATION AND COLOUR MATCHING 6

Generic approach to color modeling; Modeling transparent materials - Lambert–Beer law; Modeling opaque materials – Kubelka Munk theory, Two flux model, Multiflux models, Modeling Gonioapparent materials; Color formulation software – principle, features.

OUTCOMES:

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

1. Infer the steps in implementing colour management system and choose suitable device configuration for colour measurement following quality standards.
2. Create profiles for display, input and output devices.
3. Explain the gamut mapping concepts by applying boundary constraints
4. Design methodology to standardize the various printing processes as per ISO standards
5. Reproduce and match colour across various devices and software applications

LIST OF EXPERIMENTS:

1. Quality control evaluation of print control strip using various approaches
2. Monitor profiling and soft proofing
3. Creation of digital proof and evaluation of its quality

4. Colour management features in RIP and PDF
5. Evaluation of printed sheet as per ISO standards
6. Colour reproduction comparison using various substrates
7. Colour matching using ink formulation software
8. Spot colour characterization, reproduction and evaluation
9. Image editing and colour conversions in MATLAB
10. Colour management operations using Python

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Abhay Sharma, Understanding Colour Management, 2nd Edition, Wiley, 2018.
2. Phil Green, Michael Kriss,Colour Management: Understanding and Using ICC profiles, The Wiley-IS&T Series in Imaging Science and Technology, 2010

REFERENCES:

1. Adams R.M. & Weisberg J.B., GATF Practical Guide to Colour Management, 2nd. Ed., GATF Press, 2000
2. Bruce Fraser, Chris Murphy, & Fred Bunting, Real World Colour Management, 2nd Edition, Peachpit Press
3. Mark D.Fairchild, Colour Appearance Models, Second Edition, John Wiley & Sons Ltd., 2005
4. Phil Green, Lindsay MacDonald, Colour Engineering, John Wiley & Sons Ltd., 2002

CO's – PO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	3	3	3	3	3		3		3	3	3	3
2	3	3	3	3	3							2	3	3	
3	3	3	3	3	3								3	3	
4	3	3	3	3	3	3	3						3	3	
5	3	3	3	3	3	3	3		2				3	3	3
Avg	3	3	3	3	3	3	3	3	2	3		2.5	3	3	3

PP23034 BIOPOLYMERS AND BIODEGRADABLE POLYMERS L T P C
3 0 0 3

OBJECTIVES:

- To study the biopolymers, biodegradable polymers and processing methods.
- To Compare the structures and applications of biopolymers
- To understand the principles of biodegradation process and societal circular economy

UNIT I BIOPOLYMERS 9

Need for sustainable packaging materials, Micro plastic, Types of Biodegradable Polymers - Bio based polymers, starch based polymers, cellulose based polymers, chitin and chitosan, bacterial polyesters, synthetic biodegradable polymers, polymers from bio based monomers - Proteins, hemicelluloses and cellulose based biopolymers - Plant and animal based proteins – Solution casting of proteins – Processing of proteins as plastics – preparation and properties of hemicelluloses – Cellulose based composites - Surface and chemical modifications of cellulose fibers.

UNIT II BIODEGRADABLE POLYMERS 9

Introduction, Advantages, Classification; Degradation of polymers – Mechanism - Thermal degradation, Mechanical Degradation, Degradation by Ultrasonic Waves, Photo degradation, Degradation by High Energy Radiation, Oxidative Degradation and Hydrolytic Degradation; Biological Degradation - Enzymic Hydrolysis, Enzymic Oxidation; Analysis of Biodegradation - Enzyme assays, Plate test, Respiratory test, Natural environment, Field trial, Gas evolution test, Factors Affecting Biodegradability.

UNIT III STRUCTURE OF BIOPOLYMERS 9

Natural Polymers: chemical & physical structure, properties, source, important chemical modifications, applications of polymers such as cellulose, lignin, starch, rosin, shellac, latexes, vegetable oils and gums, proteins.– the macromolecular structure and biological functions of polymers - primary, secondary, tertiary and quaternary structure of polymers – structure maintenance and transmission of the biological information- viruses and phages – living macromolecules.

UNIT IV BIODEGRADATION OF POLYMER 9

Biodegradation in Liquid Environments - Degradation in real & laboratory Tests - Simulating real aquatic environments, Defining and optimizing liquid media-Marine degradation; Standard tests using liquid media, Biodegradation behavior of polymers in the soil - The soil environment - Surface factors, underground factors, Degradability of polymers in soil, Effects of biodegradable polymers on Soil Living Organisms.

UNIT V CIRCULAR ECONOMY 9

Key Concepts and Terminology, Linear Economy, Introduction, Need for Circular Economy, Benefits of Circular Economy, 3R’s of Circular Economy, Negative Impacts of Plastics, Disposal, and Post-disposal, Waste Management, Plastics in Circular Economy, Business Models, Industry 4.0, and Circular Economy, Life cycle analysis.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

1. At the end of the course, students will be able to
2. Compare the nature of biodegradable polymers and the degradation mechanisms.
3. Differentiate knowledge on principles of biodegradation in liquid and soil.
4. Evaluate the structures and applications of biopolymers.
5. Select biopolymer processing techniques and its application in packaging.
6. Value the structure and functions of natural biopolymers and their applications.

REFERENCE BOOKS:

1. Handbook of Biopolymers and Biodegradable Plastics, A volume in Plastics Design Library, Edited by: Sina Ebnesajjad, 2013 Elsevier
2. Biopolymers Towards Green and Sustainable Development, Sudarshan Singh, Warangkana Chunglok, Bentham books,2022.
3. Jens Nielsen, John Villadsen and Gunnar liden, “Bioreaction Engineering Principles”, 3rd edition, Springer 2011.
4. Charles Gebelein, Biotechnological Polymers: Medical, pharmaceutical and industrial applications, CRC press,1993.
5. Himadri Panda, Modern Technology of Biodegradable Plastics and Polymers with Bio- Plastics, Starch Plastic, Cellulose Polymers & Others, Engineers India Research Institute, 2015.
6. Manjari Sharma , "Bio-degradable Polymer Compositions Materials and their Structures" Manakin Press 2015.

CO’s – PO’s & PSO’s MAPPING

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

PP23035 ADVANCED PACKAGING MATERIAL CHARACTERIZATION L T P C
2 0 3 3

OBJECTIVES:

- To learn the basic concepts and Instrumentation Techniques.
- To understand various mechanical, thermal, analytical and optical characterization techniques for packaging materials.
- To study the environmental and biodegradation concepts in compliance with ASTM/ISO/IS standards

UNIT I MOLECULAR STRUCTURAL EVALUATION 9

Structural evaluation of packaging materials: Principles, theories and applications of the following techniques: Fourier transform infrared spectrometry, Ultraviolet - visible spectrometry, Nuclear magnetic resonance spectrometry, Mass spectrometry, X-ray diffraction spectrometry, Gas chromatography, ASTM/ISO/IS Standards, Polymer identification.

UNIT II THERMAL PROPERTIES 9

Thermal properties of package materials: Glass transition temperature, melting temperature, heat distortion temperature, DSC analysis. Sample preparation, standardization, conditioning of sample, processibility test, dynamic mechanical analysis, melt flow rate, softening temperature. Study of thermo-chemical analysis and differential scanning calorimeter and their applications to packaging material with suitable examples, ASTM/ISO/IS Standards.

UNIT III MECHANICAL PROPERTIES 9

Mechanical properties: principles and applications to packaging materials, Tensile strength, flexural strength, impact resistance, percentage elongation, Griffith theory, tear test, fatigue and wear, hardness, compressive strength time dependent properties like creep, stress, strain. ASTM/ISO/IS Standards.

UNIT IV OPTICAL AND ANALYTICAL PROPERTIES 9

Optical properties: Refractive index, gloss, colour matching, haze. Microscopy: Scanning electron microscopy, transmission electron microscope, FE-SEM. water absorption, moisture analysis- sieve analysis. ASTM/ISO/IS Standards.

UNIT V ENVIRONMENTAL PROPERTIES 9

Environmental resistance: Stress cracking, effect of weathering, biological degradation, fire, radiation staining. Fire test: Ignition of flame and spread, limiting oxygen index, rate of heat release, smoke toxicity test, ASTM/ISO/IS Standards.

TOTAL PERIODS: 45

OUTCOMES:

Upon completion of the course, the student should be able to:

1. Analyze the various thermal characterization techniques required for packaging materials
2. Examine different molecular/structural evaluation techniques required for packaging materials
3. Discuss the mechanical performance techniques required for packaging materials
4. Explain the optical, morphological characterization techniques required for packaging materials
5. Summarize various environmental characterization techniques required for packaging materials

REFERENCE:

1. B. Sivasankar, Engineering Chemistry, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2012
2. A. B. Mathur, I. S. Bharadwaj, Testing and Evaluation of Plastics, Allied Publishers Pvt. Ltd., New Delhi, 2003
3. A. Ya. Malkin, A.A. Askadsky, V.V. Koverica Experimental methods of polymers, Mir Publishers,

Moscow, 1998.
4. Iver, Mead and Riley, Hand book of Plastic test methods, Illith Publishers, New York, 1982.
5. S. K. Nayak, S. N. Yadav, S. Mohanty, Fundamentals of Plastic Testing, Springer, 2010.
6. Vishu Shah, Hand book of Plastics Testing and Failure Analysis, 3rd Edition, John Willey &Sons, New York, 2007.

CO's – PO's & PSO's MAPPING

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

PP23036 ADVANCED PAPER AND PAPERBOARD TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:

- To study the fibrous and non-fibrous processing
- To understand about paper manufacturing processes
- To learn the properties of paper and paper board and testing methods

UNIT I PAPER AND PAPERBOARD 9

Paper Fibre – Orientation, Z directional structure, Bonding, Internal Stresses; Inplane tensile properties – Drying stresses, Load –elongation behavior, Tensile strength, fracture toughness, fracture energy; Structural Mechanics – Bending stiffness, Compressive strength, out-of plane strength; Moisture content – Hysteresis and dynamic phenomena, Swelling, Hydrophobation; Case studies.

UNIT II PAPER BASED FLEXIBLE PACKAGING 9

Packaging Needs, Paper Bags – Types, Materials, Manufacturing, Performance testing; Multiwall Paper Sacks – Designs, Materials, Manufacturing, Closures, Testing; Paper based cap liners and diaphragms; Medical Packaging; Tea and Coffee Packaging; Sealing tapes; Paper Cushioning; Packaging Machineries; Standards; Case studies.

UNIT III PAPER LABELS AND PAPERBOARD BASED LIQUID PACKAGING 9

Labels - Types; Adhesives; Selection factors; Nature and Function; Finishing; Label application, labelling and overprinting; Legislation, Regulations and standards; Specifications, Quality Control and Testing; Paperboard based Liquid Packaging – Materials, Types, Designs, Closures, Sterilization, Testing; Case studies.

UNIT IV COMPOSITE CANS, RIGID BOXES AND FIBRE DRUMS 9

Composite Cans – Designs, Materials, Manufacturing, Labelling, Testing, Recent Trends; Rigid Boxes – Styles, Materials, Design, Manufacturing; Fibre Drums – Materials, Manufacturing, Design, Testing; Standards; Case studies

UNIT V CORRUGATED FIBREBOARD AND MOULDED PULP PACKAGING 9

Corrugated Boxes – Materials, Types, Design, Manufacturing, Testing; Solid Board Packaging - Materials, Properties, Types, Design, Manufacturing, Testing; Moulded Pulp Packaging – Materials, Design, Manufacturing, Printing/Decoration, Testing; Case studies

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Summarize the various sources for paper and board manufacturing process
2. Appraise the various Properties and testing of papers and paper board
3. Follow the standards used for testing of paper and board
4. Rectify the paper related problems in printing and packaging
5. Recognize the need, importance of corrugated box in printing and packaging applications.

TEXTBOOKS:

1. Lawrence H.Wilson, What the printer should know about paper, GATF Press, Third Edition, 2000.
2. Lothar Gottsching & Heikki Pakarinen, Papermaking Science and Technology, Book7, Fapet Publishing, 2000

REFERENCES:

1. Bob Thompson, Printing Materials Science and Technology, Pira International Publications 2nd edition, 2004.
2. Charles Finley,Printing Paper, andInk,DelmarPublisher,1997.
3. Christopher J. Biermann, Handbook of Pulping and Papermaking,1996.
4. Herbert Holik, Handbook of Paper and Board, Wiley–VCH,2006.
5. John Christopher Roberts, Paper Chemistry, Springer, 1996

CO's – PO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	3	3	3	3	3		3		3	3	3	3
2	3	3	3	3	3							2	3	3	
3	3	3	3	3	3								3	3	
4	3	3	3	3	3	3	3						3	3	
5	3	3	3	3	3	3	3		2				3	3	3
Avg	3	3	3	3	3	3	3	3	2	3		2.5	3	3	3

PP23037	COATINGS AND ADHESIVES	L	T	P	C
		3	0	0	3

OBJECTIVE

- To understand the concept of adhesion as a joining operation and how it compares with fastening
- To understand the principles of formulating various adhesives
- To understand the importance of and methods of surface preparations for adhesion and painting of substrates

UNIT I ESSENTIALS OF COATING AND ADHESION 9

Adhesives – Fundamentals – types of substrates –mechanisms of setting, adhesive strength – thermodynamics of adhesives – concepts of surface energy, contact angle etc – types of joints – joint selection.

UNIT II REACTIVE ADHESIVES AND NON REACTIVE ADHESIVES 9

Phenolics, epoxies, acrylics, anaerobics, cyanoacrylates – uses of adhesives in packaging materials. Natural adhesives like animal glue, casein, starch – rubber based adhesives – NR, SBR, NBR, CR, IIR adhesives – Latex based & solution based – principles behind formulations –Pressure sensitive & hot melt adhesives based on SBS, EVA – polyvinyl acetate & polyvinyl
alcohol based adhesives.

UNIT III SURFACE PREPARATION AND TESTING 9

Importance and Scope of surface modification, Surface Energy, Role of surface roughness, Methods – Chemical, Corona Treatment, Plasma Treatment, Laser assisted modification Surface preparation for adhesion & painting, powder coatings, factors affecting coating properties, barrier properties – rheology & its importance, adhesion performance testing.

UNIT IV COATINGS FORMULATION 9

Coating types - Oil based, water based, UV and EB coatings and nano emulsions, Roller coatings and Hybrid coatings - constituents, properties; varnishing types- matt & gloss finish and coatings; Radiation curable coatings- Ultra violet and electron beam coatings, Water based coatings, Hybrid coatings and special effects.

UNIT V SPECIAL AND FUNCTIONAL COATINGS 9

Coatings of Plastics films – Introduction, Types - Acrylic, PVdC, PVOH, Low temperature Sealing, Metalizing with aluminium, SIOX, DLC, Extrusion Coating with PE; Peelable medical coatings –Types;

TOTAL: 45 PERIODS

COURSE OUTCOME

The students will be able to

1. Appraise the concept of adhesion as a coating operation
2. Classify the types of adhesives and their uses
3. Appreciate the physical chemistry of adhesives and coatings and modify surface of substrate
4. understand the principles of formulating various adhesives and coating
5. Develop and describe the suitable coating for speciality application

TEXT BOOKS;

1. Hans-Joachim Streitberger, Artur Goldschmidt, “Basics of Coating Technology”, European Coatings Library, 2018.
2. Eri, Adhesive Technology Formulations Hand Book, Engineers India Research Institute, 2005.

REFERENCES

1. Steven Abbott, Nigel Holmes, “Nanocoatings: Principles and Practice: From Research to Production”, DesTECH Publications, 2013.
2. Sina Ebnesajjad, Arthur H. Landrock , “Adhesives Technology Handbook “, Elsevier Science 2014.
3. Jeremy Ramsden, “Nanotechnology in Coatings, Inks and Adhesives”, Pira International Limited, 2004
4. Sam Zhang, “Thin Films and Coatings”, CRC Press, 2016

CO’s – PO’s & PSO’s MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	-	-	1	-	2	1	2	-	1	1	-	3	3	1
2	2	3	1	1	-	2	1	1	-	2	2	-	3	3	1
3	3	3	3	2	3	-	1	-	-	-	-	2	3	2	2
4	3	3	3	2	3	-	1	-	-	-	-	2	2	3	1
5	2	1	3	3	3	2	3	-	3	3	3	2	3	2	3
Avg	2.6	2.5	2.5	1.8	3	2	1.4	1.5	3	2	2	2	2.8	2.6	1.6

PP23038	DESIGNING AND PLANNING FOR PRINT PRODUCTION	L	T	P	C
		3	0	0	3

OBJECTIVES:

Designing, layout and planning for print production. This introductory course will provide an overview to printing.

- To impart knowledge on various printing processes and Learn the basics of graphic design for printing.
- Understand the layout design requirements and styles for various printed product

UNIT I INTRODUCTION TO PRINTING PROCESSES

Types of process – Letterpress, Offset, Gravure, Flexography, Screen printing and Nonimpact printing processes; Introduction to image carrier preparation for different types of printing process.

UNIT II PRINCIPLES OF DESIGN

Basic concepts of designing, Creativity, steps in creativity; Typography; Visual ingredients of graphic design; Design consideration; Symbols and logos.

UNIT III DESIGN LAYOUT

Layout – purpose & advantages; layout styles; layout components; stages in preparing a layout; marking-up; Dummy, Case studies.

UNIT IV DESIGNING FOR MEDIA

Designing for Newspapers, Booklets, Magazines, Business publications, Banners & Posters, Advertising, Transit, Interactive, Web and Maps. Case studies.

UNIT V DESIGN MANAGEMENT & PRODUCTION PLANNING

Designing for Newspapers, Booklets, Magazines, Business publications, Banners & Posters, Advertising, Transit, Interactive, Web and Maps. Case studies.

OUTCOMES:

Upon completion of the course, the student should be able to:

- Describe the components and construction of different printing process
- Elaborate the principles of design in the ideation of print products
- Summarize requirements for preparing print layouts
- Construe the print specifications and design requirements for print media.
- Develop relevant production planning to design printed product

TEXT BOOKS

1. David A. Lauer, Stephen Pentak, “Design Basics”, 6th Edition, Wadsworth, 2005
2. Poppy Evans and Mark A. Thomas, ‘ Exploring the Elements of Design”, Delmar Publishers, 2004
3. Robin McAllister, “Design for Production”, Delmar Publishers, 1997.

REFERENCES

1. Albert C. Book, C. Dennis Schick, “Fundamentals of Copy and Layout”, Crain Books, 1984
2. Roger Walton, Keith Gillies, Lindsey Heppell, “Graphic Design”, Ebury Press, 1987
3. Pamela Mortimer, “Document Design Primer”, GATF, 2003
4. Helmutt Kipphan, “Handbook of Print Media”, Springer, Heidelberg, 2000
5. T. M. Adams, D.D. Faux and L. T. Ricber, “Printing Technology”, Delmar Publications Inc., 1996.

CO's – PO's & PSO's MAPPING

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	3	2	1	2	1	3	2	3	2	2	3	3	1
2	3	3	3	2	3	2	1	-	2	3	2	1	3	3	1
3	2	2	2	2	3	2	1	2	3	3	3	3	3	3	1
4	3	3	3	2	3	2	1	2	2	1	2	2	2	3	2
5	3	3	3	2	3	2	1	3	2	1	2	1	2	2	1
Avg	2.8	2.4	2.8	2	2.4	2	1	2.5	2.6	2.2	2.6	1.8	2.6	2.8	1.5

PP23039	DIGITAL PRE-PRESS TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the techniques in text encoding, representation and storage.
- To learn the file formats and processing of text, graphics and image in prepress.
- To comprehend the stages in digital, prepress workflow.
- To explain the various half toning techniques.
- To understand the working principle of imaging and output devices in prepress.

UNIT I TEXT

Text encoding - ASCII, Unicode; Text compression; Typeface - Anatomy, Taxonomy, Measurement, Classification, Typeface family; Type spacing; Font - Types, Design, Metrics; Font engine and rasterization - Hinting, Antialiasing, subpixel rendering; Font embedding; Font management; Web fonts; Typography; Typesetting; Copy editing; Proof reading; ISO standards.

UNIT II GRAPHICS AND IMAGE

Originals for reproduction; Raster and vector images; Digital Image acquisition; Image sensors - PMT, CCD, CMOS; Scanner - Working Principle, Types; Digital Camera - Working Principle, types; Image acquisition factors - Dynamic range, Resolution, Tone value quantization, Storage, Compression Techniques, File formats; Digital Image Processing.

UNIT III DIGITAL PREPRESS WORKFLOW

Page layout - Components, software; Postscript; PDF; Pre-flighting, Trapping, Proofing, Imposition - Job planning considerations, Imposition schemes, Imposition sheet, Allowances, Software; Raster image processors - structure, functions; Workflow management, Archiving, Versioning, Digital Asset Management; Management Information Systems - CIP4, JDF;

UNIT IV SCREENING

Halftone - Need, Screen ruling, Dot shape, Screen angle, Rosette, Moire, Transferable tonal range, Tone value sum, Tone value increase; Screening process - Conventional, Amplitude modulation, Frequency modulation, Intensity modulation, Hybrid screening; Digital Halftoning - Thresholding, Dithering, Clustered dots, Dispersed dots, Error diffusion; Quality - Resolution, Gray levels; Digital Screening technologies - Rational Tangent, Supercell, Irrational.

UNIT V OUTPUT DEVICES

Laser sources - Types, Selection; Modulation - Direct, Acousto-optic, Electro-Optic, Spatial; Lens and lens aberrations; Platesetters - Principle, Types; Densitometry - Optical density, Neugebauer, Murray Davies equations; Densitometer, Dotmeter - Components, Working principle; Quality control in platemaking; ISO standards.

OUTCOMES:

Upon completion of the course, the student should be able to:

1. Apply typographic principles in graphic design and solve problems in font handling.
2. Encapsulate the working principle of image acquisition devices and factors affecting image quality
3. Create imposition schemes and determine the job sequence, software and hardware requirements in prepress workflow
4. Explain the need for halftoning, compare the digital halftoning and screening technologies and choose appropriate settings in RIP.
5. Describe the components and construction of imaging devices, measuring devices and apply quality standards in prepress.

TEXT BOOKS:

1. Helmut Kipphan, Handbook of Print Media, Springer-Verlag, 2001.
2. Kaj Johansson, Peter Lundberg, Robert Ryberg, A Guide to Graphic Print Production, Wiley,3rd edition, 2011.

REFERENCES:

1. Daniel L. Lau, Gonzalo R. Arce, Modern Digital Halftoning, CRC Press, Second Edition, 2001.
2. Gerald F. Marshall and Glenn E. Stutz, Handbook of Optical and Laser Scanning, CRC Press, 2004.
3. Phil Green, Understanding digital colour, Blueprint, 1995.

CO's – PO's & PSO's MAPPING

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	3		2	2			2	3	2	2	3	3	1
2	3	2	-		3	1			2	3			3	3	1
3	2	3	3	2	3	2	1	1	3	3	2	3	3	3	1
4	2	3	2	3				2	2		3	2	2	3	2
5	3	1	2	2	1	1			2	1	2	1	2	2	1
Avg	2.8	2.4	2.5	2.3	2.3	1.5	1	1.5	2.6	2.5	2.3	2.	2.6	2.8	1.5

PP23901 FUNDAMENTALS OF PRINTING AND PACKAGING TECHNOLOGY **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the principles of design
- To be familiar with various printing processes
- To learn various stages in printing and packaging workflow.

UNIT I EVOLUTION OF PRINTING AND PACKAGING TECHNOLOGY 9

Introduction – History, Evolution of Printing Technology; Need and importance of Printing in human history; Technological Developments; History of Packaging, Materials used in Ancient Era, Modern Packaging Industry, Recent Developments in Printing and Packaging Technology.

UNIT II PRINCIPLES OF DESIGN 9

Basic concepts of designing, Creativity, Steps in creativity; Typography; Visual ingredients of graphic design; Design consideration; Symbols and logos. Layout – purpose & advantages; layout styles; layout components; stages in preparing a layout; Marking-up; Dummy, Designing For Media, Case studies.

UNIT III INTRODUCTION TO PRINTING PROCESSES 9

Types of process – Letterpress, Offset, Gravure, Flexography, Screen printing, Digital Printing Processes; Overview on image carrier preparation and finishing operations for different types of printing process.

UNIT IV FUNDAMENTALS OF PACKAGING 9

Packaging – Types, Functions; Packaging Materials; Package Design Considerations; Packaging Applications – Food, Healthcare, Industrial and FMCG Products; Environmental and Sustainability issues.

UNIT V PRODUCTION PLANNING AND MANAGEMENT 9

Relationship between designer, customer and printer; selection and co-ordination of production process; selection and specification of ink, paper and other materials; Package development Process – Specifications, Package Designers Checklist, Managing Package function, Package Design and Marketing studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

1. Explain the history and evolution of Printing and Packaging technology
2. Create layouts and designs for various printing and packaging products.
3. Identify the key characteristics of each printing process.
4. Comprehend the basics of packaging technology.
5. Manage production in printing and packaging industry

TEXT BOOKS:

1. Helmut Kipphan, Handbook of Print Media, Springer, Heidelberg, 2000
2. Walter Soroka, Fundamentals of Packaging Technology, Institute of packaging professionals, Fifth Edition, 2014.

REFERENCES:

1. Aaris Sherin, Irina Lee, Poppy Evans, The Graphic Design Reference & Specification Book, Rockport Publishers, 2013
2. Pamela Mortimer, Document Design Primer, GATF, 2003
3. Poppy Evans and Mark A.Thomas, Exploring the Elements of Design, Delmar Publishers, 2004
4. Robin McAllister, Design for Production, Delmar Publishers, 1997
5. T. M. Adams, D.D. Faux and L. T. Ricber, Printing Technology, Delmar Publications Inc., 1996

CO's – PO's & PSO's MAPPING

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

PP23902	DIGITAL PHOTOGRAPHY	L T P C
		3 0 0 3

OBJECTIVES

The students should be made to:

- To learn about the history of photography and different types of digital camera
- To understand the lights and lighting techniques used in photography
- To learn about the application of photography in journalism
- To gain knowledge of Image editing software and printing photographs
- To know about the various applications of digital photography

UNIT I INTRODUCTION 9

History of Photography, Basics of Digital Photography, Basic art and Visualizations, Types of digital photography, Types of Digital Cameras and accessories, Parts of a Camera, Camera lenses, Exposures -Apertures, shutter speeds and ISO, Applications of digital photography.

UNIT II LIGHT AND LIGHTING TECHNIQUES 9

Colour Temperature, Electromagnetic spectrum, Different types of Lights and their applications — Soft light, Hard light, Available Light, Key-Low, High, Side, Fill Light, Kicker, Background light. Three point lighting; Five point lighting, Light Reflectors and Diffusers. Light meters and Light measuring Devices.

UNIT III PHOTOJOURNALISM 9

Introduction to photojournalism, Documenting, presenting news using photographs, Different types of photojournalism, Picture editing for Newspaper and magazines, Role of a photo editor, Telling stories through pictures, Ethics in Photojournalism.

UNIT IV DIGITAL RETOUCHING AND DIGITAL OUTPUT 9

Image size and Resolution, Selection of Tools and Techniques for Digital Manipulation, Image compression and file formats. Selective Effects to images and filters, Image Processing and Editing software; Color and Tonal value correction, Ethics in image editing; Evaluating an image and imaging problems. Different types of printing media for hard copy, Different types of Printers with respect to their resolution.

UNIT V APPLICATIONS OF PHOTOGRAPHY 9

Psychology of Colour in Photography; Emotions of Different Colours; Genres of Photography - Black and white photography, Wildlife photography, Landscape, Cityscape, Architecture, Advertising, Fashion, Food, Automobile, Sports, Travel, Children, Natural photography; Portfolio making, Case studies and Photography in online applications.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the student should be able to:

- Choose camera settings and lenses for required photography.
- Use appropriate lights and lighting techniques for digital Photography.
- Tell stories and news articles through photographs.
- Edit and Retouch a digital Image.
- Design a portfolio with digital photography.

TEXT BOOKS:

1. Scott Kelby, " The Digital Photography Book", 3rd edition, Peachpit Press, 2009
2. Ben long, "Complete Digital Photography", Charles River Media, Third Edition, 2005.
3. Micheal Freeman, "The Photographer's Eye: Composition and Design for Better DigitalPhotos", Focal Press; 2nd edition (1 June 2007)

REFERENCES:

1. Fil Hunter, Steven Biver, “Paul Fuqua, Light-Science & Magic: An Introduction to PhotographicLighting”, Focal Press, 2007
2. Balakrishna Aiyer, “Digital Photojournalism”, Authors press, 2005

PP23903	SCREEN PRINTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The students should be made to:

- Learn the principle of screen printing and its applications.
- Gain knowledge on types of machines

UNIT I INTRODUCTION

Principle; Components – Stencil, fabric, frame, Squeegee, Ink and substrate; Fabric – Terminology, Selection; Squeegee – Components, Selection; Printing factors; Aspects affecting screen printing quality.

UNIT II STENCIL SYSTEMS

Fabric preparation; Handmade stencils – Hand painted stencils, Knife-cut stencils; Photomechanically made stencils – Indirect photostencils, Direct emulsion photostencils, Direct/Indirect photostencils, Capillary direct film photostencils; Faults and their Causes.

UNIT III PRINTING ON FLAT AND IRREGULAR SUBSTRATES

Design Considerations; Screen printed products, Flat substrates, Three dimensional objects; Printing factors.

UNIT IV PRINTING MACHINERY AND EQUIPMENT

Hand-bench Printing Equipment – Flat printing base with a vacuum suction facility, Hinge assembly, Frame counterbalance, Frame clamping system, Front and rear ‘off-contact’ adjustment, Register adjustment; Screen Printing Machines – Flat-bed hinged frame, Flat-bed vertical lift, Cylinder-bed presses, Container printing machines, Rotary screen.

UNIT V PROCESS PRINTING

Colour theory, Colour Separation, Printing sequence, Carousel Machines, Health and Safety issues, Troubleshooting

OUTCOMES:

Upon completion of the course the student will be able to:

- Select the type of fabric and machine based on product requirements.
- Appraise the different stencil making methods and able select suitable method
- Provide design solutions for various irregular objects
- Enumerate the sequences of operation in screen printing machine
- Review the concept of Colour Separation in screen printing process

TEXTBOOKS:

1. Samuel B. Hoff, “Screen Printing – A Contemporary Approach”, Delmar Publishers,1997.
2. John Stephens, “Screen Process Printing; a practical guide”, Blueprint Publishers,1987.

TEXTBOOKS:

1. Ingram, Samuel, “Screen Printing Primer”, GATF press, 2nd Edition, 1999.
2. William Appleton, “Screen Printing”, PIRA International, 1994.
3. NIIR Board, “Screen Printing Technology Handbook”, Asia Pacific Business Press Inc., 2004.

CO's – PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3		3	2	1	1	3	3	2	3	3	3	3
2	3	3	3		3	2		1	3	3	2	3	3	3	3
3	3	3	3	2	3	1		1	3	3	2	3	3	3	3
4	3	3	3		3				3	3	2	3	3	3	3
5	3	3	3	3	3	1		1	3	3	2	3	3	3	3
Avg	3	3	3	2.5	3	1.5	0.3	1	3	3	2	3	3	3	3

PP23E03	AUGMENTED REALITY IN GRAPHIC DESIGN	L T P C 2 0 0 2

OBJECTIVES:

- To provide a foundation to the fast growing field of AR
- To make the students aware of the various AR devices

UNIT I INTRODUCTION TO AUGMENTED REALITY 6

Augmented Reality - Defining augmented reality, history of augmented reality, The Relationship Between Augmented Reality and Other Technologies-Media, Technologies, Other Ideas Related to the Spectrum Between Real and Virtual Worlds, applications of augmented reality Augmented Reality Concepts- Concepts Related to Augmented Reality, Ingredients of an Augmented Reality Experience.

UNIT II AUGMENTED REALITY HARDWARE 6

Augmented Reality Hardware – Displays – Audio Displays, Haptic Displays, Visual Displays, Other sensory displays, Visual Perception , Requirements and Characteristics, Spatial Display Model. Processors – Role of Processors, Processor System Architecture, Processor Specifications. Tracking & Sensors - Tracking, Calibration, and Registration, Characteristics of Tracking Technology, Stationary Tracking Systems, Mobile Sensors, Optical Tracking, Sensor Fusion.

UNIT III COMPUTER VISION FOR AUGMENTED REALITY AND SOFTWARE 6

Computer Vision for Augmented Reality - Marker Tracking, Multiple-Camera Infrared Tracking, Natural Feature Tracking by Detection, Simultaneous Localization and Mapping, Outdoor Tracking Augmented Reality Software - Introduction, Major Software Components for Augmented Reality Systems, Software used to Create Content for the Augmented Reality Application.

UNIT IV AR TECHNIQUES- MARKER BASED & MARKERLESS TRACKING 6

Marker-based approach- Introduction to marker-based tracking, types of markers, marker camera pose and identification, visual tracking, mathematical representation of matrix multiplication Marker types- Template markers, 2D barcode markers, imperceptible markers. Marker-less approach- Localization based augmentation, real world examples Tracking methods- Visual tracking, feature based tracking, hybrid tracking, and initialisation and recovery.

UNIT V MIXED REALITY 6

Introduction to mixed reality, Applications of mixed reality, Input and Output in Mixed reality, Computer Vision and Mixed Reality, simultaneous localization and mapping (SLAM), variants of SLAM - dense tracking and mapping (DTAM), parallel tracking and mapping (PTAM) and semi-direct monocular visual odometry (SVO).

LIST OF EXPERIMENTS:

1. Introduction to AR software features, tools, workspace
2. Introduction to Materials and Lighting
3. Creation of Animation
4. Creation of UI objects and scripting
5. Creation of 3D Modelling and Tracking
6. Multitarget tracking
7. Advanced AR interactions
8. Model Tracking
9. Touch interactions
10. Application Development

TOTAL:60 PERIODS

COURSE OUTCOMES:

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

1. Describe how AR systems work and list the applications of AR.
2. Understand and analyse the hardware requirement of AR
3. Use computer vision concepts for AR and describe AR techniques.
4. Analyse and understand the working of various state of the art AR devices.
5. Acquire knowledge of mixed reality.

TEXT BOOKS:

1. Allan Fowler-AR Game Developmentll, 1st Edition, A press Publications, 2018, ISBN 978- 1484236178
2. Augmented Reality: Principles & Practice by Schmalstieg / Hollerer, Pearson Education India; First edition (12 October 2016),ISBN-10: 9332578494

REFERENCES:

1. Designing for Mixed Reality, Kharis O'Connell Published by O'Reilly Media, Inc., 2016, ISBN: 9781491962381
2. Sanni Siltanen- Theory and applications of marker-based augmented reality. Julkaisija – Utgivare Publisher. 2012. ISBN 978-951-38-7449-0

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
1	3	2	1										2	2
2	3	2	1										2	2
3	3	2	1										2	2
4	3	2	1										2	2
5	3	2	1										2	2
Avg.	3	2	1										2	2

PP23E04 **INDUSTRY 4.0** **L T P C**

3 0 0 3

COURSE OBJECTIVES:

- To understand the historical evolution and key principles of Industry 4.0, including Cyber-Physical Systems (CPS), Internet of Things (IoT), Big Data, Cloud Computing, and Artificial Intelligence.
- To analyze the architecture and integration of Cyber-Physical Systems and IoT in modern manufacturing environments
- To evaluate the role of Big Data and analytics in industrial applications, focusing on predictive maintenance, quality control, and supply chain optimization
- To explore the benefits and challenges of Cloud Computing and Digital Twins in manufacturing and maintenance processes.
- To investigate advanced manufacturing technologies and strategies for implementing smart factories in the context of Industry 4.0.

UNIT I INTRODUCTION TO INDUSTRY 4.0 **9**

Historical Context: Evolution from Industry 1.0 to Industry 4.0 -Key Concepts and Principles: Cyber-Physical Systems (CPS),Internet of Things (IoT),Big Data and Analytics, Cloud Computing, Artificial Intelligence (AI) and Machine Learning-Benefits and Challenges of Industry 4.0 -Case Studies and Real-world Applications.

UNIT II CYBER-PHYSICAL SYSTEMS AND IOT **9**

Introduction to Cyber-Physical Systems: Components and Architecture, Integration with Manufacturing Systems -Internet of Things (IoT) in Industry:IoT Architecture and Protocols, Sensors, Actuators, and Connectivity -Industrial IoT (IIoT),Applications and Use Cases -Case Studies on CPS and IoT Implementation.

UNIT III BIG DATA AND ANALYTICS **9**

Introduction to Big Data: Characteristics and Sources of Big Data, Data Collection and Storage -Data Analytics Techniques: Descriptive, Predictive, and Prescriptive Analytics, Machine Learning Algorithms -Applications of Big Data in Industry: Predictive Maintenance, Quality Control, Supply Chain Optimization-Case Studies on Big Data Applications.

UNIT IV CLOUD COMPUTING AND DIGITAL TWINS **9**

Introduction to Cloud Computing: Cloud Services and Deployment Models, Benefits and Challenges of Cloud Adoption- Edge Computing and its Role in Industry 4.0 -Digital Twins: Concept and Architecture, Applications in Manufacturing and Maintenance -Integration of Cloud Computing and Digital Twins -Case Studies on Cloud and Digital Twin Implementations

UNIT V ADVANCED MANUFACTURING AND SMART FACTORIES **9**

Introduction to Smart Manufacturing, Key Technologies in Smart Factories:Additive Manufacturing (3D Printing),Autonomous Robots and Drones, Augmented Reality (AR) and Virtual Reality (VR)-Implementation Strategies for Smart Factories-Future Trends and Emerging Technologies in Industry 4.0.

TOTAL: 45PERIODS

COURSE OUTCOMES:

The students will be able to

CO1. Describe the historical evolution from Industry 1.0 to Industry 4.0, and explain key concepts such as CPS, IoT, Big Data, and AI.

CO2. Identify the components and architecture of Cyber-Physical Systems and demonstrate their integration with manufacturing systems

CO3. Apply data analytics techniques to industrial scenarios, utilizing machine learning algorithms for predictive maintenance and quality control.

CO4. Assess the implementation of Cloud Computing and Digital Twins in industrial settings, and evaluate their impact on manufacturing efficiency.

CO5. Develop strategies for implementing advanced manufacturing technologies in smart factories, and anticipate future trends and emerging technologies in Industry 4.0.

TEXT BOOKS:

1. Alasdair Gilchris, 'Industry 4.0: The Industrial Internet of Things', Sringer,2016

REFERENCES:

1. Masoud Soroush, Michael Baldea, Thomas F. Edgar,'Smart Manufacturing: Concepts and Methods', Elsevier Science, 2020.
2. Klaus Schwab,'The Fourth Industrial Revolution', Crown, 2017
3. Bruno S. Sergi, Elena G. Popkova, Aleksei V. Bogoviz, Tatiana N. Litvinova, 'Understanding Industry 4.0: AI, the Internet of Things, and the Future of Work', Emerald Publishing Limited, 2019
4. Dominik T. Matt, Vladimír Modrák, Helmut Zsifkovits, 'Industry 4.0 for SMEs: Challenges, Opportunities and Requirements', Palgrave Macmillan,2020.

CO's-PO's&PSO'Smapping

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	1	2	2	1	2	-	-	-	1	-	-	1	1	2
2	1	2	2	1	2	-	-	-	1	-	-	1	1	1
3	1	2	2	1	2	-	-	-	1	-	-	1	1	1
4	1	2	2	1	2	-	-	-	1	-	-	1	1	1
5	2	2	2	1	2	-	-	-	1	-	-	1	1	1
Avg.	1	2	2	1	2	-	-	-	1	-	-	1	1	1