Curriculum

Three Year (Six Semesters) Diploma Course In

PACKAGING TECHNOLOGY

==========

3rd Semester to 6th Semester

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Prepared by:

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Curriculum Development Cell

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INSTITUTE OF RESEARCH DEVELOPMENT & TRAINING U. P., KANPUR-208002

To be
Approved and Implemented by B.T.E.
U.P.

CORRECTED AND APPROVED BY BOARD OF TECHNICAL EDUCATION U.P. LUCKNOW IN C.D.C MEETING HELD ON 16.07.2026

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PREFACE

An important issue generally debated amongst the planners and educators' world is how technical education can contribute to sustainable development of the societies struggling hard to come in the same bracket as that of the developed nations. The rapid industrialization and globalization has created an environment for free flow of information and technology through fast and efficient means. This has led to shrinking of the world, bringing people from different culture and environment together and giving rise to the concept of world turning into a global village. In India, a shift has taken place from the forgettable years of closed economy to knowledge based and open economy in the last few decades. In order to cope with the challenges of handling new technologies, materials and methods, we have to develop human resources having appropriate professional knowledge, skills and attitude. Technical education system is one of the significant components of the human resource development and has grown phenomenally during all these years. Now it is time to consolidate and infuse quality aspect through developing human resources, in the delivery system. Polytechnics play an important role in meeting the requirements of trained technical manpower for industries and field organizations.

In order to meet the requirements of future technical manpower, we will have to revamp our existing technical education system and one of the most important requirements is to develop outcome-based curricula of diploma programs. The curricula for diploma programs have been revised by adopting time-tested and nationally acclaimed scientific method, laying emphasis on the identification of learning outcomes of diploma program.

The real success of the diploma program depends upon its effective implementation. However, the best curriculum document is designed, if that is not implemented properly, the output will not be as expected. In addition to acquisition of appropriate physical resources, the availability of motivated, competent and qualified faculty is essential for effective implementation of the curricula.

It is expected of the polytechnics to carry out job market research on a continuous basis to identify the new skill requirements, reduce or remove outdated and redundant courses, develop innovative methods of course offering and thereby infuse the much needed dynamism in the system.

F.R. KHAN
Director
I.R.D.T. Kanpur

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i) Sh. Narendra Kumar Bhushan, IAS Additional Chief Secretary, Technical Education Govt. of U.P. for his exemplary vision & approach.

ii) Sh. F. R. Khan Director I.R.D.T. Kanpur for continually motivating, guiding and taking keen interest in the review of curriculum.

iii) All the participants from industries, Polytechnics and other technical institutions for their professional inputs during curriculum workshops.

iv) CDC Officer and other concerning staff of IRDT for their support and assistance in the conduct of curriculum workshops.

v) In the last but not least would like to thanks management of the industries who spare not only their precious time but also allowed the visit of their industries to the team making the curriculum.

Ravindra Kumar
Research Assistant/
Curriculum In-charge
I.R.D.T. Kanpur

Dr. A.P. Singh
Deputy Director/
Curriculum Coordinator
I.R.D.T. Kanpur

LIST OF SUBJECT EXPERTS

The following experts participated in various workshop for Developing the Curricula Structure and Contents of **Packaging Technology**.

S. No.	Name	Designation	Organization/Institute
1	Shri Anil Bharti	Principal	Lucknow Polytechnic, Lucknow
2	Shri Dinesh Goyal	Paper Industry Expert	Ramma Shyama Papers Pvt. Ltd.
3	Shri Vikas Khanna	Corrugation Industry Expert	Mohanah Enterprises
4	Prof. (Dr.) Tanweer Alam	In-Charge	IIP Lucknow
5	Prof. (Dr.) Anshuman Srivastava	Professor	IIP Lucknow
6	Dr. Pragya Gupta	Research Associate cum Assistant Professor	IIP Lucknow
7	Dr. Praveen Kumar Dubey	Research Associate cum Assistant Professor	IIP Lucknow
8	Dr. Shivi Kesarwani	Research Associate cum Assistant Professor	IIP Lucknow

SALIENT FEATURES		
1)	**Name of the Program**	➢ Diploma in Packaging Technology
2)	**Duration of the Program**	➢ Three years (Six Semesters)
3)	**Entry Qualification**	➢ Matriculation or equivalent NEP-2020/NSQF Level 4 as Prescribed by State Board of Technical Education, U.P.
4)	**Pattern of the Program**	➢ Semester Pattern
5)	**NSQF Level**	➢ Level – 5
6)	**Ratio between theory and Practice**	➢ 40% (Theory)/60% (Practical)

1) **Industrial Training/Internship:**

Four and six weeks of industrial training is made mandatory after the II and IV semesters during summer vacation. Total marks allotted to industrial training will be respectively 50 & 100.

In the last (6^{th} Semester) we have made the one semester Industrial training/Internship as optional along with usual classroom training.

2) **Audit & Pathways Subjects**:

As per AICTE and NEP-2020 directives, Essence of Indian Knowledge, & Tradition, Indian Constitution and Entrepreneurship & Startup subjects on Environmental Studies have been incorporated in the curriculum.

3) **Student Centred Activities**:

A provision of 3-6 hours per week has been made for organizing Student Centered Activities for overall personality development of students. Such activities will comprise of cocurricular activities such as expert lectures, self-study, games, hobby classes like photography, painting, singing etc. seminars, declamation contests, educational field visits, NCC, NSS and other cultural activities, disaster management and safety etc.

4) **Project work:**

Micro/Mini/Major project work has been included in the curriculum to enable the student to get familiarized with the practices and procedures being followed in the industries and provide an opportunity to work on some live projects in the industry.

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EMPLOYMENT OPPORTUNITIES

The following are the major employment opportunities for diploma holders in Packaging Technology:

S. No.	Job Role	Work Area
1	Packaging Technician	Package development, testing, material handling
2	Packaging Supervisor	Production line supervision, manpower management
3	Quality Control Inspector	Testing packaging strength, sealing, standards compliance
4	Packaging Designer/CAD Operator	Label, carton, structural package design
5	Printing Technician	Flexography, gravure, offset printing for packaging
6	Production Executive	Packaging operations in factories
7	Warehouse & Logistics Executive	Packaging, dispatch, inventory handling
8	Purchase/Material Executive	Procurement of packaging materials
9	Packaging Development Assistant	New package design and prototyping
10	Lab Technician	Material testing (paper, plastics, corrugation, adhesives)

Industries Hiring Packaging Diploma Holders

- **Food & Beverage** – companies like Nestlé, Amul, ITC Limited
- **Pharmaceuticals** – Sun Pharmaceutical Industries, Cipla, Dr. Reddy's Laboratories
- **FMCG** – Hindustan Unilever, Dabur
- **Packaging Manufacturing** – corrugated box, flexible packaging, rigid plastics, paperboard industries
- **E-commerce & Logistics** – Amazon, Flipkart, courier/logistics firms
- Pulp and paper industries (Govt. and public sector, Private sector companies)
- Disposable tableware items industries
- Corrugation industries
- Textile industries
- Paper tube industries
- Polymer industries
- Lamination industries
- Plastic industries

Government Sector Opportunities

- Technical Assistant in packaging labs/testing centers
- Instructor/Lab Assistant in polytechnics and technical institutes
- Quality Inspector roles in public sector manufacturing units
- Opportunities through state technical service recruitments and apprentice programs

LEARNING OUTCOMES OF THE PROGRAM

1. Program Outcomes (POs)

The Program Outcomes (POs) describe the knowledge, skills, and attitudes that students are expected to develop by the time they graduate from the Diploma in Packaging program. These outcomes reflect what graduates will be capable of doing because of the learning and training received throughout the course. They represent the professional abilities and attributes that define a diploma holder in engineering.
As defined by the **National Board of Accreditation (NBA)**, the following are the seven Program Outcomes for an engineering diploma graduate:

PO1: Basics and Discipline specific Knowledge
Assimilate knowledge of basic mathematics, science and engineering fundamentals.

PO2: Problem's Analysis and solution
Identify, analyse and solve problems using standard methods and established techniques.

PO3: Design and Development
Design solutions for technical problems.
Assist in designing components, systems, or processes to meet specific requirements.

PO4: Engineering Tools, Experimentation, and Testing

Use modern engineering tools and appropriate techniques to conduct experiments as per BIS standard.

PO5: Socio/ Economic /Environmental impact assessment/remedy.
Apply relevant technologies while considering societal needs, environmental impact keeping in view sustainable and ethical responsibilities.

PO6: Project Management and Communication
Apply engineering management principles, work effectively as an individual or in a team, and communicate clearly on activities.

PO7: Lifelong Learning
Recognize the importance of continuous learning and actively pursue self-improvement to keep pace with technological developments.

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At the end of the diploma program, the students will be able to:

S. No.	Upon completion, students will be able to:	Basis in syllabus
1	Explain the fundamentals, functions, and importance of packaging in product protection, preservation, communication, and marketing.	Broad packaging technology coverage across materials, food packaging, and related electives.
2	Identify, compare, and select appropriate packaging materials such as paper, plastics, glass, metal, laminates, and bio-based materials for different products and end uses.	Food packaging, paper packaging, and elective material subjects in the uploaded syllabus.
3	Perform testing and evaluation of packaging materials and finished packs for physical, mechanical, barrier, optical, and surface properties.	Paper packaging practicum and food packaging testing emphasis.
4	Apply packaging methods and technologies for food and other consumer products while considering shelf life, contamination control, labeling, and regulatory requirements.	Food packaging outcomes and content on product-package interactions and regulations.
5	Prepare engineering drawings, CAD drafts, and 3D models for packaging-related components and product development work.	CAD syllabus covers sectional views, GD&T, manual drawing, CAD drafting, and solid modeling.
6	Use graphic design, labeling, and branding tools to create packaging artwork, labels, and print-ready design outputs for industry applications.	Graphic design practicum in the uploaded syllabus develops packaging artwork and digital design competence.
7	Understand and apply major packaging conversion and manufacturing processes used for paper, plastics, printing, coating, lamination, and related packaging production systems.	Paper technology, plastics processing, and coating/lamination subjects in the syllabus.
8	Operate, observe, and evaluate packaging machinery and automation systems including filling, sealing, wrapping, labeling, sensors, PLC/HMI-based systems, and smart packaging setups.	Packaging Machinery and Automation practicum.
9	Analyze packaging line functions, process parameters, defects, and troubleshooting requirements for efficient and safe packaging operations.	Packaging machinery content includes efficiency, output, maintenance, troubleshooting, and project work.
10	Apply sustainability principles in packaging through waste minimization, recycling, circular economy, eco-friendly material selection, and waste-to-energy approaches.	Packaging waste management and sustainable packaging units.
11	Understand environmental, legal, and regulatory aspects of packaging, including compliance with labeling, safety, food contact, and packaging waste rules.	Food packaging regulations and packaging waste/environment content.
12	Understand export packaging, logistics, and supply chain requirements for storage, handling, transport, and global distribution of packaged goods.	Elective pathway subjects include Export Packaging and Logistic & Supply Chain Management.
13	Develop innovative packaging solutions using modern tools and technologies such as CAD, additive manufacturing, automation, and digital workflows.	CAD content plus advanced skill/elective orientation of the program.

14	Communicate technical and design ideas effectively through reports, presentations, labels, documentation, and professional portfolio-style outputs.	Graphic design, practicum structure, and student-centered activities support presentation and communication skills.
15	Demonstrate entrepreneurial awareness, problem-solving ability, and readiness for employment or self-employment in packaging design, production, quality, logistics, and allied industries.	The program includes entrepreneurship/start-up orientation, electives, advanced skill certifications, and industry-linked practical components.

STUDY AND EVALUATION SCHEME

3rd SEMESTER

Sr. No.	SUBJECTS	COURSE TYPE & CATEGORY	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
							INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
			L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
3.1	PAPER PACKAGING TECHNOLOGY	PROGRAM CORE (PRACTICUM)	2	-	2	3	-	40	40	60	3	-	-	60	100
3.2	PLASTIC PROCESSING TECHNIQUES	PROGRAM CORE (THEORY)	2	-	-	2	40	-	40	60	3	-	-	60	100
3.3	FOOD PACKAGING	PROGRAM CORE (PRACTICUM)	2	-	2	3	40	-	40	60	3	-	-	60	100
3.4	PROGRAM ELECTIVES-1	PROGRAM CORE (THEORY)	2	-	-	2	40	-	40	60	3	-	-	60	100
3.5	CREATIVE WRITING	PROGRAM CORE (PRACTICUM)	2	1	2	4	40	-	40	60	3	-	-	60	100
3.6	GRAPHIC DESIGN	PROGRAM CORE (PRACTICUM)	1	-	2	2	-	60	60	-	-	40	3	40	100
3.7	**(Q)** OPEN ELECTIVE-1 **OR**	OPEN ELECTIVE (THEORY)	2	-	-	2	50	-	50	-	-	-	-	-	N/A
	*ADVANCE SKILL DEVELOPMENT	OPEN ELECTIVE (Certification Course)					-	-	-	-	-	-	-	-	N/A
3.8	SUMMER INTERNSHIP** (4) WEEKS	SUMMER TRAINING	-	-	-	2	-	50	50	-	-	-	-	-	50
#Student Centered Activities			-	-	13	-	-	50	50	-	-	-	-	-	50
Total			**12**	**1**	**23**	**20**	**200**	**220**	**420**	**300**	**-**	**80**	**-**	**380**	**700**

NOTE:-**(Q)** It is compulsory to appear and to pass the examination, but marks will not be included for percentage and division of obtained marks.

* Advance skill development mention at **3.7** in the table provide the scope of selecting the course as per choice from the elective list provided in the syllabus conducted by various agency of repute of duration not less than 20 Hrs (Offline/Online).

** SUMMER INTERNSHIP (4-6 WEEKS) duration to be organized after second semester exam. Evaluation will be in third semester.

Student Centered Activities will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, library, Cultural Activities and self-study etc.

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4th SEMESTER

Sr. No.	SUBJECTS	COURSE TYPE & CATEGORY	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
							INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
			L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
4.1	HAZARDOUS MATERIALS PACKAGING	PROGRAM CORE (THEORY)	2	-	-	2	40	-	40	60	3		-	60	100
4.2	PROGRAM ELECTIVES-2	PROGRAM CORE (THEORY)	2	-	-	2	40	-	40	60	3	-	-	60	100
4.3	PRINTING TECHNOLOGY	PROGRAM CORE (THEORY)	3	-	-	3	40	-	40	60	3		-	60	100
4.4	PACKAGING DESIGN & ERGONOMICS	PROGRAM CORE (PRACTICUM)	2	-	2	3	40	-	40	60	3	-	-	60	100
4.5	PLASTICS TESTING	PROGRAM CORE (PRACTICUM)	2	-	4	4	-	40	40	60	3	-	-	60	100
4.6	LAMINATION AND FUNCTIONAL COATING	PROGRAM CORE (PRACTICUM)	2	-	4	4	-	40	40	60	3	-	-	60	100
4.7	OPEN ELECTIVE-II	OPEN ELECTIVE (THEORY)	2	-	-	2	50	-	50	-	-	-	-	-	Qualifying
	ADVANCED SKILL CERTIFICATION-II	OPEN ELECTIVE (Certification Course)					-	-	-	-	-	-	-	-	Qualifying
4.8	**ESSENCE OF INDIAN KNOWLEDGE AND TRADITION (Q)	AUDIT COURSE	1	-	-	-	50	-	50	-	-	-	-	-	-
	#STUDENT CENTERED ACTIVITIES	-	-	-	10	-	-	50	50	-	-	-	-	-	50
Total			**16**	**0**	**20**	**20**	**240**	**170**	**510**	**360**	**18**	**80**	**6**	**380**	**650**

NOTE: - (**Q**) It is compulsory to appear and to pass the examination, but marks will not be included for percentage and division of obtained marks.

* Advance skill development mention at **4.7** in the table provide the scope of selecting the course as per choice from the elective list provided in the syllabus conducted by various agency of repute of duration not less than 20 Hrs (Offline/Online).

** SUMMER INTERNSHIP (4-6 WEEKS) duration to be organized after fourth semester exam. Evaluation will be in fifth semester.

Student Centered Activities will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, library, Cultural Activities and self-study etc.

5th SEMESTER

Sr. No.	SUBJECTS	COURSE TYPE & CATEGORY	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
							INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
			L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
5.1	ADDITIVE MANUFACTURING	PROGRAM CORE (PRACTICUM)	2	-	4	4	-	40	40	60	3	-	-	60	100
5.2	COMPUTER AIDED DESIGN & DRAFTING	PROGRAM CORE (PRACTICUM)	2	-	2	3	40	-	40	60	3	-	-	60	100
5.3	PROGRAM ELECTIVES-3	PROGRAM CORE (THEORY)	3	-	-	3	40	-	40	60	3	-	-	60	100
5.4	EMERGING TRENDS IN PACKAGING TECHNOLOGY	PROGRAM CORE (THEORY)	2	1	0	3	40	-	40	60	3	-	-	60	100
5.5	PACKAGING LAWS, STANDARDS, AND REGULATIONS	PROGRAM CORE (THEORY)	2	1	0	3	40	-	40	60	3	-	-	60	100
5.6	**(Q)** OPEN ELECTIVE-3 **OR**	OPEN ELECTIVE-3*	1	-	3	2	-	50	50	-	-	-	-	-	N/A
	*ADVANCE SKILL DEVELOPMENT	OPEN ELECTIVE					-	-	-	-	-	-	-	-	N/A
5.7	INDIAN CONSTITUTION	AUDIT COURSE	2	-	-	-	50	-	50	-	-	-	-	-	N/A
5.8	SUMMER INTERNSHIP**	SUMMER TRAINING	-	-	-	2	-	60	60	-	-	40	3	40	100
	#Student Centered Activities	-	-	-	11	-		50	50	-	-	-	-	-	50
Total			**14**	**2**	**20**	**20**	**250**	**220**	**470**	**300**	**15**	**80**	**9**	**380**	**650**

NOTE- * skill development mention at **5.6** in the table provide the scope of selecting the course as per choice from the elective list provided in the syllabus conducted by various agency of repute of duration not less than 20 Hrs (Offline/Online). Assessment of this course will be done define by the Polytechnic (In case conducted at institute level) or the course conducting agency.

** Students will present a seminar/viva on their summer internship/ ADVANCE SKILL CERTIFICATION along with certificate, project and report.

Student Centered Activities will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, library, Cultural Activities and self-study etc.

6th SEMESTER

(NORMAL PATHWAY)

Sr. No.	SUBJECTS	COURSE TYPE & CATEGORY	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
							INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
			L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
6.1	ENTREPRENEURSHIP AND START-UP	HUMANITIES AND SOCIAL SCIENCE	2	-	-	2	40	-	40	60	3	-	-	60	100
6.2	ELECTIVE (PATHWAY)	PROGRAM CORE (THEORY)	3	-	-	3	40	-	40	60	3	-	-	60	100
6.3	ELECTIVE (SPECIALISATION)	PROGRAM CORE (PRACTICUM)	2	-	2	3	-	60	60	-	-	40	-	40	100
6.4	IN-HOUSE PROJECT	PROJECT	4	-	16	12	-	240	240	-	-	160	-	160	400
	#Student Centered Activities		-	-	06	-	-	50	50	-	-	-	-	-	50
Total			**11**		**25**	**20**	**80**	**350**	**430**	**120**	**-**	**200**	**-**	**320**	**750**

Student Centered Activities will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, library, Cultural Activities and self-study etc.

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6th SEMESTER

(INDUSTRIAL PATHWAY)

Sr. No.	SUBJECTS	COURSE TYPE & CATEGORY	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
							INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
			L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
6.1	ENTREPRENEURSHIP AND START-UP (Online Mode)	HUMANITIES AND SOCIAL SCIENCE	-	-	-	2	-	-	-	100	3	-	-	100	100
6.2	INDUSTRIAL HANDS-ON PRACTICE	INDUSTRIAL	-	-	-	12	150*			200**					350
6.3	INDUSTRIAL PROJECT	INDUSTRIAL	-	-	-	4	50*			50**					100
6.4	SEMINAR	IN-HOUSE	-	-	-	2	-	-	100	-	-	-	-	-	100
Total			-	-	-	**20**	-	-	**300**	**-**	**-**	**-**	**-**	**350**	**650**

NOTE: - 1) The industrial training tenure should not be less than 4 months

2) "ENTREPRENEURSHIP AND START-UP" course is mandatory in industrial training option. It will be taught in contact mode by his/her polytechnic institute. After completion the online course, student must appear for a separate exam conducted by Board of Technical Education, Lucknow.

3) In industrial training option student must attend a seminar at his/her polytechnic institute after training to ern 2 credit.

4) Monthly progress report attested by industrial authority must be submitted during industrial training.

5) The industrial unit must evaluate student using the format provided by polytechnic, in both credits and marks.

6)"Entrepreneurship and Start-up" course is also mandatory in Industrial internship/training mode. It will be conducted online mode by his/her polytechnic institute. After completing the online course, students must appear for exam conducted by the Board of Technical Education, Lucknow.

7)***Evaluation by faculty mentor:-**

The institute will depute one faculty member for mentoring at least 20-30 students undertaking apprenticeship training. Such mentors will monitor, guide and provide counselling to the students as and when required. Faculty mentor of the institute(s) may make a surprise visit to the internship/apprenticeship site to check the student's presence physically. (The Proforma of the evaluation is attached as the Annexure -1)

8)** **Evaluation by industry:-** The industry shall assess the candidates based on the following parameters attendance, discipline and punctuality, familiarity of tools and material, engineering skills, application of knowledge and problem-solving skills, comprehension and observation, professional ethics, safety and environmental consciousness, communication skills, supervisory skills and general conduct during the period (The Proforma of the evaluation is attached as the Annexure -2)

9)**# Evaluation through seminar presentation/Viva-Voce at the institute :-** The student will give a seminar based on his training report, before an expert committee constituted by the concerned department as per norms of the institute. The evaluation will be based on the following criteria:

OPEN ELECTIVE-1

SR.NO.	(Q) THEORY COURSES NAME
1.	PROJECT MANAGEMENT
2.	DISASTER MANAGEMENT
**********	
SR.NO.	***CERTIFICATE COURSES**
1.	COURSES CONDUCTED BY CENTRE OF EXCELLENCE (ESTABLISHED BY THIRD PARTY AS: - TATA TECHNOLOGIES. etc)
2.	COURSES CONDUCTED BY INFOSYS PRINGBOARD
3.	COURSES CONDUCTED BY TCS ION
4.	COURSES CONDUCTED BY OTHER RELEVANT GOVERNMENT, INTERNATIONAL/NATIONAL ORGANIZATION OR PLATFORMS OF REPUTE
5.	COURSES CONDUCTED BY AICTE-ELIS AND CENTRALLY FUNDED TECHNICAL INSTITUTES
6.	COURSES CONDUCTED BY C-DAC
7.	COURSES CONDUCTED BY NEILIT

OPEN ELECTIVE -2

SR.NO.	(Q) THEORY COURSES NAME
1.	INDUSTRIAL ROBOTICS & AUTOMATION
2.	INTERNET OF THINGS
**********	
SR.NO.	***CERTIFICATE COURSES**
1.	COURSES CONDUCTED BY CENTRE OF EXCELLENCE (ESTABLISHED BY THIRD PARTY AS: - TATA TECHNOLOGIES. etc)
2.	COURSES CONDUCTED BY INFOSYS PRINGBOARD
3.	COURSES CONDUCTED BY TCS ION
4.	COURSES CONDUCTED BY OTHER RELEVANT GOVERNMENT, INTERNATIONAL/NATIONAL ORGANIZATION OR PLATFORMS OF REPUTE
5.	COURSES CONDUCTED BY AICTE-ELIS AND CENTRALLY FUNDED TECHNICAL INSTITUTES
6.	COURSES CONDUCTED BY C-DAC
7.	COURSES CONDUCTED BY NEILIT

OPEN ELECTIVE-3

SR. NO.	SUBJECT NAME
1	SOLID WASTE MANAGEMENT
2	RECYCLING OF PACKAGING MATERIAL
**********	
SR.NO.	***CERTIFICATE COURSES**
1.	COURSES CONDUCTED BY CENTRE OF EXCELLENCE (ESTABLISHED BY THIRD PARTY AS: - TATA TECHNOLOGIES. etc)
2.	COURSES CONDUCTED BY INFOSYS PRINGBOARD
3.	COURSES CONDUCTED BY TCS ION
4.	COURSES CONDUCTED BY OTHER RELEVANT GOVERNMENT, INTER-NATIONAL/NATIONAL ORGANIZATION OR PLATFORMS OF REPUTE
5.	COURSES CONDUCTED BY AICTE-ELIS AND CENTRALLY FUNDED TECHNICAL INSTITUTES
6.	COURSES CONDUCTED BY C-DAC
7.	COURSES CONDUCTED BY NEILIT

PROGRAM ELECTIVE-1

SR. NO.	SUBJECT NAME
1	INTRODUCTION TO CERAMIC ENGINEERING
2	INTRODUCTION TO PAPER TECHNOLOGY

PROGRAM ELECTIVE-2

SR. NO.	SUBJECT NAME
1	ANCILLARY PACKAGING MATERIALS
2	FLEXIBLE PLASTIC PACKAGING

PROGRAM ELECTIVE-3

SR. NO.	SUBJECT NAME
1	METAL AND GLASS PACKAGING
2	PHARMACUTICAL AND COSMETIC PACKAGING

ELECTIVE (PATHWAY)

SR. NO.	SUBJECT NAME
1	EXPORT PACKAGING
2	LOGISTIC & SUPPLYCHAIN MANAGEMENT

ELECTIVE (SPECIALISATION)

SR. NO.	SUBJECT NAME
1	PACKAGING MACHINERY AND AUTOMATION
2	STRATEGIC BRANDING AND PACKAGING

GUIDELINES FOR ASSESMENTS OF STUDENT CENTERED ACTIVITIES (SCA)

It was discussed and decided that the maximum marks for SCA should be 50 as it involves a lot of subjectivity in the evaluation. The marks may be distributed as follows:

i. 15 Marks for general behaviour and discipline
(by HODs in consultation with all the teachers of the department)

ii. 10 Marks for attendance as per following:
(by HODs in consultation with all the teachers of the department)

a)	75 - 80%	6 Marks
b)	80 - 85%	8 Marks
c)	Above 85%	10 Marks

iii. * Even Semester:
25 Marks maximum for Sports/NCC/Cultural/Co-curricular/NSSactivities as per following: (by In-charge Sports/NCC/Cultural/Co-curricular/NSS)

a) State/National Level participation
b) Participation in two of above activities
c) Inter-Polytechnic level participation

****Odd Semester:**

25 Marks maximum

a) Language Lab Practices
b) Group Discussion and Personality Development
c) Industrial Visits/Industrial Talks
d) Power Point Presentations and Resume Making
e) Development of Aptitude and Reasoning Skills
f) Participation in the technical Exhibitions, Symposiums, Seminars,
g) Workshops at the Institute /District/State/National Level.

3.1	PAPER PACKAGING TECHNOLOGY (PRACTICUM)	L T P 2 0 2

COURSE

OBJECTIVES:

The subject gives the students the knowledge of working of individual paper and paperboard packaging materials, their properties, manufacturing, testing, and applications, while also addressing sustainability and innovations them in designing effective and eco-friendly packaging solutions.

COURSE OUTCOMES (CO):

It is important to teach theory and conduct practical exercises in a way that enables students to exhibit the following course results by gaining various learning outcomes in the cognitive, psychomotor, and affective domains. The ability for students to:

CO1: Explain the fundamentals of paper fibres, pulping methods, and evaluate strength properties such as tensile, burst, tear, and absorbency.

CO2: Demonstrate understanding of pulp processing techniques including refining, bleaching, and stock preparation, and analyze their effect on paper quality.

CO3: Describe the working of paper making machines and analyze parameters such as fibre orientation, MD:CD ratio, and drying processes.

CO4: Explain calendaring, finishing, and recycling processes, and evaluate their impact on paper properties and sustainability.

CO5: Analyze different types of paper for printing applications and evaluate their physical, optical, surface, and printability characteristics.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	1	-	-	-	-	-	*	*
CO2	3	2	-	2	-	-	-	*	*
CO3	3	3	2	2	-	-	-	*	*
CO4	2	2	2	2	2	-	-	*	*
CO5	2	3	3	3	1	-	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)
***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS:

UNIT I: FUNDAMENTALS OF PAPER AND FIBERS PROBLEMS (05 periods)

Introduction to paper fibres: strength, durability, absorbency, dimensional stability, basics of paper manufacture, pulp preparation, mechanical pulp, refiner mechanical pulp, thermo-mechanical pulp, chemical processes – sulphate (Kraft process), sulphite process, combined chemical & mechanical process.

Ex. No.	Name of Experiment	Periods
1.	To Evaluate Water Absorbency of Paper and paperboard	2
2.	To determine burst strength of paper and paperboard	2
3.	To evaluate tear strength of paper and paperboard	2
4.	To evaluate tensile properties of paper and paperboard	2

UNIT II: PULP PROCESSING AND BLEACHING PROBLEMS (04 periods)

stock preparation, non-fibrous additives, fillers or loading, refining, pulp freeness, refiners, pulp cleaning, bleaching processes and their importance in paper quality.

Ex. No.	Name of Experiment	Periods
1.	Preparation of pulp suspension (stock) from raw pulp	2
2.	Study of pulp refining process and its effect on fibre properties	2
3.	Study of bleaching process of pulp and its effect on brightness	2

UNIT III: PAPER MANUFACTURING PROCESS PROBLEMS (04 periods)

Paper making machine – wet-end, head box and slice, fibre orientation, angular flow, MD:CD ratio, wire section and forming wires, press and drier sections.

Ex. No.	Name of Experiment	Periods
1.	Study of paper making process using laboratory sheet forming (hand sheet making)	2
2.	Study of press and dryer section and its effect on water removal	2
3.	Study of fibre orientation and determination of MD:CD ratio	2

UNIT IV: CALENDARING, FINISHING AND RECYCLING PROBLEMS

(08 periods)

Calendaring – hard calendaring, soft nip calendaring, super calendaring, machine glazing, paper coatings and finishing processes, paper recycling – importance, benefits and problems, recycling process – fibre preparation, screening, centrifugal cleaning, flotation, washing, deinking plant function, continuous drum pulper, pre-screening, cleaning, flotation stages, dispersing, brightness control, thickening and storage.

Ex. No.	Name of Experiment	Periods
1.	Study of paper recycling process	2

UNIT V: PROPERTIES OF PAPER FOR PRINTING PROBLEMS (07 periods)

Specialty papers and their characteristics, printing process requirements, paper varieties for printing, influence of moisture and RH on paper and boards, paper storage requirements and variables, print quality achievable on different paper types, measurement and calculations – paper sizes Printability and runnability, physical properties, surface properties, printing defects, internal bond strength, strength properties, optical properties, barrier properties.

Ex. No.	Name of Experiment	Periods
1.	Determination of brightness and opacity of paper	2
2.	Evaluation of surface strength of paper by Wax Pick test	2
3.	Measurement of smoothness, softness and porosity of paper	2

INSTRUCTIONAL STRATEGY:

Paper-based packaging technology plays a vital role in the packaging industry. Adequate competency needs to be developed by providing sufficient practical exposure to paper manufacturing, processing, testing of physical, mechanical, barrier, optical, and surface properties, and evaluation of printing and converting processes. Laboratory work should include hands-on testing of paper and paperboard. An industrial visit may be conducted to expose students to paper mills, corrugated board units, and printing/finishing facilities to understand the real-time working of equipment and processes.

TEXT AND REFERENCE BOOKS:

1. Handbook of Paper and Paperboard Packaging Technology, Mark J. Kirwan Publisher: Wiley Blackwell.
2. Fundamentals of Packaging Technology-Fourth Edition Perfect Paper back Soroka (Author).
3. Institute of Packaging Professionals; 4 Edition (21 January 2010)
4. Pulp & Paper Technology: Technology, Testing & Applications

SUGGESTED DISTRIBUTION OF MARKS

Unit No.	Time Allotted (Periods)	Marks Allotted (%)
1	**5**	**20**
2	**4**	**10**
3	**4**	**20**
4	**8**	**25**
5	**7**	**25**
Total	**28**	**100**

3.2	PLASTICS PROCESSING TECHNIQUES (THEORY)	L	T	P
		2	0	0

COURSE OBJECTIVE:

This course is designed to develop understanding of the major plastics processing techniques used in industry, with emphasis on injection moulding, extrusion, blow moulding, compression moulding and thermoforming. It enables students to learn the principles of operation, machine components, process parameters, materials used, associated printing techniques, common defects and their remedies. The course aims to build the theoretical foundation required for selection, operation and control of suitable plastics processing methods for manufacturing different products.

COURSE OUTCOMES (CO):

After undergoing this course, the students will be able to:

CO1: Explain the principles, machine parts, process parameters and defects related to injection moulding.
CO2: Describe extrusion processes, extruder components, screw design, product applications and trouble-shooting in extrusion.
CO3: Explain blow moulding techniques, parison formation methods, materials used and defects with remedies in blow moulding.
CO4: Describe the principles, materials, moulds, methods and applications of compression moulding and thermoforming.
CO5: Identify suitable plastics processing and printing techniques for different products based on process requirements and applications.

COURSE ARTICULATION MATRIX (CAM):

CO No.	**PO1** Basic and Discipline Specific Knowledge	**PO2** Problem Analysis	**PO3** Design / Development of Solutions	**PO4** Engineering Tools	**PO5** Practice for Society, Sustainability and Environment	**PO6** Project Management	**PO7** Life-long Learning	**PSO 1**	**PSO 2**
CO1	3	2	-	2	-	-	-	*	*
CO2	3	3	-	2	-	-	2	*	*
CO3	3	2	3	2	-	-	-	*	*
CO4	3	2	2	-	-	-	-	*	*
CO5	3	2	2	-	-	-	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)
***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS:

UNIT I: INJECTION MOULDING (08 Periods)

Basic concept of injection moulding: hand injection, semi-automatic injection moulding machines (vertical and horizontal) and their features. Automatic injection moulding machine and its various parts such as hopper, screw, barrel, heating devices, clamping unit etc. Injection moulding process and process control, machine parameters, shot capacity, injection pressure, injection speed, daylight, limit switch etc. Basic concept of injection cycle. Faults and remedies in injection moulding process such as short shot, shrink mark, weld line, parting line, flash etc.

UNIT II: EXTRUSION (08 Periods)

Introduction to extrusion process. Different types of extruders: single screw extruder, twin screw extruder and vented barrel extruder. General principles of operation, die swell, function of various parts such as barrel, screw, screen pack, die and breaker plate. Types of screws used for processing different plastics. Feed zone, compression zone, metering zone and die zone. L/D ratio and its significance. Blown film extrusion: nip rolls, bubble casing, winding equipment, cutting devices, stretching and orientation. Extrusion of pipes, wires and cables, sheets and filaments. Printing techniques: flexographic printing, gravure printing, pad printing, screen printing and hot stamping. Faults and remedies in extrusion process.

UNIT III: BLOW MOULDING (06 Periods)

Basic principles of blow moulding. Types of blow moulding: extrusion blow moulding and injection blow moulding. Blow moulding of irregular containers. Materials for blow moulding. Production of parison by extrusion and injection process. Parison wall thickness control. Newer concepts including extrusion stretch blow moulding, injection stretch blow moulding and multilayer moulding. Faults and remedies in blow moulding process.

UNIT IV: COMPRESSION MOULDING (03 Periods)

Introduction, general principle and working of compression moulding. Types of compounds used in compression moulding such as SMC and DMC compounds. Types of moulds used in compression moulding. Applications of compression moulding.

UNIT IV: THERMOFORMING (03 Periods)

Introduction, Basic principles and various methods of thermoforming: straight forming, free forming, plug assist forming, drape forming, matched die forming and reverse draw forming. Limitations and advantages of thermoforming. General materials used for thermoforming. Applications of thermoforming.

INSTRUCTIONAL STRATEGY

This subject should be taught with the help of available teaching aids, charts, models and process videos to develop conceptual clarity of various plastics processing techniques. Emphasis should be given on industrial relevance of injection moulding, extrusion, blow moulding, compression moulding and thermoforming. Students should be taken for industrial visits to units having injection moulding, extrusion and blow moulding operations so that they can observe machine parts, process parameters, products and defects in actual industrial practice.

RECOMMENDED BOOKS:

1. *Injection Moulding Theory and Practice* — Rubin, Irvin
2. *Plastics Processing Technology* — Edward A. Muccio
3. *Plastic Materials and Processing* — Brent Strong
4. *Plastic Engineering Handbook* — Society of Plastic Industry Inc.
5. *Plastic Processing Data Handbook* — D.V. Rosato
6. E-books / e-tools / relevant software as recommended by AICTE / SWAYAM / BTE / NITTTR, Chandigarh

SUGGESTED DISTRIBUTION OF MARKS:

Unit No.	Time Allotted (Periods)	Marks Allotted (%)
1	08	29
2	08	29
3	06	21
4	03	11
5	03	10
Total	**28**	**100**

3.3	FOOD PACKAGING (PRACTICUM)	L T P
		2 0 2

COURSE OBJECTIVES:

This course is designed to develop practical and applied understanding of materials, methods and technologies used in food packaging for preserving safety, quality and shelf life of food products. It enables students to study product-package interactions, selection of suitable packaging materials, modern packaging systems, labelling requirements, quality evaluation and recent innovations in food packaging. The course also aims to build competency in designing cost-effective, sustainable and regulation-compliant packaging solutions for different categories of food products.

COURSE OUTCOMES (CO):

It is important to teach theory and conduct practical exercises in a way that enables students to exhibit the following course outcomes by gaining various learning outcomes in cognitive, psychomotor and affective domains. Students will be able to:

CO1: Identify and select suitable packaging materials for different food products based on quality, safety and shelf-life requirements.
CO2: Apply appropriate food packaging methods and technologies for solid, semi-solid and liquid food products.
CO3: Evaluate food packaging systems with respect to regulations, labelling requirements and sustainability considerations.

CO4: Perform quality assessment and testing of packaging materials and finished food packs.

CO5: Analyze food packaging challenges and suggest suitable solutions to reduce spoilage, improve product appeal and enhance cost-effectiveness.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design / Development of Solutions	PO4 Engineering Tools	PO5 Practice for Society, Sustainability and Environment	PO6 Project Management	PO7 Lifelong Learning	PSO1	PSO2
CO1	3	2	-	2	2	-	-	*	*
CO2	3	2	3	2	-	-	-	*	*
CO3	3	3	2	2	3	-	2	*	*
CO4	3	2	-	3	-	-	2	*	*
CO5	3	3	3	2	2	-	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENT:

UNIT I: INTRODUCTION TO FOOD PACKAGING (06 Periods)

Importance and functions of packaging in the food industry, characteristics of food products, product-package interactions, diffusion, permeation, types of contamination and spoilage, shelf-life considerations, overview of packaging regulations such as FSSAI, FDA and WHO.

Ex. No.	Name of Experiment	Periods
1.	Study different functions and roles of food packaging using market samples of food products.	2
2.	Identify product-package interactions, contamination sources and spoilage factors in selected food packages.	2

UNIT II: PACKAGING MATERIALS AND THEIR APPLICATIONS (05 Periods)

Materials used in food packaging such as paper, plastics, glass, metal, laminates and bio-based materials. Barrier properties including moisture, gas and light barrier. Compatibility and migration issues. Selection criteria for packaging materials based on product sensitivity and stability.

Ex. No.	Name of Experiment	Periods
3.	Examine and classify different food packaging materials such as paper, plastic, glass, metal, laminates and bio-based materials.	2
4.	Compare barrier properties of selected packaging materials for moisture, gas and light sensitivity.	2

UNIT III: FOOD PACKAGING TECHNIQUES AND SYSTEMS (5 Periods)

Packaging for solid, semi-solid and liquid foods. Modified Atmosphere Packaging (MAP), vacuum packaging, aseptic packaging, retort packaging, tetra packs and flexible pouches, active and intelligent packaging, microwaveable and freezer-safe packaging.

Ex. No.	Name of Experiment	Periods
5.	Study packaging methods used for solid, semi-solid and liquid foods with suitable examples.	2
6.	Compare vacuum packaging, MAP, aseptic packaging and retort packaging through case studies or market samples.	2

UNIT VI: PACKAGING DESIGN AND LABELLING (6 Periods)

Packaging design principles for food products, labelling requirements, regulatory compliance and claims, graphics, consumer appeal and branding, traceability, eco-friendly and sustainable design considerations.

Ex. No.	Name of Experiment	Periods
7.	Study mandatory labelling requirements on different packaged food products.	2
8.	Design a label for a selected food product incorporating statutory and regulatory requirements.	2

UNIT V: QUALITY, TESTING AND INNOVATIONS IN FOOD PACKAGING

(6 Periods)

Quality control tests for packaging materials and finished packs, barrier testing, mechanical strength, leak tests, shelf-life evaluation, emerging technologies such as smart, intelligent and active packaging, innovations in biodegradable and recyclable packaging, future trends in food packaging.

Ex. No.	Name of Experiment	Periods
9.	Conduct leak test / seal integrity assessment on selected food packages.	2
10.	Study mechanical strength and barrier-related quality parameters of food packaging materials.	2

TEXT BOOKS / REFERENCE BOOKS:

1. *Food Packaging: Principles and Practice* — Gordon L. Robertson, CRC Press
2. *Handbook of Food Packaging* — Frank A. Paine, CRC Press
3. *Food Packaging Technology* — Richard Coles and Mark J. Kirwan, Blackwell Publishing
4. *Innovative Food Packaging: Techniques, Materials, and Applications* — Jung H. Han, Elsevier
5. *Food Science* — N.N. Potter, CBS Publishers & Distributors
6. *Food Packaging Science and Technology* — Dong Sun Lee, Wiley-Blackwell
7. E-books / e-tools / relevant software as recommended by AICTE / SWAYAM / BTE / NITTTR, Chandigarh

Website for Reference: SWAYAM

INSTRUCTIONAL STRATEGY:

This course should be delivered through lectures, discussions, case studies, practical demonstrations, assignments, field visits and project-based learning to develop conceptual understanding and applied skills in food packaging. Students should be encouraged to observe packaging materials, packaging systems, labelling practices and quality testing methods used in the food industry. Exposure to practical examples and market samples should be provided to strengthen their ability to design innovative, safe and sustainable food packaging solutions.

SUGGESTED DISTRIBUTION OF MARKS:

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	06	10
2	05	15
3	05	25
4	06	25
5	06	25
Total	**28**	**100**

3.4.1	INTRODUCTION TO CERAMIC ENGINEERING (THEORY)	L T P
		2 0 0

COURSE OBJECTIVE:

This course is designed to provide fundamental knowledge of ceramic materials, their structure, properties, processing methods and applications. It introduces ceramic raw materials, fabrication techniques, phase behaviour, and characterization methods, with emphasis on understanding the relationship between microstructure and properties. The course aims to develop the ability to identify, evaluate and select ceramic materials for engineering, industrial and advanced technological applications.

COURSE OUTCOMES (CO):

After undergoing this course, the students will be able to:

CO1: Explain the fundamental structure, composition and classification of ceramic materials.
CO2: Describe various raw materials, processing routes and fabrication techniques used in ceramic manufacturing.
CO3: Analyze the relationship between microstructure, properties and performance of ceramic materials.
CO4: Evaluate thermal, mechanical, electrical and chemical behaviour of ceramics for engineering applications.
CO5: Select suitable ceramic materials for traditional, advanced and sustainable industrial applications.

COURSE ARTICULATION MATRIX (CAM):

CO No.	**PO1** Basic and Discipline Specific Knowledge	**PO2** Problem Analysis	**PO3** Design / Development of Solutions	**PO4** Engineering Tools	**PO5** Practice for Society, Sustainability and Environment	**PO6** Project Management	**PO7** Lifelong Learning	**PSO1**	**PSO2**
CO1	3	2	-	2	-	-	-	*	*
CO2	3	2	2	2	-	-	-	*	*
CO3	3	3	2	2	-	-	2	*	*
CO4	3	3	-	2	-	-	2	*	*
CO5	3	2	3	2	2	-	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)
***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS:

UNIT I: BASICS OF CERAMICS (05 Periods)

Definition, history and scope of ceramics. Classification of ceramics: traditional and advanced ceramics. Atomic structure and bonding in ceramics including ionic, covalent and mixed bonding. Crystal structures of ceramic materials. Amorphous ceramics and glasses.

UNIT II: RAW MATERIALS AND PROCESSING (06 Periods)

Natural and synthetic raw materials for ceramics. Powder preparation including crushing, grinding, milling and mixing. Forming methods such as dry pressing, isostatic pressing, slip casting, extrusion and injection moulding. Drying and sintering processes. Role of additives and binders.

UNIT III: PROPERTIES OF CERAMICS (05 Periods)

Mechanical properties including hardness, brittleness and strength. Thermal properties such as thermal conductivity, thermal expansion and refractory behaviour. Electrical and magnetic properties of ceramics. Optical properties including transparency and opacity. Corrosion and chemical resistance.

UNIT IV: TYPES AND APPLICATIONS OF CERAMICS (08 Periods)

Traditional ceramics including clay products, refractories, cements and glass. Advanced ceramics such as alumina, zirconia, silicon carbide and silicon nitride. Bio-ceramics and their applications. Ceramic coatings and composites. Role of ceramics in packaging, electronics, aerospace, medical and structural applications.

UNIT V: MODERN DEVELOPMENTS AND SUSTAINABILITY (04 Periods)

Nanostructured ceramics. Ceramic matrix composites (CMC). Processing techniques such as sol-gel, vapour deposition and additive manufacturing of ceramics. Recycling of ceramic materials. Environmental impact and sustainable ceramic technologies.

INSTRUCTIONAL STRATEGY:

This subject should be taught through lectures, discussions, multimedia presentations, laboratory demonstrations and case studies to develop conceptual understanding of ceramic materials, processing methods, properties and applications. Emphasis should be given to relating ceramic structure and microstructure with their engineering performance and industrial uses.

RECOMMENDED BOOKS:

1. *Engineering Chemistry (Ceramics and Glass Section)* — Jain & Jain, Dhanpat Rai Publishing Company
2. *A Textbook of Material Science* — K.M. Gupta, PHI Learning Pvt. Ltd.
3. *Introduction to Ceramics and Refractories* — N. Ramachandran and A.K. Saha, PHI Learning Pvt. Ltd.
4. *Engineering Materials: Properties and Applications of Metals and Ceramics* — R.K. Rajput, S. Chand & Company
5. E-books / e-tools / relevant software as recommended by AICTE / SWAYAM / BTE / NITTTR, Chandigarh

SUGGESTED DISTRIBUTION OF MARKS:

Unit	Time Allotted (Periods)	Marks Allotted (%)
1	05	15
2	06	20
3	05	20
4	08	30
5	04	15
Total	**28**	**100**

3.4.2	INTRODUCTION TO PAPER TECHNOLOGY (THEORY)	L T P

		2 0 0

COURSE OBJECTIVE:

This course is designed to provide fundamental knowledge of pulp and paper technology with emphasis on the preparation of pulp from wood, non-wood, agro-residue based and recycled fibre raw materials. It introduces basic terminology of the pulp and paper industry, various pulping processes, digesters, process variables, equipment and recycling methods. The course aims to develop understanding of fibre liberation, pulp manufacturing operations, flow sheets of pulping processes and environmentally responsible recycling practices used in the paper industry.

COURSE OUTCOMES (CO):

After undergoing this course, the students will be able to:

CO1: State the basic terms and definitions used in the pulp and paper industry.
CO2: Explain various processes used for manufacturing different types of pulp.
CO3: Draw and interpret flow sheets for major pulping processes.
CO4: Describe the use of different equipment and instruments employed in pulp manufacturing operations.
CO5: Apply segregation, recycling and waste paper treatment processes for cleaner and more sustainable pulp production.

COURSE ARTICULATION MATRIX (CAM):

CO No.	**PO1** Basic and Discipline Specific Knowledge	**PO2** Problem Analysis	**PO3** Design / Development of Solutions	**PO4** Engineering Tools	**PO5** Practice for Society, Sustainability and Environment	**PO6** Project Management	**PO7** Life-long Learning	**PSO1**	**PSO2**
CO1	3	2	-	-	-	-	-	*	*
CO2	3	2	2	2	-	-	-	*	*
CO3	3	3	2	2	-	-	2	*	*
CO4	3	2	-	3	-	-	2	*	*
CO5	3	3	2	2	3	-	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)
***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS:

UNIT I: INTRODUCTION (04 Periods)

Basic definitions and standard terms used in pulp and paper industry. Active alkali, total alkali, total titrable alkali, effective alkali, white liquor, black liquor and green liquor. Sulphidity, causticity and causticizing efficiency.

UNIT II: CHEMICAL PULPING (07 Periods)

Alkaline pulping: Introduction to standard terms used, characteristics of alkaline pulps, batch and continuous pulping process, chemical composition of cooking liquor, blow heat recovery systems, odour emissions and their reasons, process variables.
Sulphite pulping: Introduction to standard terms used, characteristics of sulphite pulping, process variables, factors affecting sulphite pulping, chemical composition and preparation of cooking liquor.

Pulping process for dissolving grade pulp: Pre-hydrolysis of raw material including water pre-hydrolysis and acid pre-hydrolysis, variables affecting pre-hydrolysis, characteristics of pre-hydrolysate, kraft/sulphite pulping of pre-hydrolysed material, yield calculations, determination of moisture in pulp and raw material.

UNIT III: MECHANICAL PULPING (04 Periods)

Mechanical pulping processes, process of fibre separation, stone ground wood process, pulping quality, characteristics and end use of pulp. Refiner mechanical and chemical refiner, mechanical pulping process, theory of refining, process variables, pulp quality. Thermo-mechanical and chemi-thermo-mechanical pulping processes. General principle of RMP, CRMP, TMP and CTMP processes.

UNIT IV: SEMI-CHEMICAL AND CHEMI-MECHANICAL PULPING (04 Periods)

Types of processes, process variables, pulp characteristics and uses, composition of cooking liquor and chemical reactions during treatment, chemical treatments employed.

UNIT IV: WASTE PAPER PULPING (04 Periods)

Fibre separation of waste paper in hydrapulper, deinking of waste paper, various deinking systems including enzymatic deinking, quality of deinked pulp, production of unbleached pulps, process variables, advantages of recycling of waste paper.

UNIT VI: DIFFERENT TYPES OF DIGESTERS (05 Periods)

Batch digesters: rotary and stationary. Continuous digesters: Kamyr and Pandia. Heating methods: direct and indirect methods. Digester room operations such as chip filling, liquor charging, digester relief and blow down operations. Outlines of secondary fibre pulping. Simple calculations based on yield, consistency and other properties. High density storage towers for brown stock.

INSTRUCTIONAL STRATEGY:

This subject should be taught with emphasis on process understanding, equipment operation and practical relevance in pulp and paper manufacturing. The teacher should explain each pulping technique and the use of various equipment employed in different operations with the help of charts, flow diagrams and audio-visual aids. Industrial visits to pulp and paper industries should be organized to provide exposure to actual pulping, digestion, refining and recycling operations.

RECOMMENDED BOOKS:

1. S.A. Rydholm, *Pulping Processes*, Interscience Publishers, 1965
2. G.A. Smook, *Handbook of Pulp and Paper Technologists*, 4th Edition, TAPPI Press, 2016
3. J.P. Casey (Editor), *Pulp and Paper Chemistry and Technology*, 3rd Edition, Vol. I, Wiley, 1980
4. P. Bajpai, *Biermann's Handbook of Pulp and Paper*, 3rd Edition, Vol. I, Elsevier, 2018
5. E-books / e-tools / relevant software as recommended by AICTE / SWAYAM / BTE / NITTTR, Chandigarh

SUGGESTED DISTRIBUTION OF MARKS:

Unit No.	Time Allotted (Periods)	Marks Allotted (%)
1	04	16

2	07	18
3	04	16
4	04	16
5	04	16
6	05	18
Total	**28**	**100**

3.5	CREATIVE WRITING ((PRACTICUM)	L T P
		2 1 2

COURSE OBJECTIVES:

This course is designed to develop practical writing skills for professional and creative purposes, including job applications, resumes, emails and formal letters. It enables students to learn editing techniques, self-publishing and traditional publishing processes, and the preparation of queries, synopses and cover letters. The course also aims to build the ability to create polished, submission-ready and publication-ready professional and creative written work.

COURSE OUTCOMES (CO):

It is important to teach theory and conduct practical exercises in a way that enables students to exhibit the following course outcomes by gaining various learning outcomes in cognitive, psychomotor and affective domains. Students will be able to:

CO1: Write effective job applications, resumes, formal letters and professional emails.
CO2: Apply self-editing techniques and incorporate feedback to improve writing quality.
CO3: Prepare professional queries, synopses and cover letters for submission to publishers or agents.

CO4: Analyze differences between traditional publishing and self-publishing, and select appropriate strategies.

CO5: Produce polished, publication-ready creative and professional content.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	**PO1** Basic and Discipline Specific Knowledge	**PO2** Problem Analysis	**PO3** Design / Development of Solutions	**PO4** Engineering Tools	**PO5** Practices for Society, Sustainability and Environment	**PO6** Project Management	**PO7** Life Long Learning	**PSO 1**	**PSO 2**
CO1	3	2	2	2	-	-	2	*	*
CO2	3	3	2	2	-	-	2	*	*
CO3	3	2	3	2	-	2	2	*	*
CO4	3	3	2	2	-	2	2	*	*
CO5	3	3	3	2	-	2	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENT:

UNIT I: PROFESSIONAL WRITING SKILLS (05 Periods)

Job applications, resume writing, curriculum vitae preparation, drafting formal and business letters, professional emails, cover letter essentials, tone, clarity, structure, audience awareness and etiquette in professional correspondence.

Ex. No.	**Name of Experiment**	**Periods**
1.	Draft a professional resume tailored to a specific job role.	3
2.	Write a persuasive job application letter for a selected position.	3
3.	Compose professional emails and formal letters for different workplace situations.	3

UNIT II: EDITING TECHNIQUES AND SELF-EDITING (04 Periods)

Importance of editing, self-editing strategies, common grammatical and stylistic errors, sentence clarity, paragraph coherence, voice and tone consistency, incorporating peer and mentor feedback, polishing work for readability and impact.

Ex. No.	**Name of Experiment**	**Periods**
4.	Perform self-editing on a given draft to improve grammar, structure and style.	3
5.	Conduct peer review and provide constructive feedback on classmates' writing.	3

UNIT III: WRITING FOR SUBMISSION (04 Periods)

Preparing queries, synopses and cover letters for manuscripts, understanding publisher and agent requirements, formatting submissions, pitching ideas effectively and maintaining professionalism in correspondence.

Ex. No.	Name of Experiment	Periods
6.	Prepare an effective query letter for a literary agent or publisher.	3
7.	Write a compelling synopsis for a short story, novel or non-fiction work.	4

UNIT VI: PUBLISHING FUNDAMENTALS (08 Periods)

Traditional publishing process, working with editors and agents, manuscript review, contracts, royalties, marketing, self-publishing options, print-on-demand, e-books, online platforms and promotional strategies.

Ex. No.	Name of Experiment	Periods
8.	Analyze a traditional publishing case study including submission guidelines, contracts and process flow.	2
9.	Develop a self-publishing plan for an e-book or print-on-demand manuscript including formatting, cover concept and basic marketing approach.	2

UNIT V: PRACTICAL APPLICATION AND PORTFOLIO DEVELOPMENT

(07 Periods)

Compiling edited and polished work, creating a submission-ready portfolio, simulating real-world submissions to publishers or agents, professional presentation of work, and strategies for ongoing improvement and career development in writing.

Ex. No.	Name of Experiment	Periods
10.	Compile and present a professional writing portfolio including resume, letters, edited writing samples, query, synopsis and submission documents.	4

TEXT BOOKS / REFERENCE BOOKS:

1. *On Writing Well* — William Zinsser
2. *The Elements of Style* — William Strunk Jr. and E.B. White
3. *Writer's Market 2025* — Robert Lee Brewer
4. *The Complete Guide to Self-Publishing* — Marilyn Ross and Sue Collier
5. *Writing for Publication* — Helen Sword
6. E-books / e-tools / relevant software as recommended by AICTE / SWAYAM / BTE / NITTTR, Chandigarh

INSTRUCTIONAL STRATEGY:

This course should be delivered through lectures, guided writing exercises, editing workshops, peer review sessions and real-world submission projects to develop professional writing, editing and publishing skills. Students should be encouraged to draft, revise and polish different forms of professional and creative writing, and to prepare submission-ready documents and portfolios through continuous practice and feedback.

SUGGESTED DISTRIBUTION OF MARKS:

Unit No.	Time Allotted (Periods)	Marks Allotted (%)
1	05	20
2	04	20

3	04	25
4	08	15
5	07	20
Total	**28**	**100**

3.6	GRAPHIC DESIGN (PRACTICUM)	L T P
		1 0 2

COURSE OBJECTIVES:

This course is designed to enable students to understand the foundational principles of graphics, visual language and design thinking as applied to packaging. The course focuses on developing the ability to apply design elements, colour theory and typography effectively in various packaging contexts. Students gain hands-on experience with current graphic design software relevant to packaging, including vector-, raster- and layout-based tools. The course also aims to build competence in producing packaging artwork such as layouts, labels and branding concepts, and in preparing print-ready and digital design deliverables suitable for packaging production and industry requirements.

COURSE OUTCOMES (CO):

It is important to teach theory and conduct practical exercises in a way that enables students to exhibit the following course outcomes by gaining various learning outcomes in cognitive, psychomotor and affective domains. Students will be able to:

CO1: Identify and apply core graphic design concepts and terminology.
CO2: Use colour, typography and layout effectively in packaging applications.
CO3: Create basic digital designs using professional tools.
CO4: Produce packaging artwork with industry-standard software workflows.
CO5: Deliver print-ready files and present solutions consistent with packaging requirements.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	**PO1** Basic and Discipline Specific Knowledge	**PO2** Problem Analysis	**PO3** Design / Development of Solutions	**PO4** Engineering Tools	**PO5** Practice for Society, Sustainability and Environment	**PO6** Project Management	**PO7** Lifelong Learning	**PSO 1**	**PSO 2**

CO1	3	2	-	2	-	-	2	*	*
CO2	3	2	2	2	-	-	2	*	*
CO3	3	2	3	3	-	-	2	*	*
CO4	3	3	3	3	-	-	2	*	*
CO5	3	3	3	3	-	2	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)
***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENT:

UNIT I: INTRODUCTION TO GRAPHIC DESIGN AND TOOLS (03 Periods)

Introduction to graphic design, types and uses in packaging. Design thinking and visual communication basics. Difference between raster and vector graphics. Overview of key design tools: vector graphics tools such as Adobe Illustrator, Affinity Designer and Inkscape; raster and photo editing tools such as Adobe Photoshop, GIMP and Affinity Photo; UI/UX and layout tools such as Figma, Canva and Adobe Express; and digital painting/illustration tools such as Krita. Understanding workspace, interface and basic toolsets in Canva and Illustrator.

Ex. No.	Name of Experiment	Periods
1.	Installing and exploring user interfaces of Illustrator and Canva.	2
2.	Creating basic shapes, artboards and simple layouts in Illustrator.	2
3.	Drag-and-drop design task in Canva for simple poster/layout.	2

UNIT II: ELEMENTS OF DESIGN AND COLOUR THEORY (03 Periods)

Design elements: line, shape, form, texture and space. Principles of design: balance, contrast, alignment, repetition and hierarchy. Colour theory: colour wheel, harmony, contrast and psychological impact of colour. Colour systems: RGB and CMYK, and their implications for print and digital media.

Ex. No.	Name of Experiment	Periods
4.	Create colour palettes for different product categories.	2
5.	Apply principles of design in sample label layouts.	2
6.	Use colour adjustment tools in Photoshop/GIMP.	2

UNIT III: TYPOGRAPHY AND LAYOUT FOR PACKAGING (02 Periods)

Typography basics: anatomy of type, font categories such as serif, sans serif and script. Type hierarchy, spacing and readability in packaging. Layout principles: grids, alignment, spacing and packaging panels. Mandatory packaging information hierarchy and readability strategies.

Ex. No.	Name of Experiment	Periods
7.	Develop typography pairings for brand identity.	2
8.	Perform layout design exercises using Illustrator and Figma.	2
9.	Apply typography to front and back packaging panels.	1

UNIT IV: BRANDING AND ADVANCED SOFTWARE PRACTICES (02 Periods)

Brand identity design basics: logos, marks and consistency. Logo design workflows and ideation. Advanced concepts in software such as layers, paths, masks and artboards. Export settings for packaging assets and file formats such as AI, EPS, PDF, PNG and JPEG.

Ex. No.	Name of Experiment	Periods
10.	Create a simple logo design in Illustrator/Inkscape.	2
11.	Prepare layered packaging mock-up for a product.	2
12.	Export and save files for print and web use.	1

UNIT V: PRINT-READY ARTWORK AND PACKAGING PROJECTS (04 Periods)

Print-ready artwork essentials: bleed, trim, margin and resolution. Colour proofing, soft proofing and print profiles. Common file issues and troubleshooting before print.

Ex. No.	Name of Experiment	Periods
13.	Build print-ready cardboard box dieline artwork.	2
14.	Design a full label set including front, back, spine and barcode zone.	2
15.	Submit and present a final packaging design project.	2

RECOMMENDED SOFTWARE / TOOLS / BOOKS:

Recommended Software and Tools
Vector Graphics: Adobe Illustrator, Affinity Designer, Inkscape
Photo Editing and Manipulation: Adobe Photoshop, GIMP, Affinity Photo
UI/UX and Web Design: Figma, Sketch, Framer
Digital Painting: Krita
Template-based and Rapid Design: Canva, Adobe Express

Books and Online Resources

1. *Graphic Design School* — David Dabner
2. *Design Elements, Color Fundamentals* — Aaris Sherin
3. Adobe official tutorials (Illustrator / Photoshop / Express)
4. Canva design tutorials
5. E-books / e-tools / relevant software as recommended by AICTE / SWAYAM / BTE / NITTTR, Chandigarh

INSTRUCTIONAL STRATEGY:

The instructional strategy for Graphic Design focuses on a balanced approach combining theory and practical learning. Classroom lectures are used to explain basic concepts of visual communication, design principles, colour, typography and packaging graphics with the help of real packaging examples. Demonstration methods are adopted to introduce graphic design software such as Canva and Illustrator. Practical sessions emphasize hands-on exercises, assignments and mini projects related to packaging design. Case studies and sample analysis are used to develop creative and analytical skills. Continuous assessment and feedback help students improve design quality and industry readiness.

3.7.1	PROJECT MANAGEMENT (THEORY)	L T P
		2 0 0

COURSE OBJECTIVE:

This course is designed to develop understanding of project planning, analysis, evaluation and administration from conceptualization to completion. It introduces students to project life cycle, capital budgeting, financial estimation, risk analysis, project scheduling and network techniques such as CPM and PERT. The course aims to build the ability to evaluate projects from marketing, operational and financial perspectives and to apply time-cost optimization techniques for effective project execution.

COURSE OUTCOMES (CO):

CO1: Understand the importance of projects and their phases.
CO2: Analyze projects from marketing, operational and financial perspectives.
CO3: Evaluate projects using discounting and non-discounting methods.
CO4: Develop network diagrams for planning and execution of a given project.
CO5: Apply crashing procedures for time and cost optimization.

SUGGESTED COURSE ARTICULATION MATRIX (CAM)

CO No.	**PO1** Basic and Discipline Specific Knowledge	**PO2** Problem Analysis	**PO3** Design / Development of Solutions	**PO4** Engineering Tools	**PO5** Practice for Society, Sustainability and Environment	**PO6** Project Management	**PO7** Lifelong Learning	**PSO 1**	**PSO 2**
CO1	3	2	-	-	-	2	2	*	*
CO2	3	3	2	2	-	3	2	*	*
CO3	3	3	2	2	-	3	2	*	*
CO4	3	2	3	2	-	3	2	*	*
CO5	3	3	3	2	-	3	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)
***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS:

UNIT I: CONCEPT OF A PROJECT (04 Periods)

Concept of a project. Classification of projects. Importance of project management. The project life cycle. Establishing project priorities: scope, cost and time. Project priority matrix. Work breakdown structure.

UNIT II: CAPITAL BUDGETING PROCESS (06 Periods)

Planning, analysis, selection, financing, implementation and review. Generation and screening of project ideas. Market and demand analysis. Demand forecasting techniques. Market planning and marketing research process. Technical analysis.

UNIT III: FINANCIAL ESTIMATES AND PROJECTIONS (06 Periods)

Cost of projects. Means of financing. Estimates of sales and production. Cost of production. Working capital requirement and its financing. Profitability. Projected cash flow statement and balance sheet. Break-even analysis.

UNIT IV: BASIC TECHNIQUES IN CAPITAL BUDGETING (06 Periods)

Non-discounting and discounting methods. Pay-back period. Accounting rate of return. Net present value. Benefit-cost ratio. Internal rate of return. Project risk. Social cost-benefit analysis and economic rate of return. Non-financial justification of projects.

UNIT V: PROJECT ADMINISTRATION (06 Periods)

Progress payments, expenditure planning, project scheduling and network planning, use of Critical Path Method (CPM), schedule of payments and physical progress, time-cost trade off. Concepts and uses of PERT. Cost as a function of time. Project Evaluation and Review Technique/cost mechanisms. Determination of least cost duration. Post-project evaluation. Introduction to various project management software.

INSTRUCTIONAL STRATEGY:

This subject should be taught through lectures, problem-solving sessions, case studies and practical illustrations related to project planning and evaluation. The teacher should explain project formulation, financial appraisal, scheduling and network techniques with the help of examples, charts and numerical exercises. Exposure to project management software and real-life project cases should be provided to strengthen understanding of planning, monitoring and control of projects.

REFERENCE BOOKS:

1. *Project Planning, Analysis, Selection, Implementation and Review* — Prasanna Chandra, Tata McGraw Hill
2. *Project Management: The Managerial Process* — Clifford F. Gray and Erik W. Larson, McGraw Hill
3. *Project Management* — David I. Cleland, McGraw Hill International Edition, 1999
4. *Project Management* — Gopala Krishnan, Macmillan India Ltd.
5. *Project Management* — Harry Maylor, Pearson Publication
6. E-books / e-tools / relevant software as recommended by AICTE / SWAYAM / BTE / NITTTR, Chandigarh

SUGGESTED DISTRIBUTION OF MARKS:

Unit No.	Time Allotted (Periods)	Marks Allotted (%)
1	04	12
2	06	22
3	06	22
4	06	22
5	06	22
Total	**28**	**100**

3.7.2	DISASTER MANAGEMENT (THEORY)	L T P
		2 0 0

COURSE OBJECTIVE:

This course is designed to develop understanding of various types of natural and man-made disasters, their causes, consequences and control measures. It introduces students to pre-disaster, during-disaster and post-disaster management strategies, institutional frameworks and disaster management practices in India. The course also aims to build awareness of technological tools and scientific approaches used in disaster risk reduction, preparedness, response and rehabilitation.

COURSE OUTCOMES (CO):

After undergoing this course, the students will be able to:

CO1: Explain the basic concepts and types of disasters.
CO2: Describe precautions, preparedness measures and awareness related to various disasters.
CO3: Identify the immediate actions to be taken during different disaster situations.
CO4: Explain the disaster management framework and institutional mechanisms in India.
CO5: Select suitable science and information technology tools used in disaster management.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	**PO1** Basic and Discipline Specific Knowledge	**PO2** Problem Analysis	**PO3** Design / Development of Solutions	**PO4** Engineering Tools	**PO5** Practice for Society, Sustainability and Environment	**PO6** Project Management	**PO7** Lifelong Learning	**PSO 1**	**PSO 2**
CO1	3	2	-	-	2	-	2	*	*
CO2	3	2	2	-	3	-	2	*	*
CO3	3	3	2	2	3	-	2	*	*
CO4	3	2	-	2	2	2	2	*	*
CO5	3	2	2	3	2	-	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)
***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS:

UNIT I: UNDERSTANDING DISASTER **(04 Periods)**

Understanding the concepts and definitions of disaster, hazard, vulnerability, risk and capacity. Disaster and development, and disaster management.

UNIT II: TYPES, TRENDS, CAUSES, CONSEQUENCES AND CONTROL OF DISASTERS

(06 Periods)

Geological disasters such as earthquakes, landslides, tsunami and mining disasters. Hydro-meteorological disasters such as floods, cyclones, lightning, thunderstorms, hail storms, avalanches, droughts, cold waves and heat waves. Biological disasters such as epidemics, pest attacks and forest fire. Technological disasters such as chemical, industrial, radiological and nuclear disasters. Man-made disasters such as building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemical and biological disasters. Global disaster trends, emerging risks of disasters, climate change and urban disasters.

UNIT III: DISASTER MANAGEMENT CYCLE AND FRAMEWORK

(06 Periods)

Disaster management cycle and paradigm shift in disaster management. Pre-disaster: risk assessment and analysis, risk mapping, zonation and micro zonation, prevention and mitigation of disasters, early warning system, preparedness, capacity development and awareness. During disaster: evacuation, disaster communication, search and rescue, emergency operation centre, incident command system, relief and rehabilitation. Post-disaster: damage and needs assessment, restoration of critical infrastructure, early recovery, reconstruction and redevelopment. IDNDR, Yokohama Strategy and Hyogo Framework of Action.

UNIT IV: DISASTER MANAGEMENT IN INDIA (06 Periods)

Disaster profile of India, mega disasters of India and lessons learnt. Disaster Management Act, 2005. Institutional and financial mechanism. National Policy on Disaster Management. National guidelines and plans on disaster management. Role of government at local, state and national level, non-government and inter-governmental agencies.

UNIT V: APPLICATIONS OF SCIENCE AND TECHNOLOGY FOR DISASTER MANAGEMENT

(06 Periods)

Geo-informatics in disaster management including remote sensing, GIS and GPS. Disaster communication system including early warning and its dissemination. Land use planning and development regulations. Disaster-safe designs and constructions. Structural and non-structural mitigation of disasters. Science and technology institutions for disaster management in India.

INSTRUCTIONAL STRATEGY:

This subject should be taught through lectures, discussions, case studies, audio-visual presentations and examples of past disasters to develop awareness and understanding of disaster management practices. The teacher should explain pre-disaster preparedness, emergency response, post-disaster rehabilitation and the role of institutions and technology in disaster management. Real-life case studies and demonstrations of warning, communication and rescue systems should be used to make learning practical and relevant.

REFERENCE BOOKS:

1. Publications of National Disaster Management Authority (NDMA) on various templates and guidelines for disaster management
2. Bhandani, R.K., *An Overview on Natural and Man-made Disasters and Their Reduction*, CSIR, New Delhi
3. Srivastava, H.N. and Gupta, G.D., *Management of Natural Disasters in Developing Countries*, Daya Publishers, Delhi
4. Alexander, David, *Natural Disasters*, Kluwer Academic, London
5. Ghosh, G.K., *Disaster Management*, A.P.H. Publishing Corporation
6. Murthy, D.B.N., *Disaster Management: Text and Case Studies*, Deep & Deep Pvt. Ltd.
7. E-books / e-tools / relevant software as recommended by AICTE / SWAYAM / BTE / NITTTR, Chandigarh

SUGGESTED DISTRIBUTION OF MARKS:

Unit No.	Time Allotted (Periods)	Marks Allotted (%)
1	04	12

2	06	22
3	06	22
4	06	22
5	06	22
Total	**28**	**100**

ADVANCED SKILL DEVELOPMENT

To fulfill the requirements for Advanced Skill Development, a minimum of 20 hours of skill certification is necessary. This certification must be obtained from a recognized national or international agency or institute. The assessment and certification process will be conducted by the respective agency or institute. Students must present their certificate to earn 02 credits for this subject.

4.1	HAZARDOUS MATERIALS PACKAGING (THEORY)	L T P
		2 0 0

COURSE OBJECTIVES:

The course aims to provide fundamental understanding of hazardous materials, their classification based on UN guidelines, and key properties such as flammability, toxicity, corrosivity, and reactivity, along with the basic principles of safe packaging for hazardous goods. The objective is to develop knowledge of materials and design considerations for hazardous packaging, including selection of appropriate materials, container types, and bulk packaging systems suitable for safe transport and storage.

COURSE OUTCOMES (COs):

It is important to teach theory in a way that enables students to exhibit the following course results by gaining various learning outcomes in the cognitive, psychomotor, and affective domains. The ability for students to:

CO1: Understand the classification and properties of hazardous materials and the principles of safe packaging.
CO2: Select appropriate materials and design packaging systems for hazardous goods based on compatibility and safety requirements.
CO3: Apply hazard classification, labelling, and safety standards such as GHS and UN specifications in packaging and documentation.
CO4: Analyze and comply with international regulations and standards for transportation of dangerous

goods.

CO5: Evaluate packaging performance through testing methods and implement safe handling, storage, and emergency response practices.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	1	-	-	2	-	-	*	*
CO2	3	2	2	2	1	-	-	*	*
CO3	3	3	2	2	2	-	-	*	*
CO4	2	2	2	2	3	1	-	*	*
CO5	2	3	3	3	2	1	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS:

UNIT I: FUNDAMENTALS OF HAZARDOUS MATERIALS AND PACKAGING

(05 periods)

Definition and classification of hazardous materials (UN classes 1-9), key properties including corrosivity, flammability, toxicity, reactivity, and environmental hazards, basic principles of hazardous material packaging such as containment, protection, and compatibility, regulatory overview with UN Recommendations on Transport of Dangerous Goods.

UNIT II: MATERIALS AND DESIGN FOR HAZARDOUS PACKAGING

(06 periods)

Materials suitable for chemical packaging including plastics (HDPE, PP), metals (steel, aluminium), composites, and liners, design principles for drums, jerricans, bottles, and specialized containers, bulk packaging such as intermediate bulk containers (IBCs), flexible IBCS (FIBCs), and rigid bulk options, climate considerations with insulated, refrigerated, and vented packaging for exports.

UNIT III: HAZARD CLASSIFICATION, LABELING, AND SAFETY STANDARDS

(06 periods)

Globally Harmonized System (GHS) with hazard pictograms, signal words, and safety data sheets (SDS), labelling requirements including handling instructions, barcodes, batch numbers, and UN specification marks, packaging groups (I, II, III) and compatibility charts, introduction to non-hazardous vs. hazardous chemical packaging differences.

UNIT IV: GLOBAL EXPORT REGULATIONS AND DANGEROUS GOODS STANDARDS

(06 periods)

International standards including IATA DGR (air), IMDG Code (sea), ISPM 15 (wood pallets), ISO, and WTO guidelines, UN certification for dangerous goods packaging, BIS and other national regulations (e.g., OSHA), Extended Producer Responsibility (EPR) and export compliance (documentation, marking), pallet and crate standards for hazardous exports.

UNIT V: TESTING, CERTIFICATION, AND HANDLING PRACTICES

(05 periods)

UN performance testing including drop, stack, pressure, and leakproofness tests, certification processes with approvals, requalification, and inspections, safe handling, storage, emergency response, and spill management, case studies on real-world failures and best practices in hazardous packaging.

TEXT AND REFERENCE BOOKS:

1. Gazette of India: Extraordinary Part-II (3(i)) Ministry of Environment and Forest, Notification 8th July 2011.
2. ASTM D4919-03 Standard Specification for Testing of Hazardous Materials Packaging Dangerous good regulations (DGR)., IATA.
3. Eugene Meyer, Kindle, Chemistry of Hazardous Materials (6th Edition).
4. Materials/Dangerous Goods in Intermodal Equipment-Highway, Rail and Water, Institute of Packaging Professionals.

SUGGESTED DISTRIBUTION OF MARKS:

Unit No.	Time Allotted (Periods)	Marks Allotted (%)
1	5	20
2	6	15
3	6	20
4	6	20
5	5	25
Total	**28**	**100**

4.2.1	ANCILLARY PACKAGING MATERIALS (THEORY)	L T P
		2 0 0

COURSE OBJECTIVE:

The objective of this course is to familiarize students with ancillary packaging materials such as labels, closures, adhesives, cushioning, and supporting materials used in packaging systems. The course emphasizes the selection, functionality, performance, regulatory aspects, branding role, and sustainability of ancillary materials in ensuring product protection, convenience, and market appeal in packaging applications.

COURSE OUTCOMES (CO):

After undergoing this course, the students will be able to:

CO1: Understand the classification, importance, and role of ancillary packaging materials in packaging systems.
CO2: Explain types of labels, printing technologies, and their role in branding and regulatory compliance.
CO3: Identify different types of closures and sealing materials used for product protection and shelf-life extension.
CO4: Select suitable adhesives, cushioning, and support materials based on packaging requirements and applications.
CO5: Apply sustainability principles in the selection and use of ancillary packaging materials.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	**PO1** Basic and Discipline Specific Knowledge	**PO2** Problem Analysis	**PO3** Design/ Development of Solutions	**PO4** Engineering Tools	**PO5** Practices for Society, Sustainability and Environment	**PO6** Project Management	**PO7** Life Long Learning	**PSO1**	**PSO2**
CO1	3	1	-	-	2	-	-	*	*
CO2	3	2	2	2	1	-	-	*	*
CO3	3	3	2	2	2	-	-	*	*
CO4	2	2	2	2	3	1	-	*	*

CO5	2	3	3	3	2	1	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS:

UNIT I: INTRODUCTION TO ANCILLARY PACKAGING MATERIALS

(05 Periods)

Definition and classification of ancillary packaging materials, historical development and evolution of ancillary materials, importance and role in modern packaging systems, criteria for selection of ancillary packaging materials based on product and distribution requirements.

UNIT II: LABELS AND PRINTING TECHNOLOGIES (06 Periods)

Types of labels including pressure-sensitive labels, in-mould labels, shrink labels and wet-glue labels, label printing technologies such as flexography, digital printing, offset printing and gravure printing, role of labels in branding, marketing and product communication, labelling regulations, standards and compliance requirements, sustainable labelling practices and eco-friendly printing approaches.

UNIT III: CLOSURES AND SEALING SYSTEMS (06 Periods)

Types of closures including screw caps, snap caps, flip-top caps and dispensing closures, sealing materials such as liners, gaskets and induction seals, tamper-evident and child-resistant closure systems, role of closures in maintaining product integrity and extending shelf life, functional aspects of closure design and performance evaluation.

UNIT IV: ADHESIVES AND BONDING TECHNIQUES (05 Periods)

Types of adhesives including hot-melt adhesives, pressure-sensitive adhesives, water-based adhesives and solvent-based adhesives, principles of adhesion and bonding mechanisms, Van der Waals theory of adhesion, bonding techniques used in packaging applications, testing methods and quality evaluation of adhesives and carton boxes.

UNIT V: CUSHIONING, PALLETIZATION AND SUSTAINABILITY (06 Periods)

Cushioning materials such as expanded polystyrene (EPS), expanded polyethylene (EPE) and moulded pulp, support and handling materials including wooden pallets, plastic pallets, slip sheets and dunnage bags, strapping materials and techniques, role of cushioning in product protection during transportation, sustainable practices and selection of eco-friendly ancillary packaging materials.

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TEXT AND REFERENCE BOOKS:

1. K. L. Yam, *The Wiley Encyclopedia of Packaging Technology*, 3rd Edition, Wiley, 2009
2. W. Soroka, *Fundamentals of Packaging Technology*, 4th Edition, IoPP, 2009
3. J. F. Hanlon, *Handbook of Package Engineering*, 3rd Edition, CRC Press, 1998
4. F. A. Paine, *The Packaging Users Handbook*, Springer, 1990

SUGGESTED DISTRIBUTION OF MARKS:

Unit No.	Time Allotted (Periods)	Marks Allotted (%)
1	05	20
2	06	15

3	06	25
4	05	20
5	06	20
Total	**28**	**100**

4.2.2	FLEXIBLE PLASTIC PACKAGING (THEORY)	L T P
		2 0 0

COURSE OBJECTIVE:

This course equips students with comprehensive knowledge of flexible plastic packaging materials—from traditional plastics like PE and PP to advanced and biodegradable options like PLA and PHA—covering manufacturing processes, machinery, and applications to design sustainable, market-ready packaging solutions for food, pharma, and consumer sectors.

COURSE OUTCOMES (CO):

After undergoing this course, the students will be able to:

CO1: Identify and classify traditional, advanced, and biodegradable materials used in flexible plastic packaging.
CO2: Analyze historical evolution and market applications of flexible packaging formats.
CO3: Demonstrate manufacturing processes like blown film, lamination, and pouch forming.
CO4: Operate key machinery such as form-fill-seal and stand-up pouch makers.
CO5: Design sustainable flexible packaging incorporating recycling and compostable standards.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	2	1	1	2	-	1	*	*
CO2	3	2	2	2	3	-	-	*	*
CO3	2	3	3	2	2	1	-	*	*
CO4	3	2	2	3	1	2	1	*	*
CO5	2	3	3	2	3	1	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)
***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS:

UNIT I: INTRODUCTION TO FLEXIBLE PLASTIC PACKAGING (5 Periods)

Overview of flexible plastic packaging types including pouches, bags, films, wraps, historical evolution from cellophane to modern plastics, market applications in food, pharma, consumer goods.

UNIT II: TRADITIONAL PLASTIC MATERIALS IN FLEXIBLE PACKAGING

(6 Periods)

Plastic materials: polyethylene (LDPE, HDPE) films, polypropylene (BOPP, CPP), polyvinyl chloride (PVC) wraps, polystyrene films, polyamide (nylon) laminates, sourcing and grades used in flexible packaging.

UNIT III: ADVANCED AND SPECIALTY PLASTIC MATERIALS

(6 Periods)

New developments: PET films, EVOH co-extrusions, PVDC barriers, metallized films, paper-plastic hybrids, recycling-compatible materials like rPET, material selection for specific pack formats.

UNIT IV: BIODEGRADABLE AND SUSTAINABLE FLEXIBLE PLASTICS

(5 Periods)

Biodegradable materials: PLA (polylactic acid) from corn starch, PHA (polyhydroxyalkanoates), starch-based blends, cellulose-derived films, PBS (polybutylene succinate), compostable certifications and standards.

UNIT V: PROCESSES, MACHINERY, AND APPLICATIONS (6 Periods)

Manufacturing processes: blown film, cast film, extrusion coating, lamination, pouch forming, machinery types like form-fill-seal, stand-up pouch makers, applications in retort pouches, vacuum bags, sustainable trends.

TEXT AND REFERENCE BOOKS:

1. The Science and Technology of Flexible Packaging: Multilayer Films from Resin and Process to End Use (2nd Edition) by Barry A. Morris (2022) - Comprehensive guide covering materials, processes, and applications from traditional to sustainable films.eboo
2. Multilayer Flexible Packaging (2nd Edition) by John R. Wagner Jr. (2016) - Focuses on manufacturing, materials (including bio-based), and machinery for flexible plastic films.
3. Plastic Films: Technology and Packaging Applications by W. Jenkins and K.R. Osborn (2019) - Illustrated reference on plastic films, processes, and packaging formats with schematics.
4. Manufacturing Flexible Packaging: Materials, Machinery, and Techniques by Anne Emblem (2014) - Practical guide to blown/cast films, lamination, and equipment for flexible packaging
5. Recycling of Flexible Plastic Packaging by M. Niaounakis (2019) - Covers sustainable materials (rPET, biodegradables like PLA/PHA) and recycling processes.

SUGGESTED DISTRIBUTION OF MARKS:

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	05	20
2	06	15
3	06	25
4	05	20
5	06	20
Total	**28**	**100**

4.3	PRINTING TECHNOLOGY (THEORY)	L T P
		3 0 0

COURSE OBJECTIVE:

This course is designed to provide knowledge of printing technologies used in packaging, covering conventional and modern printing processes, pre-press, press and post-press operations. It enables students to understand printing workflows, printing ink technology, common defects and quality control measures, along with the suitability of different printing methods for packaging applications. The course aims to develop the ability to select appropriate printing processes and apply printing knowledge effectively in packaging practice.

COURSE OUTCOMES (CO):

CO1: Understand the scope, applications and importance of printing technology in packaging.
CO2: Identify different conventional and modern printing processes used in the packaging industry.
CO3: Explain basic pre-press, press and post-press operations along with printing ink technology.
CO4: Detect common printing defects and suggest appropriate corrective measures.
CO5: Select suitable printing processes for different packaging materials and products.

3. SUGGESTED COURSE ARTICULATION MATRIX (CAM)

CO No.	**PO1** Basic and Discipline Specific Knowledge	**PO2** Problem Analysis	**PO3** Design / Development of Solutions	**PO4** Engineering Tools	**PO5** Practice for Society, Sustainability and Environment	**PO6** Project Management	**PO7** Lifelong Learning	**PSO 1**	**PSO 2**
CO1	3	2	-	2	-	-	2	*	*
CO2	3	2	2	2	-	-	2	*	*
CO3	3	2	2	3	-	-	2	*	*
CO4	3	3	2	2	-	-	2	*	*
CO5	3	3	3	2	-	-	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)
***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS:

UNIT I: INTRODUCTION TO PRINTING TECHNOLOGY (09 Periods)

History of printing, scope and applications of the printing industry, overview of the Indian printing industry, growth trends, contribution to economy, employment opportunities and recent trends in printing technology.

UNIT II: PRINTING PROCESSES (09 Periods)

Introduction to conventional printing processes: relief, planography, intaglio and screen printing. Modern and on-demand printing processes: electrostatic, digital and mini-offset. Specialized printing processes: thermography, die stamping, hot foil stamping and hologram printing. Suitability, limitations and applications of various printing processes.

UNIT III: PRINTING INK TECHNOLOGY (08 Periods)

Functions and applications of printing ink. History of printing ink production. Raw materials of printing ink. Manufacturing processes. Principles of ink formulation: colour matching, grinding, consistency, drying times, length of ink, printed appearance, machine performance, fading and special requirements.

UNIT IV: BASIC OPERATIONS IN PRINTING (08 Periods)

Pre-press operations: basic concepts, typesetting of text matter, formatting, pagination, arrangement of images and graphics, colour separation, film outputting, assembly of film and plate making. Press operations: pre-make-ready and make-ready operations. Post-press and finishing operations.

UNIT V: PRINTING DEFECTS AND QUALITY CONTROL (08 Periods)

Common printing defects in packaging, causes of defects and remedial measures. Introduction to basic quality control in printing processes.

INSTRUCTIONAL STRATEGY:

This course should be delivered through lectures, demonstrations, printed sample analysis, case studies and industrial visits to provide understanding of printing processes and quality control in packaging applications. The teacher should explain conventional and modern printing technologies with the help of charts, printed specimens, videos and process illustrations. Emphasis should be given to workflow understanding, defect identification and the selection of suitable printing methods for different packaging materials and products.

RECOMMENDED BOOKS:

1. C. S. Misra, *Letter Press Printing*, Part I and II
2. Adams, Faux and Rieber, *Printing Technology*
3. Babett Magee, *Screen Printing Review*
4. John Stephens, *Screen Printing*
5. N. N. Sarkar, *Art and Print Production*
6. E-books / e-tools / relevant software as recommended by AICTE / SWAYAM / BTE / NITTTR, Chandigarh

SUGGESTED DISTRIBUTION OF MARKS:

Unit No.	Time Allotted (Periods)	Marks Allotted (%)
1	09	20
2	09	25
3	08	20
4	08	20
5	08	15
Total	**42**	**100**

4.4	PACKAGING DESIGN & ERGONOMICS (PRACTICUM)	L T P 2 0 2

COURSE OBJECTIVES:

This course is designed to develop practical skills in packaging design and ergonomics with emphasis on human-centred design principles, usability, safety, comfort and efficiency. It enables students to design functional and ergonomic packaging solutions by applying concepts of anthropometry, human factors, workplace ergonomics and sustainability in packaging systems. The course also aims to build competence in developing inclusive, user-friendly and practically feasible packaging designs for diverse user groups and packaging operations.

COURSE OUTCOMES (CO):

It is important to teach theory and conduct practical exercises in a way that enables students to exhibit the following course outcomes by gaining various learning outcomes in cognitive, psychomotor and affective domains. Students will be able to:

CO1: Develop packaging design concepts considering functionality, aesthetics and user requirements.
CO2: Apply human-centred and ergonomic principles in packaging and workspace design.
CO3: Use anthropometric data for packaging, product and workplace design.

CO4: Analyze human factors affecting safety, comfort and performance in packaging operations.
CO5: Design inclusive and user-friendly packaging solutions for diverse user groups.

SUGGESTED COURSE ARTICULATION MATRIX (CAM)

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design / Development of Solutions	PO4 Engineering Tools	PO5 Practice for Society, Sustainability and Environment	PO6 Project Management	PO7 Lifelong Learning	PSO 1	PSO 2
CO1	3	2	3	2	2	-	2	*	*
CO2	3	2	3	2	-	-	2	*	*
CO3	3	3	2	2	-	-	2	*	*
CO4	3	3	2	2	2	-	2	*	*
CO5	3	2	3	2	3	-	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)
***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENT:

UNIT I: PACKAGING DESIGN FUNDAMENTALS (06 Periods)

Packaging design process from concept to prototype, conceptual thinking and problem solving. Use of typography, colour, images, and graphics in folded, flexible, and rigid packaging. Materials selection and sustainability considerations in packaging design.

S. No.	Experiment	Periods
1	Development of basic packaging design concepts and sketches	3
2	Preparation of package mock-ups using paperboard/flexible materials	3

UNIT II: PACKAGING MATERIALS AND PRODUCTION CONSTRAINTS (05 Periods)

Overview of packaging materials: paper, plastics, metals, and glass. Design methods considering manufacturing feasibility, cost, and production constraints, Sustainable material selection and eco-design strategies.

S. No.	Experiment	Periods
1	Comparative study of packaging materials based on strength, cost, and sustainability	3
2	Evaluation of design feasibility under production constraints	2

UNIT III: HUMAN-CENTRED DESIGN AND USABILITY (06 Periods)

Principles of human-centred design in packaging, User interaction, usability, and accessibility, Motor control: coordination, sequencing, timing of action and reaction time.

S. No.	Experiment	Periods
1	Study of user interaction with packaging products	3

2	Evaluation of ease of handling and usability of packaging designs	3

UNIT IV: ANTHROPOMETRY AND WORKPLACE ERGONOMICS (05 Periods)

Anthropometric data and its application in packaging and workspace design, Ergonomic principles: posture, movement, and workspace layout, Environmental factors: illumination, noise, vibration, and motion.

S. No.	Experiment	Periods
1	Measurement and application of anthropometric data for packaging/workspace design	3
2	Ergonomic assessment of packaging workstations	2

UNIT V: SAFETY, HUMAN FACTORS AND INCLUSIVE DESIGN (06 Periods)

Human factors engineering and error reduction, Workplace safety: hazard identification, MSDs, PPE, Inclusive design: elderly, children, and differently-abled users, Applications of ergonomics in packaging systems and case studies.

S. No.	Experiments	Periods
1	Identification of ergonomic hazards and safety issues in packaging operations	2
2	Design of inclusive and ergonomically safe packaging/workstation solutions	2
3	Case study on accident prevention and user-friendly packaging systems	2

TEXT BOOKS / REFERENCE BOOKS:

1. J. Bridger R. S., *Introduction to Ergonomics*, Taylor & Francis, London, 2013
2. Mark S. Sanders, *Human Factors in Engineering and Design*, McGraw-Hill, New York, 1993
3. G. Karl Kroemer, Henrike Kroemer and Karin Kroemer-Elbert, *Ergonomics: How to Design for Ease & Efficiency*, Prentice Hall, 2001
4. E-books / e-tools / relevant software as recommended by AICTE / SWAYAM / BTE / NITTTR, Chandigarh

INSTRUCTIONAL STRATEGY:

This course should be delivered through lectures, demonstrations, design exercises, mock-up preparation, ergonomic assessments, case studies and industrial visits to provide hands-on experience in packaging design and ergonomics. Students should be encouraged to develop packaging concepts, prepare mock-ups, apply ergonomic principles and evaluate packaging systems with respect to usability, safety and inclusiveness.

SUGGESTED DISTRIBUTION OF MARKS:

Unit No.	Time Allotted (Periods)	Marks Allotted (%)
1	06	25
2	05	20
3	06	25
4	05	15

5	06	15
Total	**28**	**100**

4.5	PLASTICS TESTING (PRACTICUM)	L T P 2 0 4

COURSE OBJECTIVES:

This course is designed to develop practical knowledge and skills for testing plastic materials with emphasis on identification, sample preparation, standard procedures and evaluation of mechanical, rheological and thermal properties. It enables students to understand the importance of testing in material selection, quality control and product development, and to use standard test methods and instruments for assessing plastic materials. The course also aims to build competence in interpreting test data and selecting suitable materials based on performance requirements.

COURSE OUTCOMES (CO):

It is important to teach theory and conduct practical exercises in a way that enables students to exhibit the following course outcomes by gaining various learning outcomes in cognitive, psychomotor and affective domains. Students will be able to:

CO1: Understand basic concepts, sample preparation methods and standards related to plastics testing.
CO2: Identify plastic materials using simple physical and chemical methods.
CO3: Perform mechanical testing of plastics and interpret test results.
CO4: Evaluate rheological and thermal properties of plastic materials using standard test methods.
CO5: Select suitable plastic materials for applications based on testing data and performance requirements.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	**PO1** Basic and Discipline Specific Knowledge	**PO2** Problem Analysis	**PO3** Design / Development of Solutions	**PO4** Engineering Tools	**PO5** Practice for Society, Sustainability and Environment	**PO6** Project Management	**PO7** Lifelong Learning	**PSO 1**	**PSO 2**
CO1	3	2	-	2	-	-	2	*	*
CO2	3	2	-	2	-	-	2	*	*

CO3	3	3	2	3	-	-	2	*	*
CO4	3	3	2	3	-	-	2	*	*
CO5	3	3	3	2	2	-	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENT:

UNIT I: BASIC CONCEPTS, STANDARDS AND SAMPLE PREPARATION (06 Periods)

Basic concept of testing. Destructive and non-destructive testing. National and international standards such as BIS, ASTM and ISO. Sample preparation, sample conditioning, test atmosphere and environmental conditions for testing. Basic precautions in plastics testing. Importance of testing in quality control and product performance. These areas are consistent with plastics testing coverage and emphasis on standards and testing fundamentals.

Ex. No.	Name of Experiment	Periods
1.	Study of basic plastics testing concepts, laboratory precautions, sample preparation and sample conditioning procedures.	4
2.	Study of BIS / ASTM / ISO standards used in plastics testing and preparation of standard test specimens.	4
3.	Determination of density of plastics by displacement method.	4

UNIT II: IDENTIFICATION OF PLASTICS BY SIMPLE METHODS (05 Periods)

Identification techniques such as visual inspection, drop test, flame test, density-based assessment, particle size by sieve analysis, melting point by simple method and solubility test. Brief introduction to simple spectroscopic characterization methods for polymer identification.

Ex. No.	Name of Experiment	Periods
4.	Identification of plastics by simple methods such as visual, drop and flame tests.	4
5.	Determination of melting point / softening behaviour of plastic materials by simple method.	2
6.	Solubility test and sieve analysis for identification / classification of plastic materials.	4

UNIT III: MECHANICAL TESTING OF PLASTICS (07 Periods)

Stress-strain behaviour, polymer fracture, toughness, tensile strength, percentage elongation, flexural strength, compressive strength, tear resistance, impact strength by Izod and Charpy methods, abrasion resistance, hardness by Shore A and Shore D, and basic understanding of creep and stress relaxation.

Ex. No.	Name of Experiment	Periods
7.	Determination of hardness of plastics using Shore A and Shore D hardness testers.	4
8.	Determination of tensile strength and percentage elongation of plastic specimens.	4
9.	Determination of impact strength of plastics by Izod / Charpy meth-	4

	od.	
10.	Study / demonstration of flexural or compressive testing of plastic materials.	2

UNIT IV: RHEOLOGICAL TESTING OF PLASTICS (05 Periods)

Rheological properties of plastics including Melt Flow Index (MFI), intrinsic viscosity using Unbeholden viscometer, K-value, dynamic viscosity, cup and spiral flow tests, apparent bulk density and bulk factor.

Ex. No.	Name of Experiment	Periods
11.	Determination of Melt Flow Index (MFI) of thermoplastic materials.	4
12.	Determination of intrinsic viscosity / K-value of polymer solution.	4
13.	Determination of apparent bulk density / bulk factor of plastic material.	2

UNIT 5 – THERMAL TESTING AND INTERPRETATION OF RESULTS (05 Periods)

Thermal properties of plastics such as Heat Deflection Temperature (HDT), Vicat Softening Point (VSP), thermal expansion, brittleness temperature, reversion test of pipe and shrinkage behaviour. Brief introduction to DSC, TGA and DMA. Interpretation of test results for material selection, quality control and end-use suitability.

Ex. No.	Name of Experiment	Periods
14.	Determination of Heat Deflection Temperature (HDT) / Vicat Softening Point (VSP) of plastics.	4
15.	Determination of reversion of plastic pipe / thermal shrinkage behaviour.	4
16.	Interpretation of mechanical, rheological and thermal test data for selection of suitable plastic material for a given application.	2

INSTRUCTIONAL STRATEGY:

The teacher should explain the purpose, procedure and significance of each test with emphasis on sample preparation, standard operating practices and result interpretation. Students should be given practical assignments based on material testing, comparison of results and selection of suitable plastics for applications. Demonstrations of standard testing instruments and industry-oriented practical problems should be included to strengthen laboratory skills and understanding of quality control.

TEXT BOOKS / REFERENCE BOOKS:

Text Books:

1. *Fundamentals of Plastics Testing* — Prof. (Dr.) S.K. Nayak.
2. *Handbook of Plastics Testing Technology* — Vishu Shah, 2nd Revised Edition, Wiley-Blackwell, 1998.

Reference Book:

1. *Simple Methods for Identification of Plastics* — Dietrich Braun, 4th Revised Edition, Carl Hanser Verlag, 2013.
2. E-books / e-tools / relevant software as recommended by AICTE / SWAYAM / BTE / NITTTR, Chandigarh.

Website References:
ASTM, MatWeb, Intertek Polymers Testing, Instron, Plastics Technology Online and ISO standards portals.

SUGGESTED DISTRIBUTION OF MARKS:

Unit No.	Time Allotted (Periods)	Marks Allotted (%)
1	06	20
2	05	15
3	07	30
4	05	15
5	05	20
Total	**28**	**100**

		L T P
4.6	**LAMINATION AND FUNCTIONAL COATING (PRACTICUM)**	**2 0 4**

COURSE OBJECTIVES:

The course aims to provide fundamental knowledge of coating and lamination processes used in packaging, focusing on their role in enhancing barrier properties, mechanical strength, protection, and aesthetic appeal of packaging materials, along with understanding different substrates and processing techniques. The course is also designed to develop an understanding of coating materials, formulations, and technologies, including binders, pigments, additives, and functional coatings, and to familiarize students with various coating methods and curing mechanisms used in the packaging industry.

COURSE OUTCOMES (CO):

It is important to teach theory and conduct practical exercises in a way that enables students to exhibit the following course results by gaining various learning outcomes in the cognitive, psychomotor, and affective domains. The ability for students to:

CO1: Understand the fundamentals of coating and lamination processes and their significance in packaging applications.

CO2: Analyze different coating materials, formulations, and application technologies used in packaging industries.

CO3: Apply knowledge of lamination techniques and adhesive systems to develop effective multilayer packaging structures.

CO4: Evaluate the performance of coated and laminated materials using standard testing methods and quality parameters.

CO5: Identify defects in coating and lamination processes and propose suitable troubleshooting and improvement strategies.

SUGGESTED COURSE ARTICULATION MATRIX :

CO No.	**PO1** Basic & Discipline Specific Knowledge	**PO2** Problem Analysis	**PO3** Design / Development of Solutions	**PO4** Engineering Tools	**PO5** Society, Sustainability & Environment	**PO6** Project Management	**PO7** Life Long Learning	**PSO1**	**PSO2**
CO1	3	1	-	-	-	-	-	*	*
CO2	3	2	-	2	-	-	-	*	*
CO3	3	3	2	2	-	-	-	*	*
CO4	2	2	2	2	2	-	-	*	*
CO5	2	3	3	3	1	-	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS:

UNIT I: FUNDAMENTALS OF COATING AND LAMINATION (06 periods)

Coating and lamination are essential processes in packaging used to enhance barrier properties, improve mechanical strength, provide protection, and increase visual appeal, coating involves the application of a liquid layer on a substrate surface while lamination involves bonding two or more layers together, the main functions include moisture resistance, oxygen barrier, heat sealability, and print enhancement, different types of coatings such as aqueous coatings, solvent-based coatings, and UV coatings are widely used depending on application requirements, lamination can be categorized into dry lamination, wet lamination, extrusion lamination, and solventless lamination, commonly used substrates include paper, paperboard, plastic films, and aluminium foil, and their selection depends on the end-use application and performance requirements.

Ex. No.	Name of Experiment	Periods
1.	Identification of coated and laminated packaging samples	2
2.	Study of different substrate materials (paper, film, foil)	2
3.	Demonstration of coating methods (manual/rod coating)	3
4.	Preparation of simple coated paper samples	3

UNIT II: COATING MATERIALS AND TECHNOLOGIES (06 periods)

Coating formulations consist of binders, pigments, solvents, and additives that determine the performance characteristics of the coated surface, binders provide film formation and adhesion, pigments contribute to opacity and color, and additives enhance properties such as flow, leveling, and stability, functional coatings such as barrier coatings, antimicrobial coatings, and heat seal coatings are increasingly used in packaging applications, different coating techniques such as gravure coating, roll coating, blade coating, and spray coating are employed based on substrate and production scale, drying and curing processes including thermal drying, ultraviolet curing, and electron beam curing play a crucial role in achieving desired coating properties and performance

Ex. No.	Name of Experiment	Periods
1	Preparation of coating formulations using binders and additives	2
2	Application of coating using bar/rod coater	2
3	Measurement of coating thickness and coat weight	2
4	Drying and curing of coated samples	2
5	Testing of coated surfaces for gloss and smoothness	2
6	Adhesion testing of coated layers	2

UNIT III: LAMINATION TECHNIQUES AND ADHESIVES (06 Periods)

Lamination involves combining multiple layers using adhesives or heat to achieve improved strength and barrier properties, various lamination processes such as dry lamination, wet lamination, extrusion lamination, and solventless lamination are used in the packaging industry, adhesives used in lamination include solvent-based adhesives, water-based adhesives, and hot melt adhesives, the adhesion mechanism depends on interfacial bonding, surface energy, and compatibility of materials, factors such as temperature, pressure, curing time, and adhesive formulation significantly affect lamination quality, proper control of these parameters ensures strong bonding and defect-free laminates

Ex. No.	Name of Experiment	Periods
1	Lamination using laboratory laminator	2
2	Preparation and application of adhesives	2
3	Study of bonding between different substrates	2
4	Peel strength testing of laminates	2
5	Observation and analysis of lamination defects	2
6	Delamination testing and evaluation	2

UNIT IV: TESTING AND QUALITY EVALUATION (05 Periods)

Testing and quality evaluation of coated and laminated packaging materials are essential to ensure performance and compliance with standards, mechanical properties such as tensile strength, tear resistance, and burst strength determine material durability, barrier properties including water vapor transmission rate and oxygen transmission rate are critical for shelf life, optical properties such as gloss, haze, and transparency

influence product appearance, seal strength and integrity are important for packaging safety, various standard methods such as ASTM, ISO, and TAPPI are used to evaluate these properties, ensuring consistent quality and reliability of packaging materials

Ex. No.	Name of Experiment	Periods
1	Tensile strength testing of coated/laminated samples	2
2	Peel strength and bond strength measurement	2
3	Heat seal strength testing	2
4	WVTR/OTR testing (demonstration or calculation-based)	2
5	Coefficient of friction (COF) testing	2
6	Optical property testing (gloss, haze)	2

UNIT V: APPLICATIONS, DEFECTS, AND INNOVATIONS (05 Periods)

Coating and lamination are widely applied in food packaging, pharmaceutical packaging, cosmetic packaging, and industrial packaging to meet specific functional requirements, common defects such as delamination, bubbling, curling, pinholes, and uneven coating may occur due to improper processing conditions, identifying and troubleshooting these defects is important for quality control, sustainable coatings such as water-based, biodegradable, and bio-based coatings are gaining importance due to environmental concerns, recycling of laminated materials poses challenges due to multi-layer structures, recent innovations include nano-coatings, smart coatings, and edible coatings that provide advanced functionalities and improved sustainability

Ex. No.	Name of Experiment	Periods
1	Case study of commercial laminate structures (e.g., flexible packaging)	2
2	Identification and analysis of coating and lamination defects	2
3	Troubleshooting exercises for process defects	2
4	Demonstration of recycling/separation of laminated materials	2
5	Development of eco-friendly coated packaging material	2

INSTRUCTIONAL STRATEGY:

The course will be delivered through a combination of lectures, practical sessions, demonstrations, and interactive learning methods to ensure a strong balance between theoretical knowledge and hands-on skills, classroom teaching will focus on fundamental concepts of coating and lamination, materials, processes, and testing methods using presentations, case studies, and real-life industrial examples, emphasis will be given to problem-solving and analytical thinking through discussions on process parameters, defects, and troubleshooting techniques Practical sessions will play a major role in the learning process, where students will perform laboratory experiments related to coating application, lamination techniques, adhesive preparation, and testing of packaging materials, demonstrations using laboratory equipment such as coaters, laminators, and testing instruments will help students understand industrial practices, students will be encouraged to analyze results, interpret data, and correlate theoretical concepts with practical observations

TEXT AND REFERENCE BOOKS:

1. Handbook of Paper and Board – Herbert Holik
2. Flexible Packaging Materials and Applications – Alain B. Birot
3. Introduction to Flexible Packaging – Diana Twede
4. Packaging Technology Fundamentals, Materials and Processes – Gordon L. Robertson
5. Coating and Laminating in Packaging – John Matthews

SUGGESTED DISTRIBUTION OF MARKS:

Unit No.	Time Allotted (Periods)	Marks Allotted (%)
1	6	20
2	6	10
3	6	20
4	5	25
5	5	25
Total	**28**	**100**

OPEN ELECTIVE-II/ ADVANCED SKILL CERTIFICATION-II		
4.7.1	**INDUSTRIAL ROBOTICS & AUTOMATION (THEORY)**	**L T P** **2 0 0**

COURSE OBJECTIVE:

This course is designed to provide diploma students with a fundamental understanding of industrial robotics and automation systems. It introduces robot structure, classification, drives, sensors, basic kinematics, robot programming and automation concepts used in manufacturing environments. The course aims to develop the ability to understand the working of industrial robots, automated systems and their applications in modern production, and to prepare students for further skill development in robotics, automation and mechatronics.

COURSE OUTCOMES (CO):

After undergoing this course, the students will be able to:

CO1: Explain robot anatomy, classification, characteristics, advantages and limitations of industrial robots.
CO2: Describe various robotic drive systems, feedback devices and control methods used in automation.
CO3: Explain different types of sensors and basic concepts of robot vision systems.
CO4: Understand robot kinematics and basic robot programming concepts.
CO5: Describe industrial applications of robots in manufacturing and automation systems.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO	PSO

No.	Basic and Discipline Specific Knowledge	Problem Analysis	Design / Development of Solutions	Engineering Tools	Practice for Society, Sustainability and Environment	Project Management	Lifelong Learning	1	2
CO1	3	2	-	2	-	-	2	*	*
CO2	3	2	2	2	-	-	2	*	*
CO3	3	3	2	3	-	-	2	*	*
CO4	3	3	3	2	-	-	2	*	*
CO5	3	2	3	2	-	2	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)
***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS:

UNIT I: FUNDAMENTALS OF ROBOTICS (06 Periods)

Introduction and definition of industrial robots, robot anatomy and working principle, robot components such as manipulator and end-effectors, construction of links and types of joints. Classification of robots: Cartesian, cylindrical, spherical, SCARA and articulated robots. Structural characteristics of robots, mechanical rigidity, work envelope and work volume, comparison of robot work volumes, advantages and limitations of industrial robots.

UNIT II: ROBOTIC DRIVE SYSTEMS AND CONTROLLERS (06 Periods)

Actuators used in robotics: hydraulic, pneumatic and electrical drives. Linear and rotary actuators, AC servo motors, DC servo motors and stepper motors. Conversion between linear and rotary motion. Feedback devices such as potentiometers, optical encoders and DC tachometers. Robot controllers, levels of control, open-loop and closed-loop control systems.

UNIT III: SENSORS AND ROBOT VISION SYSTEMS (06 Periods)

Requirements of sensors in robotics. Position sensors such as encoders, resolvers and piezoelectric sensors. Range sensors based on triangulation principle and structured lighting. Proximity sensing, force and torque sensing. Introduction to machine vision, image scanning and digitization, image processing and analysis. Cameras and image acquisition. Applications of robot vision systems in inspection, identification, navigation and servicing.

UNIT IV: ROBOT KINEMATICS AND PROGRAMMING (05 Periods)

Forward and inverse kinematics, difference between forward and inverse kinematics. Forward and inverse kinematics of manipulators with two degrees of freedom in two-dimensional motion. Introduction to robot programming languages, VAL programming, motion commands, sensor commands, end-effector commands and simple robot programs.

UNIT V: AUTOMATION CONCEPTS AND INDUSTRIAL APPLICATIONS

(05 Periods)

Automation concepts, basic elements of automated systems, levels of automation and advanced automation functions. Robot path control: point-to-point control, continuous path control and sensor-based path control. Industrial applications of robots in machining, welding, assembly, pick-and-place, inspection and material handling. Role of robotics in modern automated manufacturing systems.

INSTRUCTIONAL STRATEGY:

This subject should be taught through classroom lectures, visual aids, videos, industrial case studies and virtual demonstrations. The teacher should explain robot anatomy, sensors, drives, controllers, programming basics and industrial applications with the help of diagrams, animations and practical examples. Problem-based learning and discussions on automation systems should be used to strengthen conceptual understanding of robotics and its industrial relevance.

REFERENCE BOOKS / ONLINE RESOURCES:

1. Saeed B. Niku, *Introduction to Robotics*, Pearson Education
2. M. P. Groover, *Industrial Robotics: Technology, Programming and Applications*, Tata McGraw-Hill
3. Fu K. S., Gonzalez R. C. and Lee C. S. G., *Robotics: Control, Sensing, Vision and Intelligence*, McGraw-Hill
4. Yoram Koren, *Robotics for Engineers*, McGraw-Hill
5. Ganesh S. Hegde, *Industrial Robotics*, Laxmi Publications
6. S. R. Deb and Sankha Deb, *Robotics Technology and Flexible Automation*, Tata McGraw-Hill
7. E-books / e-tools / relevant software as recommended by AICTE / SWAYAM / BTE / NITTTR, Chandigarh

SUGGESTED DISTRIBUTION OF MARKS:

Unit No.	Time Allotted (Periods)	Marks Allotted (%)
1	06	22
2	06	20
3	06	20
4	05	18
5	05	20
Total	**28**	**100**

OPEN ELECTIVE-II/ ADVANCED SKILL CERTIFICATION-II		
4.7.2	INTERNET OF THINGS (IoT) (THEORY)	L T P 2 0 0

COURSE OBJECTIVE:

This course is designed to introduce students to the fundamentals of the Internet of Things (IoT), including IoT concepts, embedded systems, device components, networking basics and real-world applications. It enables diploma students to understand the interaction between hardware and software in connected devices and the communication technologies used in smart systems. The course also aims to develop awareness of IoT-based industrial, commercial and societal applications relevant to modern automation and packaging environments.

COURSE OUTCOMES (CO):

After undergoing this course, the students will be able to:

CO1: Define Internet of Things and explain its technological evolution.
CO2: Identify the components and architecture of IoT systems.
CO3: Explain the interaction between hardware and software in IoT devices.
CO4: Describe basic networking concepts used in IoT communication.
CO5: Identify industrial and societal applications of IoT.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	**PO1** Basic and Discipline Specific Knowledge	**PO2** Problem Analysis	**PO3** Design / Development of Solutions	**PO4** Engineering Tools	**PO5** Practice for Society, Sustainability and Environment	**PO6** Project Management	**PO7** Lifelong Learning	**PSO 1**	**PSO 2**
CO1	3	2	-	2	-	-	2	*	*
CO2	3	2	2	2	-	-	2	*	*
CO3	3	2	2	3	-	-	2	*	*
CO4	3	3	2	2	-	-	2	*	*
CO5	3	2	3	2	2	-	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)
***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS:

UNIT I: INTRODUCTION TO INTERNET OF THINGS (06 Periods)

Definition of Internet of Things. Technological trends leading to IoT. Evolution of connected systems. Impact of IoT on society. Industrial, commercial and smart environment applications of IoT.

UNIT II: ARCHITECTURE AND COMPONENTS OF IoT SYSTEMS (06 Periods)

Basic architecture of IoT systems. Components of IoT systems such as sensors, actuators, controllers, gateways and cloud platforms. Functional blocks of IoT. Data acquisition, processing and communication in IoT systems.

UNIT III: EMBEDDED SYSTEMS IN IoT (06 Periods)

Overview of embedded systems. Components of embedded systems. Interaction of embedded systems with the physical world. Core hardware components used in IoT devices such as microcontrollers, memory units, input-output interfaces and power units.

UNIT IV: INTERFACING AND NETWORKING IN IoT (05 Periods)

Interaction between software and hardware. Basics of interfacing in IoT devices. Fundamentals of networking, networking hardware and structure of the Internet. Introduction to IoT communication and data exchange in connected systems.

UNIT V: IoT APPLICATIONS IN INDUSTRY AND SOCIETY (05 Periods)

Applications of IoT in smart homes, healthcare, agriculture, transportation, industrial automation and packaging environments. Benefits and challenges of IoT systems. Role of IoT in modern industry and smart services.

INSTRUCTIONAL STRATEGY:

This subject should be taught through classroom lectures, demonstrations, videos, case studies and application-based discussions to develop conceptual understanding of IoT systems. The teacher should explain IoT architecture, embedded system fundamentals, device communication and networking basics with the help of simple diagrams and practical examples. Real-life examples from industrial and societal applications should be used to make learning meaningful and relevant.

SUGGESTED LEARNING RESOURCES:

1. Raj Kamal, *Internet of Things*, McGraw Hill Education
2. Arshdeep Bahga and Vijay Madisetti, *Internet of Things: A Hands-On Approach*, Orient Blackswan
3. E-books / e-tools / relevant software as recommended by AICTE / SWAYAM / BTE / NITTTR, Chandigarh

SUGGESTED SOFTWARE / LEARNING WEBSITES:

- Arduino IoT
- Raspberry Pi
- Microchip IoT Design Center
- Adafruit Learning Resources

SUGGESTED DISTRIBUTION OF MARKS:

Unit No.	Time Allotted (Periods)	Marks Allotted (%)
1	06	20
2	06	20
3	06	20
4	05	20
5	05	20
Total	**28**	**100**

ADVANCED SKILL CERTIFICATION-II

To fulfill the requirements for Advanced Skill Development, a minimum of 20 hours of skill certification is necessary. This certification must be obtained from a recognized national or international agency or institute. The assessment and certification process will be conducted by the respective agency or institute. Students must present their certificate to earn 02 credits for this subject.

4.8	ESSENCE OF INDIAN KNOWLEDGE AND TRADITION	L	T	P
		2	-	-

COURSE OBJECTIVE:

Understand the fundamental aspects of the Indian Knowledge System, its integration with modern science, principles of Yoga and holistic healthcare, and practical applications in contemporary contexts.

COURSE OUTCOMES (CO):

Upon completion of the course, the student will be able to demonstrate knowledge of the following topics:

CO1: Overview, importance, and relevance of the Indian Knowledge System, including Vedas, Upavedas, Vedangas, and Upangas.
CO2: Relevance of science and spirituality, and contributions of ancient Indian science and technology.
CO3: Basic principles of Yoga, benefits of holistic healthcare, and integration with modern healthcare.
CO4: Practical applications and case studies of the Indian Knowledge System's relevance today.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	1	1	1	2	1	3	*	*
CO2	3	2	2	1	3	1	3	*	*
CO3	3	2	2	1	3	1	3	*	*
CO4	3	2	3	2	3	2	3	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENT:

Unit 1: Introduction to Indian Knowledge System (07 Periods)

Overview of Indian Knowledge System
- Importance and relevance
- Introduction to the Vedas
- Upavedas
- Vedangas
- Upangas

Unit 2: Modern Science and Indian Knowledge System (07 Periods)

- Relevance of Science and Spirituality,
- Science and Technology in Ancient India,

Unit 3: Yoga and Holistic Healthcare (07 Periods)

- Basic principles of Yoga

- Benefits of holistic healthcare practices
- Integration with modern healthcare

Unit 4: Case Studies / Assignment (07 Periods)

- Practical Applications / Case studies demonstrating the relevance of Indian Knowledge System in modern times

RECOMMENDED BOOKS:

1. Indian Knowledge Systems" by Kapil Kapoor
2. "The Vedas: An Introduction to Hinduism's Sacred Texts" by Roshen Dalal
3. "Science and Spirituality in Ancient India" by Subhash Kak
4. "Light on Yoga" by B.K.S. Iyengar
5. "Indian Science and Technology in the Eighteenth Century" by Dharampal

INSTRUCTIONAL STRATEGY:

Adopt an experiential, reflective learning strategy that integrates ancient texts (Vedas, Upavedas) with modern scientific inquiry, using case studies, guided yoga practices, and interdisciplinary discussions to explore the relevance and application of Indian Knowledge Systems in contemporary health, technology, and holistic living.

SUGGESTED DISTRIBUTION OF MARKS

Unit No.	Time Allotted (Periods)	Marks Allocation (%)
1.	07	40
2.	07	30
3.	07	15
4.	07	15
Total	28	100

5.1	ADDITIVE MANUFACTURING (PRACTICUM)	L T P
		2 0 4

COURSE OBJECTIVES:

The course is designed to introduce students to the fundamentals and applications of Additive Manufacturing (AM). It focuses on developing an understanding of AM principles, processes, materials, and design considerations. Students will learn various 3D printing technologies, material selection criteria, and workflow steps from design to post-processing. The course also emphasizes applications of additive manufacturing in packaging, product development, and industry, along with sustainability, safety practices, and emerging trends. The objective is to develop practical knowledge and problem-solving skills required for modern manufacturing environments.

COURSE OUTCOMES:

CO1: Explain the fundamentals, history, benefits, and limitations of additive manufacturing and differentiate it from subtractive manufacturing processes.
CO2: Identify and compare major additive manufacturing processes such as FDM, SLA, SLS, DLP, Binder Jetting, and Material Jetting based on accuracy, speed, and applications.
CO3: Select suitable materials for additive manufacturing by analyzing material properties, limitations, recyclability, and end-use requirements.
CO4: Apply design principles for additive manufacturing, including CAD modeling, slicing parameters, build orientation, support structures, and optimization methods.
CO5: Demonstrate awareness of industrial applications, sustainability aspects, safety procedures, and future trends in additive manufacturing.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design / Development of Solutions	PO4 Engineering Tools	PO5 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Lifelong Learning	PSO1	PSO2
CO1	3	2	-	-	-	-	2	*	*
CO2	3	2	-	2	-	-	2	*	*
CO3	3	3	2	2	2	-	-	*	*
CO4	3	2	3	3	-	-	2	*	*
CO5	3	2	2	-	3	-	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)
***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENT:

UNIT 1: INTRODUCTION TO ADDITIVE MANUFACTURING (04 Periods)

Definition and history of additive manufacturing, difference between subtractive and additive processes, benefits and limitations of AM, AM in product development and packaging, overview of the AM workflow: design, slicing, printing, post-processing.

Ex. No.	Name of Experiment	Periods
1	Study of additive manufacturing systems	2
2	Study of additive manufacturing workflow	2

UNIT 2: ADDITIVE MANUFACTURING PROCESSES (06 Periods)

Detailed study of major AM processes: Fused Deposition Modelling (FDM), Stereolithography (SLA), Selective Laser Sintering (SLS), Binder Jetting, Digital Light Processing (DLP), Material Jetting and Direct Energy Deposition. Comparison of process capabilities, accuracy, and speed.

Ex. No.	Name of Experiment	Periods
1	CAD model preparation for 3D printing	3
2	Conversion of CAD model to STL file	3
3	Slicing of 3D models using slicing software	3

UNIT 3: MATERIALS FOR ADDITIVE MANUFACTURING (06 Periods)

Polymers (PLA, ABS, PETG, Nylon), photopolymers used in SLA/DLP, metals (stainless steel, titanium, aluminum), composites and hybrid materials, material properties and selection criteria, material limitations and recyclability.

Ex. No.	Name of Experiment	Periods
1	FDM 3D printing of a simple component	3
2	Study of printing parameters such as layer height, infill, and speed	3
3	Effect of layer height on surface finish	3

UNIT 4: DESIGN FOR ADDITIVE MANUFACTURING (06 Periods)

Design principles for 3D printing, CAD modeling basics for AM, slicing software and parameters, build orientation, support structures, infill patterns, common design constraints and optimization techniques, file formats (STL, OBJ), lightweighting and part consolidation.

Ex. No.	Name of Experiment	Periods
1	Effect of infill density on strength and material usage	3
2	Study of build orientation	3
3	Material study of PLA, ABS, PETG, and Nylon	3

UNIT 5: APPLICATIONS, TRENDS, AND SAFETY (06 Periods)

Applications of AM in packaging, tooling, jigs, fixtures, prototypes, and molds, custom packaging solutions using AM, AM in medical, automotive, aerospace, and consumer goods, sustainability and environmental impact of AM, safety procedures in operating AM machines, future trends such as 4D printing, bioprinting, and distributed manufacturing.

Ex. No.	Name of Experiment	Periods
1	Dimensional accuracy measurement of printed parts	3
2	Post-processing and finishing of printed components	3
3	Study of safety procedures and maintenance practices in AM laboratory	3

INSTRUCTIONAL STRATEGY:

The course will be delivered through a combination of classroom lectures, visual presentations, case studies, demonstrations, and practical exposure. Concepts will be explained using real-life industrial examples related to packaging and product development. CAD demonstrations and videos of additive manufacturing processes will enhance understanding. Hands-on practice with slicing software and 3D printed components will be encouraged. Group discussions, assignments, and problem-based learning will be used to strengthen analytical skills. Emphasis will be given to safety practices, sustainability, and emerging technologies to align students with current industry requirements.

RECOMMENDED TEXTBOOKS AND REFERENCES:

1. Ian Gibson, David Rosen, and Brent Stucker, *Additive Manufacturing Technologies*.
2. Chee Kai Chua and Kah Fai Leong, *3D Printing and Additive Manufacturing: Principles and Applications*.
3. G. K. Gibson, *Additive Manufacturing Handbook*.
4. Hod Lipson and Melba Kurman, *Fabricated: The New World of 3D Printing*.
5. ASTM F42 Committee on Additive Manufacturing standards and ISO/ASTM 52900.

SUGGESTED DISTRIBUTION OF MARKS:

Unit	Time Allotted (Periods)	Marks Allotted (%)
1	04	19
2	06	19
3	06	19
4	06	24
5	06	19
Total	**28**	**100**

5.2	COMPUTER AIDED DESIGN & DRAFTING (PRACTICUM)	L T P
		2 0 2

COURSE OBJECTIVES:

This course aims to develop practical knowledge and skills in computer aided design and drafting for engineering applications. It focuses on understanding engineering drawing conventions, sectional views, dimensioning practices, and geometric dimensioning and tolerancing. Students will learn 2D drafting, 3D solid modeling, assembly drawing, and print generation using CAD software. The course also emphasizes interpretation of machine component drawings, preparation of assembly views, and application of CAD tools in product design and manufacturing. The objective is to equip students with drafting accuracy, visualization skills, and software competency required in modern engineering and industrial practice.

COURSE OUTCOMES (CO):

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

CO1: Explain the fundamentals of engineering drafting, sectional views, and standard drawing conventions used in CAD practice.
CO2: Apply dimensioning principles and geometric dimensioning and tolerancing concepts in engineering drawings.
CO3: Prepare 2D CAD drawings of machine components and assembly views with proper dimensions.
CO4: Create 3D solid models and assemblies of engineering components using CAD software.
CO5: Generate complete drafting outputs including views, dimensions, and print layouts for engineering applications.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design / Development of Solutions	PO4 Engineering Tools	PO5 Practice for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	2	-	2	-	-	2	*	*
CO2	3	3	2	2	-	-	-	*	*
CO3	3	2	3	3	-	-	-	*	*
CO4	3	2	3	3	-	-	2	*	*
CO5	3	2	2	3	-	-	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)
* PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENT:

UNIT 1: INTRODUCTION TO CAD AND ENGINEERING DRAFTING (04 Periods)

Introduction to computer aided design and drafting, CAD software interface and tools, engineering drawing standards, line types, lettering, scale, basic object creation and editing commands, coordinate systems, drawing setup, layers, and templates.

Ex. No.	Name of Experiment	Periods
1	Study of CAD software interface, drawing limits, units, layers, and basic commands	2
2	Preparation of basic 2D geometric drawings using CAD tools	2

UNIT 2: SECTIONAL VIEWS AND DIMENSIONING (04 Periods)

Sectioning, sectional views, representation of sectional plane, hatching, spacing and inclination, full and half sections, conventional representation of materials in section, dimensioning rules, tolerances, and introduction to GD&T. This follows the same core emphasis given in the uploaded CAD reference syllabus.

Ex. No.	Name of Experiment	Periods
1	Drafting of sectional views of simple machine components	2
2	Application of dimensions, limits, fits, and basic GD&T symbols in CAD drawings	2

UNIT 3: 2D DRAFTING OF MACHINE COMPONENTS (06 Periods)

Preparation of orthographic views, assembly front view, top/side view, dimensioning of machine parts, interpretation of detailed drawings, bill of materials concept, and drafting practice of common components. The CAD reference specifically includes assembled front view plus top/side view and dimensioning as the basis of drafting practice.

Ex. No.	Name of Experiment	Periods
1	Preparation of 2D detailed drawing of a simple machine component	2
2	Preparation of assembly drawing of sleeve and cotter joint / similar component	2
3	Drafting of plummer block / bushed bearing / flange coupling in 2D CAD	2

UNIT 4: 3D SOLID MODELING AND ASSEMBLY (08 Periods)

Introduction to solid modeling, sketch-based features, extrusion, revolve, cut, fillet, chamfer, pattern, mirror, constraints, file formats, part modeling, assembly creation, and generation of basic views from solid models. The uploaded CAD reference explicitly includes solid modeling and assembly of components using CAD software.

Ex. No.	Name of Experiment	Periods
1	Creation of 3D solid model of a simple machine part	2
2	Creation of 3D model of flange coupling / plummer block component	2
3	Assembly of modeled components using CAD constraints	2
4	Generation of orthographic views from 3D solid model and assembly	2

UNIT 5: PRINTING, LAYOUTS, AND CAD APPLICATIONS (06 Periods)

Preparation of drawing sheets, title block, plotting and printing, model space and layout space, viewports, scale setting, export of CAD drawings, and practical applications of CAD in product design, drafting offices, and manufacturing environments. The uploaded reference also lists CAD printout generation and supporting learning resources for CAD software use.

Ex. No.	Name of Experiment	Periods
1	Preparation of final drawing sheet with title block, dimensions, and annotations	2
2	Plotting and printing of 2D and 3D CAD outputs	2
3	Mini project: complete CAD drafting and modeling of a selected mechanical component	2

TEXT BOOKS / REFERENCE BOOKS:

1. Cameron Coward, *A Beginner's Guide to 3D Modeling*.
2. Amit Bhatt and Mark Wiley, *SolidWorks 2022 Step by Step Guide*.
3. N. D. Bhatt, *Engineering Drawing*.
4. K. Venugopal, *Engineering Graphics and Design*.
5. CAD software manuals and standard drafting references.

SUGGESTED SOFTWARE / LEARNING WEBSITES:

a. Autodesk AutoCAD tutorials
b. MyCADSite tutorials
c. NPTEL lectures on CAD / Engineering Graphics
d. SolidWorks / Fusion 360 / FreeCAD learning resources

INSTRUCTIONAL STRATEGY:

This course will be delivered through demonstrations, guided CAD laboratory sessions, practice-based assignments, and drawing exercises. Students will first learn basic drafting and dimensioning principles, then gradually progress to machine component drafting, solid modeling, and assembly creation. Emphasis will be laid on hands-on work, interpretation of engineering drawings, correct use of CAD tools, and preparation of printable drawing sheets. Continuous practice, model-based exercises, and mini-projects will be used to develop drafting accuracy, visualization ability, and confidence in software usage. This structure follows the practicum-style organization seen in the uploaded demo file.

SUGGESTED DISTRIBUTION OF MARKS:

Unit No.	Time Allotted (Periods)	Marks Allotted (%)
1	04	15
2	04	15
3	06	20
4	08	30
5	06	20
Total	**28**	**100**

5.3.1	METAL AND GLASS PACKAGING (THEORY)	L T P
		3 0 0

COURSE OBJECTIVES:

The course provides students with knowledge of metal and glass packaging materials, their properties, manufacturing processes, testing methods, applications, and sustainability aspects, enabling them to analyse, evaluate, and design suitable packaging solutions for food, beverages, cosmetics, and pharmaceutical industries.

COURSE OUTCOMES:

CO1: Understand the properties, manufacturing processes, and applications of metal and glass packaging.
CO2: Conduct standard tests to evaluate the strength, barrier performance, and durability of metal and glass containers.
CO3: Select appropriate metal and glass packaging materials for food, beverage, cosmetic, and pharmaceutical products.
CO4: Demonstrate awareness of sustainability, recycling, and recent innovations in metal and glass packaging.
CO5: Apply knowledge of metal and glass packaging in solving practical packaging problems and improving package performance for different end-use applications.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	**PO1** Basic and Discipline Specific Knowledge	**PO2** Problem Analysis	**PO3** Design / Development of Solutions	**PO4** Engineering Tools	**PO5** Practice for Society, Sustainability and Environment	**PO6** Project Management	**PO7** Lifelong Learning	**PSO1**	**PSO2**
CO1	3	2	-	-	-	-	-	*	*
CO2	3	3	-	2	-	-	2	*	*
CO3	3	2	3	-	-	-	-	*	*
CO4	3	-	2	-	3	-	2	*	*
CO5	3	2	3	-	-	-	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)
***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS:

UNIT I: INTRODUCTION TO PACKAGING MATERIALS – GLASS BASICS (07 Periods)

Glass as packaging material, advantages and limitations, types of glass used in packaging such as soda-lime, borosilicate, flint and amber, raw materials, composition and chemistry.

UNIT II: GLASS MANUFACTURING, FORMING & BLOWING (09 Periods)
Melting and refining of glass, forming processes including blow-blow, press-blow and narrow-neck press and blow, annealing, moulding and finishing, container nomenclature, closures and sealing principles.

UNIT III: PROPERTIES, TESTING & SUSTAINABILITY OF GLASS (08 Periods)
Physical properties such as density and thermal expansion, mechanical strength including impact, compressive and tensile strength, optical properties such as transparency, color and gloss, barrier properties including gas, moisture and light, thermal shock resistance, defect analysis, recycling and sustainability considerations.

UNIT IV: METAL PACKAGING MATERIALS & MANUFACTURING (10 Periods)
Metals used in packaging including tinplate, aluminium, steel, tin-free steel and alloys, corrosion, surface coatings and internal linings, advantages, limitations and selection criteria, can types such as two-piece and three-piece, ends, lids and closures, sheet preparation, forming processes including drawing, ironing and bending, seam formation and quality requirements.

UNIT V: PROPERTIES, TESTING & SUSTAINABILITY OF METALS

(08 periods)

Physical properties such as density and thermal conductivity, mechanical properties including tensile, compressive, bending and cupping strength, barrier properties, surface finish and optical properties, defect analysis, hermeticity and corrosion testing, recycling and sustainability.

TEXT BOOKS/REFERENCE BOOKS:

1. Canmaking: The Technology of Metal Protection and Decoration – T.A. Turner – Springer
2. Metal Packaging – F. Debeaufort – Wiley
3. Packaging Technology – Anne Emblem – Elsevier
4. Packaging Technology – Anne Emblem – Elsevier
5. Glass Packaging – F. Debeaufort – Wiley
6. When Glass Meets Pharma – Dr. Bettine Boltres – Schott

SUGGESTED DISTRIBUTION OF MARKS:

Unit No.	Time Allotted (Periods)	Marks Allotted (%)
1	7	20
2	9	10
3	8	20
4	10	20
5	8	10
Total	**42**	**100**

5.3.2	PHARMACEUTICAL AND COSMETICS PACKAGING (THEORY)	L T P 3 0 0	COURSE OBJECTIVE

S:

The course is designed to help students understand the selection and properties of glass used in pharmaceutical packaging, along with its methods of production. It also aims to develop knowledge of different materials such as glass, plastics, and rubber that are commonly used for pharmaceutical containers and closures, enabling students to compare their properties and applications. Further, the course focuses on packaging materials and packaging methods used for oral pharmaceutical products, including blister packaging, to provide students with a practical understanding of pharmaceutical packaging systems.

COURSES OUTCOME:

The theory should be taught in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

CO1: Describe the characteristics and testing of glass containers used in pharmaceutical packaging.
CO2: Evaluate the advantages and disadvantages of materials such as glass, plastics, and rubber for pharmaceutical packaging.
CO3: Apply packaging techniques for oral pharmaceutical products, including the design and functionality of blister packs.
CO4: Analyze cosmetic packaging materials and understand the formulation of different cosmetic products.
CO5: Demonstrate the ability to select suitable pharmaceutical and cosmetic packaging materials based on product requirements, protection, and functionality.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	**PO1** Basic and Discipline Specific Knowledge	**PO2** Problem Analysis	**PO3** Design / Development of Solutions	**PO4** Engineering Tools	**PO5** Practice for Society, Sustainability and Environment	**PO6** Project Management	**PO7** Lifelong Learning	**PSO 1**	**PSO 2**
CO1	3	2	-	2	-	-	-	*	*
CO2	3	3	-	2	-	-	2	*	*
CO3	3	2	3	2	-	-	-	*	*
CO4	3	2	2	-	-	-	-	*	*
CO5	3	2	2	-	-	-	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)
***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS:

UNIT I: INTRODUCTION TO PHARMACEUTICAL PACKAGING (08 periods)
Introduction to packaging of pharmaceutical products, classification of pharmaceuticals, importance and functions of packaging, selection criteria for pharmaceutical packaging materials

UNIT II: GLASS PACKAGING FOR PHARMACEUTICALS (08 periods)
Introduction to glass, selection of glass as packaging material for pharmaceutical products, advantages and disadvantages of glass containers, properties of glass, production of glass, types of glass including soda glass, sulphated glass, neutral glass and borosilicate glass, manufacturing of glass containers, testing of glass containers

UNIT III: PLASTICS, RUBBER & OTHER PACKAGING MATERIALS (08periods)

Study of glass and plastics as materials for containers and rubber as a material for closure including their merits and demerits, materials used for packaging of injectables such as aluminium, paper and board, introduction to aerosol packaging and its types, plastic introduction, structure of polymers, raw materials of plastics, types of plastics

UNIT IV: PACKAGING OF PHARMACEUTICAL PRODUCTS: ORAL DOSAGE FORMS (10 periods)

Packaging of pharmaceutical products with emphasis on oral dosage forms, introduction to packaging materials used for oral products including rigid and semi-rigid materials such as glass containers, aluminium tubes, tinplate containers and plastic containers, flexible packaging materials such as paper, cellulosic films and aluminium foil, blister packaging including introduction, blister design parameters, materials used, types of blisters, advantages and disadvantages, common defects and blister packing machines

UNIT V: COSMETIC PACKAGING & FORMULATION (08 periods)

Introduction to packaging of cosmetics, cosmetic classification, advantages and disadvantages, scope of cosmetic industry, study of physical and chemical properties of ingredients used in cosmetics, formulation and development of hair care products including shampoo, colorants, hair removers, hair gel and hair oils, growth of cosmetic industry in India

TEXT BOOKS/REFERENCE BOOKS:

1. Remington's Pharmaceutical Sciences.
2. The Extra Pharmacopoeia-Martindale
3. Indian Institute of Packaging -Packaging Technology (volume -4)
4. Cosmetic Science and Technology Vol. I, Il, Ill by Sagarin
5. New Cosmetic Science
6. Industrial Pharmacy by Leon Lachman
7. Perfume: History & chemistry By DD. Wasule
8. Indian Herbs by Chopra
9. Wealth of India, published by CSIR
10. D. A. Dean, Roy Evans, Ian Hall. Pharmaceutical packaging technology. Tylor and Francis.

SUGGESTED DISTRIBUTION OF MARKS:

Unit No.	Time Allotted (Periods)	Marks Allotted (%)
1	8	19
2	8	19
3	8	19
4	10	24
5	8	19
TOTAL	**42**	**100**

5.4	EMERGING TRENDS IN PACKAGING TECHNOLOGY (THEORY)	L T P
		2 1 0

COURSE OBJECTIVES:

The course aims to provide advanced knowledge of emerging technologies in packaging, focusing on active, smart, and sustainable packaging systems and their role in enhancing product quality, safety, and shelf life. The course is also designed to develop an understanding of modern packaging materials, intelligent systems, and digital integration technologies such as RFID, blockchain, and AI, along with exposure to future trends and innovations in the packaging industry.

COURSE OUTCOMES (CO):

It is important to teach theory and tutorials in a way that enables students to exhibit the following learning outcomes in cognitive and analytical domains. The ability for students to:

CO1: Understand the principles and applications of active packaging technologies.

CO2: Analyze smart and intelligent packaging systems including sensors, indicators, and digital tools.

CO3: Evaluate sustainable packaging solutions based on environmental and life cycle considerations.

CO4: Examine advanced packaging materials and emerging technologies used in modern packaging.

CO5: Assess future trends and integrated packaging systems using Industry 4.0 and digital innovations.

SUGGESTED COURSE ARTICULATION MATRIX

CO No.	PO1 Basic & Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design / Development of Solutions	PO4 Engineering Tools	PO5 Society, Sustainability & Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	2	1	-	1	-	2	*	*
CO2	3	3	2	2	1	-	2	*	*
CO3	2	2	3	2	3	-	2	*	*
CO4	3	3	3	3	2	-	2	*	*
CO5	3	2	3	3	2	1	3	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS:

UNIT I: ACTIVE PACKAGING TECHNOLOGIES (06 periods)

Active packaging involves interaction between packaging and the product environment to extend shelf life and improve safety. It includes oxygen scavengers (sachets, films, labels), moisture absorbers, carbon dioxide emitters and absorbers, and ethylene scavengers used in fresh produce packaging. Antimicrobial packaging systems, intelligent release packaging, flavor and odour absorbers, and microwave susceptibility packaging are also covered. Integration of time-temperature indicators and regulatory aspects related to food safety validation are important components.

UNIT II: SMART AND INTELLIGENT PACKAGING SYSTEMS (06 periods)

Smart packaging includes systems that monitor and communicate product condition. Intelligent packaging indicators such as freshness indicators, temperature abuse indicators, leakage detection systems, and tamper evidence devices are studied. Technologies such as RFID, NFC, QR codes, and blockchain for traceability are discussed. Nanotechnology-based sensors, gas composition indicators, smart labels, and data analytics applications in packaging are also included.

UNIT III: SUSTAINABLE PACKAGING SOLUTIONS (05 periods)

Sustainable packaging focuses on reducing environmental impact through eco-friendly materials and processes. Topics include biodegradable polymers such as PLA, PHA, and starch-based plastics, compostable packaging standards, paper-based barrier solutions, mycelium packaging, and seaweed-based materials. Life cycle assessment, circular economy models, carbon-neutral packaging, and regulatory frameworks are also covered.

UNIT IV: ADVANCED PACKAGING MATERIAL DEVELOPMENTS (06 periods)

This unit covers innovations in packaging materials such as nanocomposites, graphene-based materials, and carbon nanotubes. Self-healing polymers, shape memory materials, and bio-based coatings are discussed. High-barrier nano-coatings, antimicrobial nanoparticles, plasma-treated surfaces, aerogel insulation materials, and conductive inks for smart packaging are also included.

UNIT V: FUTURE TRENDS AND INTEGRATED PACKAGING SYSTEMS

(05 periods)

Future packaging technologies include Industry 4.0 integration, AI and machine learning applications, blockchain-enabled supply chains, and digital printing for personalized packaging. Edible packaging, packaging robotics, automation, and zero-waste systems are explored. Regulatory challenges, commercialization aspects, and global market trends are also discussed.

INSTRUCTIONAL STRATEGY:

The course will be delivered through lectures and tutorial sessions focusing on conceptual understanding and

problem-solving. Teaching methods will include presentations, case studies, and industry examples to explain emerging technologies. Tutorials will emphasize analytical exercises such as packaging selection, indicator evaluation, and sustainability assessment. Students will be encouraged to engage in discussions, assignments, and mini-projects to connect theoretical knowledge with real-world applications.

TEXT AND REFERENCE BOOKS:

1. Ahvenainen, R. – *Novel Food Packaging Techniques*
2. Kerry, J. & Butler, P. – *Smart Packaging Technologies for FMCG*
3. Emblem, A. & Emblem, H. – *Packaging Technology: Fundamentals, Materials and Processes*
4. Dainelli, D. – *Active and Intelligent Food Packaging*
5. Siracusa, V. – *Food Packaging and Preservation*

SUGGESTED DISTRIBUTION OF MARKS:

Unit No.	Time Allotted (Periods)	Marks Allotted (%)
1	6	20
2	6	20
3	5	20
4	6	20
5	5	20
Total	**28**	**100**

5.5	PACKAGING LAWS, STANDARDS, AND REGULATIONS (THEORY)	L T P 2 1 0

COURSE OBJECTIVES:

The course is designed to provide students with a comprehensive understanding of packaging laws, standards, and regulations at national and international levels. It aims to develop knowledge of the Indian regulatory framework related to packaging, including legal metrology, BIS certification, packaged commodities rules, food packaging laws, and export quality requirements. The course also focuses on international packaging laws, labelling standards, compliance requirements, and product-specific regulations governing storage, declarations, and safety. Further, it seeks to familiarize students with enforcement procedures, quality assurance systems, penalties for non-compliance, and the role of packaging regulations in consumer protection, fair trade, and quality assurance.

COURSE OUTCOMES:

CO1: Understand the Indian regulatory framework governing packaging, including legal metrology, BIS certification, and food packaging laws.
CO2: Explain the requirements for declarations, standards, and labelling rules applicable to packaged commodities in trade and commerce.
CO3: Identify and compare international packaging laws, regulations, and standards relevant to global trade and compliance.
CO4: Analyze product-specific packaging requirements, storage regulations, and statutory provisions under food and agricultural laws.
CO5: Apply packaging laws, standards, and quality assurance procedures to evaluate compliance, prevent violations, and support consumer protection.

SUGGESTED COURSE ARTICULATION MATRIX (CAM)

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design / Development of Solutions	PO4 Engineering Tools	PO5 Practice for Society, Sustainability and Environment	PO6 Project Management	PO7 Lifelong Learning	PSO1	PSO2
CO1	3	2	-	-	-	-	-	*	*
CO2	3	3	-	2	-	-	2	*	*
CO3	3	2	3	2	-	-	-	*	*
CO4	3	2	2	-	2	-	-	*	*
CO5	3	2	2	-	3	-	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)
* PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS:

UNIT I: INDIAN REGULATORY FRAMEWORK FOR PACKAGING (04 Periods)

Indian regulatory system introduction, Standards of Weights and Measures Act (SWMA) provisions, standard units and definitions, laws and ministries involved in packaging regulation, Essential Commodities Act requirements, Agricultural Produce (Grading and Marketing) Act provisions, Prevention of Food Adulteration Act (PFA) packaging specifications, Codex Standard Act compliance, Export (Quality Control and Inspection) Act requirements, Bureau of Indian Standards (BIS) certification processes.

UNIT II: PACKAGED COMMODITIES DECLARATIONS & STANDARDS (04 Periods)

Declarations for interstate trade and commerce requirements, standard packages definitions and specifications, maximum permissible error limits, mandatory label declarations for packaged goods, standard quantity specifications for various product categories, symbols and units usage guidelines, net quantity declaration rules, retail sale packaging regulations, wholesale packages specifications, packaged commodities rules enforcement.

UNIT III: INTERNATIONAL PACKAGING LAWS & REGULATIONS (06 Periods)

Uniform Weights and Measures Law principles, Uniform Packaging and Labelling Regulation (UPLR) requirements, Uniform Unit Pricing Regulation (UPR) guidelines, international packaging standards overview, EU-REACH regulations impact on packaging materials, global food safety packaging standards, international trade packaging compliance, WTO packaging regulations.

UNIT IV: STORAGE, PFA & PRODUCT-SPECIFIC REGULATIONS (08 Periods)

Packaging storage requirements for different products, raw material specifications for packaging, PFA packaging material requirements, packaging specifications under Prevention of Food Adulteration Act, declaration and labelling requirements under PFA, display panel specifications, statutory requirements on packages, Fruit Products Order (FPO) packaging standards, Meat Food Products Order (MFPO) requirements, Agricultural Grading and Marking Rules (AGMARK) specifications, Edible Oil Packaging (Regulatory) Order provisions.

UNIT V: ENFORCEMENT, VIOLATIONS & QUALITY ASSURANCE (06 Periods)

PFA enforcement methods and procedures, violations of packaging laws and penalties under various sections, offences and punishments for non-compliance, quality control inspection procedures, legal metrology enforcement mechanisms, BIS quality certification processes, packaging audit procedures, consumer protection laws related to packaging, dispute resolution in packaging regulations.

TEXT BOOKS / REFERENCE BOOKS:

1. Bureau of Indian Standards (BIS), relevant Indian Standards on packaging and labelling.
2. Legal Metrology Act and Packaged Commodities Rules, Government of India publications.
3. Food Safety and Standards Authority of India (FSSAI), regulations related to packaging and labelling.
4. Codex Alimentarius Commission, international food packaging and labelling guidelines.
5. Export Inspection Council / BIS / AGMARK manuals and certification guidelines.
6. Soroka, W., *Fundamentals of Packaging Technology*, Institute of Packaging Professionals.
7. Yam, K. L. (Ed.), *The Wiley Encyclopedia of Packaging Technology*, John Wiley & Sons.
8. Relevant Government notifications, packaging laws, standards, and compliance manuals.

SUGGESTED DISTRIBUTION OF MARKS:

Unit No.	Time Allotted (Periods)	Marks Allotted (%)
1	04	19
2	04	19
3	06	19
4	08	24
5	06	19
Total	**28**	**100**

5.6.1	PACKAGING WASTE MANAGEMENT (PRACTICUM)	L T P
		1 0 3

COURSES OBJECTIVE :

The course is designed to provide students with an understanding of packaging waste management and its importance in environmental protection and sustainable development. It aims to develop knowledge of different types of packaging waste generated from paper, plastic, glass, metal, and composite materials, along with their sources, collection, segregation, treatment, recycling, and disposal methods. The course also focuses on the principles of waste minimization, resource recovery, circular economy, and legal regulations related

to packaging waste management. Further, it seeks to familiarize students with sustainable packaging practices, environmental impacts of packaging waste, and modern strategies for reducing waste and promoting eco-friendly packaging solutions.

COURSES OUTCOME:

CO1: Understand the concept, sources, and types of packaging waste and their impact on the environment.
CO2: Explain the methods of collection, segregation, recycling, treatment, and disposal of packaging waste materials.
CO3: Identify suitable waste management practices for different packaging materials such as paper, plastic, glass, metal, and composites.
CO4: Analyze the role of waste minimization, resource recovery, circular economy, and legal regulations in packaging waste management.
CO5: Apply the principles of packaging waste management to develop sustainable and eco-friendly solutions for reducing environmental impact.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	**PO1** Basic and Discipline Specific Knowledge	**PO2** Problem Analysis	**PO3** Design / Development of Solutions	**PO4** Engineering Tools	**PO5** Practices for Society, Sustainability and Environment	**PO6** Project Management	**PO7** Lifelong Learning	**PSO1**	**PSO2**
CO1	3	2	-	-	-	-	-	*	*
CO2	3	3	-	2	-	-	2	*	*
CO3	3	2	3	2	-	-	-	*	*
CO4	3	2	2	-	2	-	-	*	*
CO5	3	2	2	-	3	-	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)
***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENT:

UNIT I: FUNDAMENTALS OF PACKAGING WASTE (02 periods)
Types of packaging waste including post-consumer vs post-industrial waste, sources identification, lifecycle analysis of packaging materials from production to disposal, carbon footprint assessment, basic recycling processes overview including mechanical and chemical methods.

S.No.	**Name of Experiment / Practical**	**Periods**
1	Waste stream identification exercise for different packaging materials	2
2	Sorting of packaging waste into paper, plastic, glass, metal and composite categories	2

UNIT II: PLASTIC WASTE MANAGEMENT & CIRCULAR ECONOMY

(02 periods)

Plastic waste streams identification, collection, sorting and preparation techniques, material recovery processes and granulation methods, properties and applications of recycled plastic granules, circular economy principles for packaging, designing for recyclability.

S. No.	Name of Experiment / Practical	Periods
1	Plastic sorting and identification by resin codes	2
2	Classification of plastic packaging materials based on resin type	2
3	Mechanical recycling simulation of plastic waste	2

UNIT III: ENVIRONMENTAL IMPACT & REGULATIONS (04 periods)
Plastic pollution effects including microplastics impact on ecosystems, Extended Producer Responsibility (EPR) frameworks and compliance, global and Indian regulations overview including Plastic Waste Management Rules, strategies for plastic waste reduction.

S. No.	Name of Experiment / Practical	Periods
1	Collection and preparation of water samples for microplastic analysis	2
2	Extraction of microplastics from water samples	2
3	Observation and identification of extracted microplastic particles	2

UNIT IV: ADVANCED RECYCLING TECHNOLOGIES (03 periods)
Chemical recycling methods, pyrolysis, gasification and energy recovery techniques, bio-based and plasma arc recycling processes, role of IoT and AI in waste management optimization.

S. No.	Name of Experiment / Practical	Periods
1	Demonstration of pyrolysis process for packaging waste	2
2	Study of process parameters in pyrolysis of waste materials	2

UNIT V: SUSTAINABLE PACKAGING SOLUTIONS (03 periods)
Sustainable material alternatives, biodegradable packaging development, waste-to-energy systems integration, regulatory compliance strategies, future trends in packaging waste management

S. No.	Name of Experiment / Practical	Periods
1	Testing of biodegradable packaging materials	2
2	Study of properties of biodegradable packaging materials	2
3	Sustainable packaging design project	2
4	Development of eco-friendly packaging concepts	2

TEXT BOOKS/REFERENCE BOOKS:

1. Yam, K. L. (Ed.), The Wiley Encyclopedia of Packaging Technology, John Wiley & Sons.
2. Letcher, T. M. (Ed.), Plastic Waste and Recycling, Elsevier.
3. Worrell, E. and Reuter, M. A. (Eds.), Handbook of Recycling, Elsevier.
4. Liu, L. and Ramakrishna, S. (Eds.), An Introduction to Circular Economy, Springer.
5. Baskar, C. et al. (Eds.), Handbook of Solid Waste Management: Sustainability through Circular Economy, Springer.
6. Mwanza, B. G. et al., Sustainable Technologies and Drivers for Managing Plastic Solid Waste, Springer.
7. Soroka, W., Fundamentals of Packaging Technology, IoPP.
8. ISTA, ISTA Resource Book / ISTA Test Procedures, ISTA

5.6.2	RECYCLING OF PACKAGING MATERIAL (PRACTICUM)	L T P 1 0 3

COURSES OBJECTIVES:

The course is designed to provide students with a comprehensive understanding of the recycling of packaging materials and its importance in sustainable packaging systems. It aims to develop knowledge of the collection, segregation, processing, and recycling methods used for different packaging materials such as paper, plastic, glass, metal, and composites. The course also focuses on the principles of material recovery, reuse, waste minimization, and resource conservation, while highlighting the environmental and economic benefits of recycling. Further, it seeks to familiarize students with modern recycling technologies, quality issues in recycled materials, and the role of recycling in promoting circular economy and sustainable development.

COURSES OUTCOME:

CO1: Understand the concept, importance, and methods of recycling different packaging materials.
CO2: Explain the collection, segregation, processing, and recovery techniques used in recycling of paper, plastic, glass, metal, and composite packaging materials.
CO3: Identify suitable recycling processes for different types of packaging waste based on material properties and end-use requirements.
CO4: Analyze the environmental and economic benefits, challenges, and quality issues associated with recycled packaging materials.
CO5: Apply the principles of recycling and resource recovery to support sustainable packaging practices and circular economy goals.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	**PO1** Basic and Discipline Specific Knowledge	**PO2** Problem Analysis	**PO3** Design / Development of Solutions	**PO4** Engineering Tools	**PO5** Practices for Society, Sustainability and Environment	**PO6** Project Management	**PO7** Lifelong Learning	**PSO1**	**PSO2**

CO1	3	2	-	-	-	-	-	*	*
CO2	3	3	-	2	-	-	2	*	*
CO3	3	2	3	2	-	-	-	*	*
CO4	3	2	2	-	2	-	-	*	*
CO5	3	2	2	-	3	-	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)
***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENT:

UNIT I: FUNDAMENTALS OF PACKAGING RECYCLING (02 periods)

Introduction to packaging recycling systems, types of packaging materials for recycling including paper, plastics, metals, glass, classification of recyclable vs non-recyclable packaging, recycling yield factors, contamination effects, post-consumer vs post-industrial recycling streams, basic recycling economics and market values.

S. No.	Name of Experiment / Practical	Periods
1	Packaging waste stream audit	2
2	Recyclability assessment of different packaging materials	2
3	Contamination identification exercise in packaging waste	2

UNIT II: PAPER AND BOARD RECYCLING PROCESSES (03 periods)

Paper recycling process including pulping, de-inking, screening, cleaning, refining, corrugated board recycling specifics, solid fiber board recycling challenges, paper recycling yield limitations, quality degradation in recycled fiber, applications of recycled paper in packaging.

S. No.	Name of Experiment / Practical	Periods
1	Paper pulping and de-inking demonstration	2
2	Recycled paper sheet formation	2
3	Fiber quality analysis	2

UNIT III: PLASTICS AND METALS RECYCLING (04 periods)

Plastic resin identification and sorting systems, mechanical recycling of PET, HDPE, PP packaging, metal recycling including aluminum, tinplate, steel drums, washing and granulation processes, recycled plastic properties and limitations, alloy separation in metal recycling.

S. No.	Name of Experiment / Practical	Periods
1	Plastic resin identification and sorting	2
2	Mechanical shredding and washing of plastic waste	2
3	Metal separation demonstration	2

UNIT IV: GLASS, COMPOSITES & ADVANCED RECYCLING (03 periods)

Glass container recycling including cullet preparation, color sorting, contamination removal, composite packaging recycling challenges, multi-layer packaging recycling technologies, chemical recycling methods, pyrolysis and gasification of mixed plastics.

S. No.	Name of Experiment / Practical	Periods
1	Glass cullet preparation and sorting	2
2	Study of recycling challenges in composite materials	2
3	Small-scale pyrolysis demonstration	2

UNIT V: SUSTAINABLE SYSTEMS & QUALITY CONTROL (02 periods)

Recycling rate measurement and improvement strategies, circular economy integration in packaging supply chain, quality standards for recycled materials, regulatory frameworks for packaging recycling, life cycle assessment of recycling processes.

S. No.	Name of Experiment / Practical	Periods
1	Recycling efficiency calculation	2
2	Quality testing of recycled materials	2

TEXT BOOKS / REFERENCE BOOKS:

1. Yam, K. L. (Ed.), The Wiley Encyclopedia of Packaging Technology, John Wiley & Sons.
2. Meskers, C., Worrell, E. and Reuter, M. A. (Eds.), Handbook of Recycling, Elsevier.
3. Niaounakis, M., Recycling of Flexible Plastic Packaging, Elsevier.
4. Auras, R. et al., Degradation, Stabilization, and Recycling of Packaging Materials, Wiley.
5. Soroka, W., Fundamentals of Packaging Technology, IoPP.
6. Letcher, T. M. (Ed.), Plastic Waste and Recycling, Elsevier.
7. Worrell, E. and Reuter, M. A. (Eds.), Handbook of Recycling, Elsevier.
8. Recycling of Packaging Material in Food Packaging: Principles and Applications.

5.7	INDIAN CONSTITUTION (THEORY)	L T P 2 0 0

COURSE OBJECTIVES:

The course is designed to help students understand the historical background, principles, and major interpretations of the Indian Constitution. It aims to develop knowledge of the structure and key roles of the Indian Union Government, including the President, Prime Minister, and Council of Ministers, as well as the composition, powers, and functions of the Lok Sabha, Rajya Sabha, and the Supreme Court. The course also seeks to familiarize students with the roles and powers of the Governor, Chief Minister, Council of Ministers, and the State Secretariat at the state level. Further, it provides an understanding of local administration, including district administration, municipal corporations, and Zila Panchayats, along with the structure, role, and functions of the Election Commission of India.

COURSE OUTCOMES:

- **CO1:** Explain the historical background, Preamble, basic structure, and fundamental rights and duties of the Indian Constitution.
- **CO2:** Describe the structure and functions of the Indian Union Government, including the President, Prime Minister, and Council of Ministers.
- **CO3:** Explain the composition, powers, and functions of the Lok Sabha, Rajya Sabha, and the Supreme Court of India.
- **CO4:** Describe the roles and powers of the Governor, Chief Minister, Council of Ministers, and State Secretariat in the State Government.
- **CO5:** Explain the structure and functions of local administration and the Election Commission of India.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design / Development of Solutions	PO4 Engineering Tools	PO5 Practice for Society, Sustainability and Environment	PO6 Project Management	PO7 Lifelong Learning	PSO1	PSO2
CO1	3	2	-	-	-	-	2	*	*
CO2	3	2	-	-	-	-	2	*	*
CO3	3	2	2	-	-	-	2	*	*
CO4	3	2	-	-	-	-	2	*	*
CO5	3	2	-	-	2	-	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS:

Unit I: The Constitution- Introduction (06 Periods)

- The History of the Making of the Indian Constitution
- Preamble and the Basic Structure, and its interpretation
- Fundamental Rights and Duties and their interpretation

Unit II: Union Government (06 Periods)

- Structure of the Indian Union Government
- President – Election, Role and Power
- Prime Minister and Council of Ministers

Unit III: Indian Legislature & Judiciary **(06 Periods)**

- Composition of Lok Sabha and Rajya Sabha
- Powers and Functions of Lok Sabha and Rajya Sabha
- Structure of Supreme Court including Appointment of Judges
- Powers and Functions of Supreme Court

Unit IV: State Government **(03 Periods)**

- Governor – Role and Power
- Chief Minister and Council of Ministers
- State Secretariat

Unit V: Local Administration **(04 Periods)**

- District Administration
- Municipal Corporation
- Zila Panchayat

Unit VI: Election Commission **(03 Periods)**

- Structure of Election Commission of India
- Role and Function of Election Commission

TEXTBOOKS / REFERENCE BOOKS

1. Rajeev Bhargava, *Ethics and Politics of the Indian Constitution*, Oxford University Press, New Delhi, 2008.
2. B. L. Fadia, *The Constitution of India*, Sahitya Bhawan, New Edition, 2017.
3. D. D. Basu, *Introduction to the Constitution of India*, LexisNexis, 23rd Edition, 2018.
4. Subhash Chand Kashyap, *Our Constitution*, NBT, New Delhi.

SUGGESTED SOFTWARE / LEARNING WEBSITES

a. constitution.org/cons/india/const.html
b. legislative.gov.in/constitution-of-india
c. sci.gov.in/constitution
d. toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/
e. ncert.nic.in/textbook.php

6.1	ENTREPRENEURSHIP AND START-UP	L T P
		2 0 0

COURSE OBJECTIVES:

The course is designed to develop entrepreneurial spirit, self-reliance, and resourcefulness among students. It aims to familiarize them with the effective use of human and financial resources for earning a dignified livelihood through entrepreneurial ventures. The course also focuses on building an understanding of the concept, process, and significance of entrepreneurship, along with its contribution to individual growth and national development. Further, it seeks to develop entrepreneurial qualities, competencies, and motivation, while equipping students with the skills required for identifying business opportunities, planning, organizing, financing, and managing start-up ventures successfully.

COURSE OUTCOMES:

CO1: Explain the concept, characteristics, and importance of entrepreneurship and start-ups in economic and social development.
CO2: Identify business opportunities, develop business ideas, and understand the process of converting ideas into viable ventures.
CO3: Apply basic concepts of marketing, accounting, management, and strategic planning for organizing and managing a small business.
CO4: Describe financing options, intellectual property rights, and methods of presenting business ideas to investors.
CO5: Understand succession, dissolution, and business plan preparation as essential elements of entrepreneurial venture creation and sustainability.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design / Development of Solutions	PO4 Engineering Tools	PO5 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	2	-	-	-	-	2	*	*
CO2	3	3	2	-	-	-	2	*	*
CO3	3	2	3	2	-	2	-	*	*
CO4	3	2	2	-	-	-	2	*	*
CO5	3	2	2	-	-	2	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)
***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS:

UNIT I: INTRODUCTION TO ENTREPRENEURSHIP AND START-UPS

(04 Periods)

- Definitions, classification of entrepreneur
- Traits of an entrepreneur, intrapreneurship, motivation
- Types of business structures on the basis of size and ownership
- Similarities and differences between entrepreneurs and managers

UNIT II: BUSINESS IDEAS AND THEIR IMPLEMENTATION (04 Periods)

- Discovering ideas and visualizing the business
- Activity map
- Business plan (case study)

UNIT III: IDEAS TO START-UP (06 Periods)

- Marketing and accounting: definition and importance
- Market analysis – STP (Segmentation, Targeting, Positioning)
- Competition evaluation and strategy development – vision, mission, goal, objectives
- Risk analysis – SWOT analysis

UNIT IV: MANAGEMENT (04 Periods)

- Definition, concept, and functions of management
- Company's organization structure – concept and classification
- Recruitment and selection – definition
- Training and development – importance

UNIT V: FINANCING AND PROTECTION OF IDEAS (06 Periods)

- Financing methods available for entrepreneurship/start-ups in India (government schemes, banking, NBFCs, SHG, and micro-financing)
- Intellectual Property Rights – overview of copyrights, trademark, geographical indicators, patenting, and licenses
- Communication of ideas to potential investors – investor pitch

UNIT VI: SUCCESSION, DISSOLUTION AND HARVESTING STRATEGY

(04 Periods)

- Ways of succession
- Types of dissolution

TEXT BOOKS / REFERENCE BOOKS:

1. Steve Blank and Bob Dorf, *The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company*, K & S Ranch.
2. Vasant Desai, *Entrepreneurship Development (A New Venture Creation)*, Himalaya Publication.
3. S. S. Khanka, *Entrepreneurship Development*, S. Chand & Company Limited, New Delhi.
4. Gupta and Srinivasan, *Entrepreneurship Development*, S. Chand & Company Limited, New Delhi.
5. Adrian J. Slywotzky with Karl Weber, *Demand: Creating What People Love Before They Know They Want It*, Headline Book Publishing.
6. Eric Ries, *The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses*, Penguin UK.
7. Clayton M. Christensen, *The Innovator's Dilemma*, Harvard Business.

SUGGESTED SOFTWARE / LEARNING WEBSITES:

a. fundable.com/learn/resources/guides/startup
b. corporatefinanceinstitute.com/resources/knowledge/finance/corporate-structure
finder.com/small-business-finance-tips
c. profitbooks.net/funding-options-to-raise-startup-capital-for-your-business
NPTEL Course on Entrepreneurship
d. National Geographic Channel YouTube video on "GI Tag Crafts of Bharat"

SUGGESTED DISTRIBUTION OF MARKS:

Unit No.	Time Allotted (Periods)	Marks Allotted (%)
1	04	15
2	04	15
3	06	20
4	04	15

5	06	20
6	04	15
Total	**28**	**100**

6.2.1	EXPORT PACKAGING (THEORY)	L T P 3 0 0

COURSES OBJEC-TIVES:

The course is designed to provide students with a comprehensive understanding of export packaging and its importance in international trade. It aims to develop knowledge of the principles, functions, and requirements of packaging for export consignments, with special emphasis on protection, preservation, handling, storage, and transportation of goods during global distribution. The course also seeks to familiarize students with different packaging materials, methods, standards, regulations, and documentation related to export packaging, while highlighting the role of packaging in minimizing damage, reducing losses, and ensuring product safety and customer satisfaction in overseas markets.

COURSE OUTCOMES:

CO1: Understand the concept, importance, and functions of export packaging in international trade.
CO2: Explain the requirements, materials, and methods used for packaging goods meant for export.

CO3: Identify suitable export packaging systems for the protection, handling, storage, and transportation of different products.

CO4: Analyze export packaging standards, regulations, and documentation required for safe and efficient global distribution.

CO5: Apply the principles of export packaging to minimize damage, reduce losses, and ensure product safety and customer satisfaction in overseas markets.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design / Development of Solutions	PO4 Engineering Tools	PO5 Practice for Society, Sustainability and Environment	PO6 Project Management	PO7 Lifelong Learning	PSO1	PSO2
CO1	3	2	-	-	-	-	-	*	*
CO2	3	3	-	2	-	-	2	*	*
CO3	3	2	3	2	-	-	-	*	*
CO4	3	2	2	-	2	-	-	*	*
CO5	3	2	2	-	3	-	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENT:

UNIT I: INTRODUCTION TO EXPORT PACKAGING & REGULATIONS (06 periods)

Fundamentals of export packaging, importance in international trade, international packaging standards including ISO 780, UN recommendations for dangerous goods, IATA/ICAO air cargo regulations, export packaging vs domestic packaging requirements, customs clearance documentation related to packaging, prohibited and restricted packaging materials, role of packaging in product protection during global transit.

UNIT II: PACKAGING MATERIALS FOR EXPORT (06 periods)

Export-worthy packaging materials including corrugated fiberboard, wood, plastics, metal containers, cushioning materials, desiccants and barrier films, material selection criteria based on product type, weight, fragility and destination climate, hazardous goods packaging requirements, temperature-controlled packaging for perishables, moisture/vibration/impact resistant materials, cost optimization in material selection.

UNIT III: EXPORT PACKAGING DESIGN & STRUCTURAL ENGINEERING (09 periods)

Export package design principles, structural design for stacking, handling and palletization, unit load design and pallet patterns, marking and labeling requirements (country of origin, handling instructions, barcoding), shrink/stretch wrapping techniques, wooden packaging fumigation and ISPM-15 compliance, reusable export packaging systems, package testing protocols.

UNIT IV: SPECIALIZED EXPORT PACKAGING & HANDLING (12 periods)

Packaging for air, sea, rail and road export modes, container loading optimization and dunnage requirements, packaging for hazardous chemicals (UN approved packaging), temperature-controlled packaging for pharmaceuticals/foods (reefer containers, insulated boxes), export packaging for textiles/garments/leather goods, fragile items packaging (glass, electronics), overseas consolidation packaging.

UNIT V: QUALITY CONTROL, TESTING & SUSTAINABLE EXPORT PACKAGING (09 periods)

Export package testing methods (drop test, vibration, compression, stacking), ISTA/ASTM testing standards, quality assurance in export packaging lines, documentation for packaging certification, sustainable export packaging practices, biodegradable/recyclable materials compliance, reverse logistics and returnable

packaging systems, case studies of export packaging failures and successes, future trends in global packaging regulations.

1. TEXT BOOKS/REFERENCE BOOKS:

1. Yam, K. L. (Ed.), The Wiley Encyclopedia of Packaging Technology, John Wiley & Sons.
2. Paine, F. A., The Packaging User's Handbook, Springer.
3. Hanlon, J. F., Kelsey, R. J. and Forcinio, H. E., Handbook of Package Engineering, CRC Press.
4. Soroka, W., Fundamentals of Packaging Technology, IoPP.
5. Branch, A. E., Export Cargo Packaging, Stowage and Marking, Springer.
6. ISTA, ISTA Resource Book / ISTA Test Procedures, International Safe Transit Association.
7. Cook, T. A., Mastering the Business of Global Trade, Routledge.
8. Cook, T. A., Compliance in Today's Global Supply Chain, Routledge.

SUGGESTED DISTRIBUTION OF MARKS:

Unit No.	Time Allotted (Periods)	Marks Allotted (%)
1	06	19
2	06	19
3	09	19
4	12	24
5	09	19
Total	**42**	**100**

6.2.2	LOGISTIC AND SUPPLYCHAIN MANAGEMENT (THEORY)	L T P 3 0 0

COURSES OBJECTIVE:

The course is designed to provide students with a comprehensive understanding of logistics and supply chain management and their role in modern business operations. It aims to develop knowledge of the planning, movement, storage, and control of materials, products, and information from the point of origin to the point of consumption. The course also focuses on key activities such as transportation, warehousing, inventory management, procurement, distribution, and coordination among supply chain partners to ensure efficiency and customer satisfaction. Further, it seeks to familiarize students with the importance of integrated logistics systems, cost optimization, risk management, and emerging trends in global supply chain practices.

COURSES OUTCOME:

CO1: Understand the concepts, functions, and importance of logistics and supply chain management in business operations.

CO2: Explain the processes involved in transportation, warehousing, inventory control, procurement, and distribution within a supply chain.

CO3: Identify the role of different supply chain partners and analyze the flow of materials, information, and finances across the supply chain.

CO4: Evaluate logistics and supply chain strategies for improving operational efficiency, cost effectiveness, and customer satisfaction.

CO5: Apply the principles of logistics and supply chain management to optimize business operations and address real-world supply chain challenges.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	**PO1** Basic and Discipline Specific Knowledge	**PO2** Problem Analysis	**PO3** Design / Development of Solutions	**PO4** Engineering Tools	**PO5** Practice for Society, Sustainability and Environment	**PO6** Project Management	**PO7** Lifelong Learning	**PSO1**	**PSO2**
CO1	3	2	-	-	-	-	-	*	*
CO2	3	3	-	2	-	-	2	*	*
CO3	3	2	3	2	-	-	-	*	*

CO4	3	2	2	-	2	-	-	*	*
CO5	3	2	2	-	3	-	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)
***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENT:

UNIT I: FUNDAMENTALS OF LOGISTICS AND SUPPLY CHAIN (06 periods)
Concept of logistics including distribution packaging as a systems approach, scope and definition, historical perspective, importance of logistics and distribution, logistics and supply chain structure, overview of supply chain management including introduction, nature, concept, contribution and system, supply chains specific to product groups and major differences, integrated logistics and supply chain including total logistic concept planning, financial impact of logistics, globalization and integration, competitive advantage through logistics.

UNIT II: STRATEGIC SUPPLY CHAIN AND CUSTOMER FOCUS (06 periods)
Strategic supply chain management including introduction, supply chain in value chain perspective, strategic role and architecture, customer service and logistics including importance, components and measurement, customer value, service and channel strategies in supply chain including consumer value, customer service elements and costs, gap analysis and service measurement, multi-modal systems and their impact on packaging requirements.

UNIT III: KEY ISSUES, PLANNING AND INFORMATION MANAGEMENT (09 periods)
Key issues and challenges related to logistics including external environment, manufacturing and supply, planning for logistics with parameters such as pressure for change, design, product characteristics, product life cycles, packing, logistics process tools and techniques, value of information and order management in logistics and supply chain including introduction, nature, concept, components of order management, market intelligence, demand forecast.

UNIT IV: TRANSPORTATION, FLEET AND WAREHOUSING MANAGEMENT (12 periods)
Transportation and fleet management including location of transport supply, elements of transport, selection of transport and mode, containerization, warehousing and material management including principles of warehousing, strategy, operation, storage and handling, pallet movement, warehousing design, cross-docking, tracking distribution losses and evaluation of distribution packaging, procurement management basics.

UNIT V: STRATEGIC SOURCING, OUTSOURCING AND PERFORMANCE MEASUREMENT (09 periods)

Strategic sourcing and outsourcing management including introduction, strategy of supply chain management, supply chain in value chain, customer value and supply chain, performance measurement of logistics and supply chain including key metrics, evaluation tools and benchmarking.

TEXT BOOKS/REFERENCE BOOKS:

1. Christopher, M., Logistics and Supply Chain Management, Pearson.
2. Chopra, S., Supply Chain Management: Strategy, Planning, and Operation, McGraw Hill.
3. Coyle, J. J., Langley Jr., C. J., Novack, R. A. and Gibson, B. J., Supply Chain Management: A Logistics Perspective, Cengage.
4. Bowersox, D., Closs, D. and Cooper, M. B., Supply Chain Logistics Management, McGraw Hill.
5. Mangan, J., Lalwani, C. and Butcher, T., Global Logistics and Supply Chain Management, Routledge.
6. Simchi-Levi, D., Kaminsky, P. and Simchi-Levi, E., Designing and Managing the Supply Chain: Con-

cepts, Strategies and Case Studies.
7. Chopra, S. and Meindl, P., Supply Chain Management: Strategy, Planning, and Operation.
8. Heizer, J., Render, B. and Munson, C., Operations Management: Sustainability and Supply Chain Management, Pearson.

SUGGESTED DISTRIBUTION OF MARKS:

Unit No.	Time Allotted (Periods)	Marks Allotted (%)
1	06	19
2	06	19
3	09	19
4	12	24
5	09	19
Total	**42**	**100**

6.3.1	STRATEGIC BRANDING AND PACKAGING (PRACTICUM)	L T P 2 0 2

COURSE OBJECTIVES:

This course aims to provide students with a clear understanding of the fundamental types of 3D packaging and their practical applications in the packaging industry. It helps learners explore the design, budgetary, and production considerations involved in creating packaging for both mass-market and prestige-market products. The course also develops an understanding of how target markets influence packaging design decisions, including structure, appearance, and consumer appeal. In addition, it introduces the concept of branding product lines and the importance of maintaining brand identity through effective packaging. Further, the course familiarizes students with the process of launching a new product design, covering the key stages from concept development to market presentation.

COURSE OUTCOMES:

CO1: Identify the key elements of a packaging composition.
CO2: Identify the production, design, and budgetary differences involved in packaging development.
CO3: Develop an understanding of how marketing research, target audiences, and user profiles influence the packaging design process.
CO4: Develop an understanding of how playful packaging design is created through typography, balance, color, and other design attributes.
CO5: Understand and discuss how a product line is developed, updated, and expanded.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design / Development of Solutions	PO4 Engineering Tools	PO5 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Lifelong Learning	PSO1	PSO2
CO1	3	2	-	2	-	-	-	*	*
CO2	3	3	-	2	-	-	2	*	*
CO3	3	2	3	2	-	-	-	*	*
CO4	3	2	2	-	-	-	-	*	*
CO5	3	2	2	-	-	-	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)
***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS:

UNIT I: INTRODUCTION TO BRANDING & LOGO DESIGN (05 periods)

Branding concepts, recent branding aspects, case studies, visual tools of a brand including logo, different types of logos, brainstorming, mind mapping, mood board, logo design essentials and process, identity manual, variations and evolution of a logo, corporate colours.

S. No.	Name of Experiment / Practical	Periods
1	Logo sketching for different concepts	2
2	Ideation using brainstorming techniques	2

UNIT II: BRAND PROMOTIONAL DESIGN & VISUALIZATION (05 periods)

Brand promotional designs, spot colours, dominant visual colours in design, stationery including business

card, letterhead and envelope, brochure and different folding methods, visualization of design, handmade prototypes, importance of negative space, dummy designs for branding, ethics of branding.

S. No.	Name of Experiment / Practical	Periods
1	Creation of brochure with different folding styles	2
2	Development of handmade prototype	2
3	Preparation of dummy branding kit	2

UNIT III: PACKAGING DESIGN FUNDAMENTALS (06 periods)

Role of packaging including historical perspective, marketing, technical and functional considerations, packaging materials, measuring the success of a package design, anatomy of packages, structural design, types of packaging such as cartons, bottles, tubes, cans, tubs and jars, multipacks, clamshells and blister packs.

S. No.	Name of Experiment / Practical	Periods
1	Structural design of carton using paperboard	1
2	Analysis of different package forms	1
3	Sketching of different package forms	1
4	Development of basic carton prototype	1
5	Development of basic bottle concept	1
6	Preparation of final package prototype	1

UNIT IV: DESIGN THINKING & 3D PACKAGING PROJECTS (06 periods)

Seeing in 3D, projects on Indian tiffin and snacks takeaway packages, fixing school food and promoting healthy alternatives among kids, mass versus prestige design, project on mass design such as gas stove, gift box reuse and inventing secondary uses for packages

S. No.	Name of Experiment / Practical	Periods
1	Redesign of existing package for sustainability	2
2	Redesign of existing package for reuse	2

UNIT V: ADVANCED PACKAGING PROJECTS & PRODUCT DEVELOPMENT

(06 periods)

Tangible visual marketing, projects on soft drinks and beverages packaging, branding product lines, projects on champagne cartons, packaging culture and solutions for multicultural gift shops, launching a new product design, projects on cosmetic packaging.

S. No.	Name of Experiment / Practical	Periods
1	Design of beverage packaging	2
2	Prototype development of beverage packaging	2
3	Development of packaging for a cosmetic product line	2
4	Prototype preparation for cosmetic product packaging	2

TEXT AND REFERENCE BOOKS:

1. Designing Brand Identity: An Essential Guide for the Whole Branding Team: Alina Wheeler
2. Branding: In Five and a Half Steps: Michael Johnson
3. The Definitive book of Branding: Kartikeya Kompella
4. Brands and Branding: John Simmons
5. Designing Brand Identity: Alina Wheeler
6. LOGO: The reference guide to Symbols & Logotypes: Michael Evamy.
7. What is Branding: Matthew Healey
8. Carter, David E. The Big Book of Layouts. Harper Design, 16 June 2009
9. Tondreau, Beth. Layout Essentials: 100 Design Principles for Using Grids. Rockport Publishers, 1 February 2009
10. The Best of News Design, 35th Edition. Rockport Publishers; 35th Revised edition, 15 November 2014

6.3.2	PACKAGING MACHINERY AND AUTOMATION (PRACTICUM)	L T P 2 0 2

COURSE OBJECTIVES:

The course is designed to provide students with an understanding of the principles and technologies used in packaging machinery. It aims to develop practical knowledge and hands-on experience in the design, operation, and maintenance of packaging machines, thereby enhancing skills related to automation, control systems, and troubleshooting for efficient packaging processes. The course also seeks to familiarize students with emerging trends in automation and robotics in the packaging industry.

COURSE OUTCOME:

CO1: Understand the different types and functions of packaging machineries used in industry.

CO2: Explain the working principles and applications of various packaging machines in packaging operations.
CO3: Identify suitable packaging machineries for different products and industrial requirements.
CO4: Analyze the role of packaging machineries in improving efficiency and productivity of packaging operations.
CO5: Contribute to the productivity and effectiveness of packaging operations in industry through proper understanding and use of packaging machineries.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	**PO1** Basic and Discipline Specific Knowledge	**PO2** Problem Analysis	**PO3** Design / Development of Solutions	**PO4** Engineering Tools	**PO5** Practices for Society, Sustainability and Environment	**PO6** Project Management	**PO7** Lifelong Learning	**PSO1**	**PSO2**
CO1	3	2	-	2	-	-	-	*	*
CO2	3	3	-	2	-	-	2	*	*
CO3	3	2	3	2	-	-	-	*	*
CO4	3	2	2	-	-	-	-	*	*
CO5	3	2	2	-	-	-	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)
***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS:

UNIT I: INTRODUCTION TO PACKAGING MACHINERY AND AUTOMATION

(04 periods)

Introduction to packaging machinery, types of packaging machinery including filling, sealing, wrapping and labeling machines, automation in packaging and its benefits, safety and regulations in packaging machinery such as ISO standards, GMP requirements and operator safety protocols.

S. No.	**Name of Experiment / Practical**	**Periods**
1	Demonstration of basic packaging machine components	8

UNIT II: PACKAGING MACHINERY COMPONENTS AND OPERATION

(04 periods)

Mechanical components in packaging machinery including motors, gears, belts and conveyors, electrical and control systems such as drives, sensors and relays, packaging machinery operation principles, efficiency calculation, output measurement and preventive maintenance schedules.

S. No.	**Name of Experiment / Practical**	**Periods**
1	Study of safety features of packaging machines using mock setups	4

UNIT III: AUTOMATION IN PACKAGING PROCESSES **(06 periods)**

Automation in packaging lines including inline integration and flow control, sensors and actuators for position, pressure and proximity detection, programmable logic controllers (PLCs) programming basics, human-machine interfaces (HMI) design and operation, case studies of automated packaging applications in food and pharma industries.

S. No.	Name of Experiment / Practical	Periods
1	Identification of different types of packaging machinery models	4

UNIT IV: EMERGING TECHNOLOGIES IN PACKAGING MACHINERY

(08 periods)

Sustainable packaging solutions using eco-friendly machinery and materials, Industry 4.0 concepts including IoT connectivity and data analytics in packaging, robotics applications such as pick-and-place and robotic sealing, artificial intelligence for predictive maintenance and quality inspection, practical demonstrations of smart packaging systems.

S. No.	Name of Experiment / Practical	Periods
1	Classification of packaging machinery models based on function and application	6

UNIT V: ADVANCED SYSTEMS, MAINTENANCE AND PROJECT WORK

(06 periods)

Integrated packaging line design and optimization, advanced maintenance techniques including predictive and condition-based strategies, troubleshooting common machinery faults, practical project work on complete packaging automation setup, industry case studies and future trends in packaging technology.

S. No.	Name of Experiment / Practical	Periods
1	Observation and recording of machine components and safety systems	6

TEXT AND REFERENCE BOOKS:

1. Groover, M.P., Automation, Production Systems, and Computer-Integrated Manufacturing, Pearson Education.
2. Bolton, W., Programmable Logic Controllers, Newnes.
3. Webb, J.W. and Reis, R.A., Programmable Logic Controllers: Principles and Applications, Prentice Hall.
4. Krishna Kant, Microprocessors and Microcontrollers, PHI Learning.
5. Nagrath, I.J. and Gopal, M., Control Systems Engineering, New Age International.
6. Mikell P. Groover, Industrial Robotics: Technology, Programming and Applications, McGraw Hill.

EVALUATION METHODOLOGY

1. EVALUATION METHOD for THEORY

	Internal Assessment (40 marks)				External Assessment (60 marks)
	IA 1	**IA 2**	**IA 3**	**IA 4**	
Mode	**Written Test**	**Written Test**	**Attendance and Assignments**	**Pre – Semester Examination**	**End Semester Examination**
Portion	2 units	2 units	Regularly	All units	All units
Duration1hr	1hr	1hr	-	3hrs	3hrs
Exam Marks	20	20	20	60	60
Converted to	10	10	15	15	60
Tentative Schedule	5th Week	10th Week	Regularly	12th -13th Week	

IA1 and IA2: A written assessment test worth 20 marks should be conducted for two units. The marks earned (20 marks) will be converted to 10 marks. The best of the two assessments will be evaluated for an internal 10-mark assessment.

IA3: Assignments given after the completion of each unit, along with attendance throughout the semester, will be assessed for a total of 15 marks.

IA4: The pre-semester examination should follow the end-semester examination question pattern. The marks should be adjusted to 15 for internal assessment.

2. EVALUATION METHOD for PRACTICAL

	Internal Assessment (60 marks)				External Assessment (40 marks)
	IA 1	**IA 2**	**IA 3**	**IA 4**	
Mode	**Practical Test**	**Practical Test**	**Attendance and Practical Documentation**	**Practical Test and Quiz – Viva Voce**	**Practical Examination**
Portion	50% Practical	50% practical	All practical	All practical	All practical
Duration	3hrs	3 hrs	Regularly	3 hrs	3hrs
Exam Marks	20	20	20	20	40
Tentative Schedule	5th Week	10th Week	Regularly	12th -13th Week	

IA1 and IA2: Complete all exercises and experiments as outlined and retain them for the practical test. The test should be conducted in accordance with the evaluation scheme. The best of the two practical tests will be internally evaluated for a total of 20 marks.

IA3: Maintain a practical file for each exercise while ensuring attendance throughout the semester. Submit the required documents for the practical file, quiz, and practical test along with a valid certificate (Progress Card). This will be assessed for 20 marks.

IA4: The pre-semester practical examination, quiz, and viva-voce should follow the end-semester practical examination pattern, with marks adjusted to 20 for internal assessment.

SUGGESTED DISTRIBUTION OF MARKS FOR **INTERNAL** EVALUATION

Part	Description	Marks Allotted
A.	Objective	**5**
B.	Circuit Diagram	**5**
C.	Procedure and Connections	**10**
D.	Observation Table and Calculation	**10**

E.	Result and its Discussion, Conclusion	**10**
F.	Practical Test	**20**
	Total	**60**

SUGGESTED DISTRIBUTION OF MARKS FOR **EXTERNAL** EVALUATION

Part	Description	Marks Allotted
A.	Objective	**5**
B.	Circuit Diagram	**5**
C.	Procedure and Connections	**5**
D.	Observation Table and Calculation	**5**
E.	Result and its Discussion, Conclusion	**10**
F.	Viva-Voce	**10**
	Total	**40**

3. EVALUATION METHOD for PRACTICUM (End Exam-Practical)

	Internal Assessment (60 marks)				**External Assessment (40 marks)**
	IA 1	**IA 2**	**IA 3**	**IA 4**	
Mode	**Practical Test**	**Practical Test**	**Attendance and Practical Documentation**	**Micro Project**	**Practical Examination**
Portion	50% practical	50% practical	All practical	All practical	All practical
Duration	3hrs	3 hrs	Regularly	Regularly	3hrs
Exam Marks	20	20	20	20	40
Tentative Schedule	5th Week	10th Week	Regularly	12th -13th Week	

- **IA1 and IA2:** Complete all exercises and experiments as instructed and retain them for the practical test. The test should be conducted according to the evaluation scheme. The best of the two practical tests will be internally assessed for a total of 20 marks.
- **IA3:** Maintain a practical file for each exercise, ensuring attendance throughout the semester. Submit the required documents for the practical file, quiz, practical test, and end-semester examination, along with a valid certificate (Progress Card). This will be evaluated by 20 marks.
- **IA4:** Submit a micro-project report along with a fabrication model or analysis report. The performance of each student in the group will be assessed by both the laboratory supervisor and an internal examiner. This evaluation will contribute 20 marks.

SUGGESTED DISTRIBUTION OF MARKS FOR **INTERNAL** EVALUATION

Part	Description	Marks Allotted
A.	Objective	**5**
B.	Circuit Diagram	**5**
C.	Procedure and Connections	**10**
D.	Observation Table and Calculation	**10**
E.	Result and its Discussion, Conclusion	**10**
F.	Mini Project	**20**
	Total	**60**

SUGGESTED DISTRIBUTION OF MARKS FOR **EXTERNAL** EVALUATION

Part	Description	Marks Allotted
A.	Objective	**5**
B.	Circuit Diagram	**5**
C.	Procedure and Connections	**5**
D.	Observation Table and Calculation	**5**
E.	Result and its Discussion, Conclusion	**10**
F.	Viva-Voce	**10**
	Total	**40**

4. EVALUATION METHOD for <u>PRACTICUM (End Exam-Theory)</u>

	Internal Assessment (40 marks)						**External Assessment (60marks)**
	IA 1		**IA 2**		**IA 3**	**IA 4**	
Mode	**Written Test**	**Practical Test**	**Written Test**	**Practical Test**	**Attendance and Practical Documentation**	**Pre Semester Examination and Micro Project**	**End Semester Examination**
Portion	2 units	Practical related to the units	2 units	Practical related to the units	All unit	All Practical	All unit
Duration	1hr	3hrs	1hr	3 hrs	3hrs	Regularly	3hrs
Exam Marks	10	20	10	20	60	60	60
	30		30				
Converted to	10		10		15	15	60
Tentative Schedule	5^{th} Week		10^{th} Week		Regularly	12^{th} -13^{th} Week	

IA1 and IA2: A written assessment test worth 10 marks should be conducted for two **UNIT**s. Complete all exercises and experiments as outlined and retain them for the practical test worth 20 marks. The practical test should be conducted in accordance with the evaluation scheme. The total marks earned (30 marks) will be converted to 10 marks. The best of the two assessments will be internally evaluated for a total of 10 marks.

IA3: Attendance and the pre-semester examination should follow the end-semester examination question paper pattern. The marks should be adjusted to 15 for internal assessment.

IA4: Maintain a practical file for each exercise. Submit the required documents for the practical file, quiz/viva-voice, practical test, and end-semester examination, along with a valid certificate (Progress Card). This will be assessed for 40 marks. Additionally, submit a micro-project report along with a fabrication model or analysis report. The performance of each student in the group will be evaluated by both the laboratory supervisor and an internal examiner. The total of 60 marks will be converted to 15 marks.

SUGGESTED DISTRIBUTION OF MARKS FOR **INTERNAL** EVALUATION FOR IA4

Part	Description	Marks Allotted

A.	Objective	**5**
B.	Circuit Diagram	**5**
C.	Procedure and Connections	**5**
D.	Observation Table and Calculation	**5**
E.	Result and its Discussion, Conclusion	**10**
F.	Attendance & Mini Project	**10**
	Total	**40**

LIST OF LAB EQUIPMENT REQUIRED

PAPER PACKAGING TECHNOLOGY

S. No.	Description	Quantity	Approx. Total Price (INR)
1	Brightness & Opacity Tester	1	6,00,000
2	Wax Pick Tester Kit	1	1,50,000
3	Smoothness Tester (Bendtsen type)	1	16,00,000
4	Porosity Tester (Gurley type)	1	5,00,000
5	Softness Tester (Handle-O-Meter)	1	4,00,000
6	Laboratory Sheet Former (Hand Sheet Making Machine)	1	5,00,000
7	Press Section (Lab Hydraulic Press)	1	3,00,000
8	Laboratory Dryer (Drum/Hot Plate Dryer)	1	2,50,000
9	Tensile Strength Tester	1	50,00,000
10	Burst Strength Tester (Mullen type)	1	8,00,000
11	Tear Strength Tester (Elmendorf)	1	7,00,000
12	Cobb Tester (Water Absorbency)	1	1,00,000
13	Laboratory Refiner/Beater (PFI/Valley Beater)	1	8,00,000
14	Canadian Standard Freeness Tester	1	2,50,000
15	Pulp Disintegrator	1	4,00,000
16	pH Meter	1	50,000
17	Electronic Weighing Balance	1	90,000
18	Hot Plate with Stirrer	5	40,000
19	Glassware (Beakers, Measuring Cylinders, etc.)	Set	70,000
20	Sample Cutter (GSM Cutter)	5	25,000

FOOD PACKAGING TECHNOLOGY

S. No.	Description	Quantity	Approx. Total Price (INR)
1	Assorted packaged food samples (solid, liquid, semi-solid)	Lot	5000
2	Paper-based packaging samples (cartons, kraft paper, etc.)	Lot	1500
3	Plastic packaging samples (PET bottles, pouches, films)	Lot	2000
4	Glass containers (bottles/jars)	10	2000
5	Metal cans (tin/aluminium)	10	1500
6	Laminated packaging samples	Lot	2000
7	Bio-based packaging samples (PLA, paper composites, etc.)	Lot	3000
8	Magnifying glass / inspection lens	5	1000
9	Digital weighing balance	1	3000
10	Vernier caliper	1	1500

11	Micrometer screw gauge	1	2000
12	Water vapour transmission rate instrument	1	2,00,00,000
13	Oxygen transmission rate instrument	1	2,00,00,000
14	Light exposure box (for light sensitivity study)	1	300000
15	Vacuum packaging machine (lab scale)	1	150000
16	Heat sealing machine	1	500000
17	Leak test apparatus (water bath / vacuum chamber)	1	700000
18	Compression strength tester (basic/manual)	1	1000000
19	pH meter (for food interaction study)	1	25000
20	Thermometer / temperature probe	2	1000
21	Label samples of packaged foods	Lot	1000
22	Computer with design software	1	40000
23	Colour printer	1	15000
24	Label printing sheets / stickers	100 sheets	1500
25	Stop watch (for shelf-life / testing timing)	3	900
26	Personal Protective Equipment (gloves, mask, caps)	15 sets	3000
27	Storage containers for shelf-life study	10	2000
28	Marker pens and stationery	Lot	1000

CREATIVE WRITING			
Sr. No.	**Description**	**Qty**	**Approx. Total Price (Rs)**
1.	Stools	40	10,000
2.	Display Board/Screen	2	6,000
3.	Sound recording and playing system	1	6,000
4.	Audio cassettes	60	2,000
5.	Overhead Projector	1	5,000
6.	Transparencies slides	100	500
7.	TV, VCR and camera for video recording	1 each	20,000
8.	English spoken course	1	2,000
9.	A Quiz room equipped with two way audio system, back projection system and slide projector	1	30,000
10.	Miscellaneous	LS	1,500

GRAPHIC DESIGN			
S. No.	**Description**	**Quantity**	**Approx. Total Price (INR)**
1	High-end computer systems (i7/i9, 16–32 GB RAM, GPU)	10	1200000
2	Licensed Adobe Creative Cloud Suite (Illustrator, Photoshop, InDesign, Canva Pro)	10 licenses	300000
3	High-speed dedicated internet setup (fiber + router)	1	50000
4	Professional A3+ colour printer (photo-quality)	1	80000
5	High-resolution flatbed scanner	1	25000
6	Professional drawing tablets	5	150000
7	Interactive smart board / projector system	1	150000
8	Premium packaging samples	Lot	10000
9	Barcode & QR code generation software/tools	1	10000
10	Pantone colour matching system (full guide set)	1	60000
11	External SSD storage devices (high speed)	5	50000

12	Professional layout sheets & premium paper stock	Lot	5000
13	Premium stationery kits (design tools, markers, pens)	Lot	5000
14	High-quality paperboard & specialty substrates for mock-ups	Lot	8000
15	Precision cutting tools set (industrial cutters, mats)	10	10000
16	Industrial-grade adhesives & mounting tools	Lot	5000
17	LED light box (A2 size, professional grade)	2	20000
18	Advanced packaging dieline software/templates	1	25000
19	Colour calibration device (Spyder/X-Rite)	1	40000
20	UPS with power backup (for all systems)	2	80000
21	DSLR camera for documentation and project work	1	80000

PACKAGING DESIGN & ERGONOMICS			
S. No.	**Description**	**Quantity**	**Approx. Total Price (INR)**
1	Drawing sheets (A3/A4)	100 sheets	10
2	Sketching pencils set	10 sets	150
3	Erasers and sharpeners	10 sets	50
4	Scale (30 cm)	10	50
5	Colour markers / sketch pens	10 sets	300
6	Paperboard sheets (duplex/corrugated)	50 sheets	40
7	Flexible packaging films (plastic laminates)	20 rolls	200
8	Adhesives (Fevicol/glue gun)	5 units	250
9	Cutting tools (scissors/cutters)	10	150
10	Cutting mat	5	500
11	Weighing balance (digital)	1	3000
12	Vernier caliper	2	1500
13	Measuring tape	5	150
14	Sample packaging materials (glass, metal, plastic containers)	Assorted	5000
15	Computer system with design software	2	40000
16	Printer (colour)	1	15000
17	Anthropometric measurement kit	1 set	10000
18	Lux meter (illumination)	1	3000
19	Sound level meter	1	4000
20	Stopwatch	5	300
21	Ergonomic chair and workstation setup	2 sets	8000
22	Personal Protective Equipment (PPE kit)	10 sets	200
23	Sample packaged products	Assorted	3000
24	Camera / mobile for recording	1	10000
25	Whiteboard and markers	1	2000

PLASTIC TESTING			
S. No.	**Description**	**Quantity**	**Approx. Total Price (INR)**
1	Restivity test equipment	1	300000
2	U.T.M m/c(2ton)	1	600000
3	Impact testing machine	1	100000
4	Hardness testing machine (Shore A & Shore D)	2	60000
5	Film dart Impact testing machine	1	100000
6	Melt flow machine	1	80000
7	HDT machine	1	80000
8	Software’s as per requirements	1	500000

LAMINATION AND FUNCTIONAL COATING			
S. No.	**Description**	**Quantity**	**Approx. Total Price (INR)**
1	Laboratory Laminator (Solventless / Roll-to-Roll)	1	15,00,000
2	Pouch Laminator (Basic Teaching Use)	2	20,000
3	Bar / Rod Coater (Manual Lab Coater)	2	1,50,000
4	Gravure Coating Unit (Lab Scale)	1	6,00,000
5	Hot Air Oven (Drying Unit)	1	1,50,000
6	UV Curing Chamber / UV Lamp	1	3,00,000
7	Precision Weighing Balance (Analytical)	1	80,000
8	Thickness Gauge (Micrometer)	2	25,000
9	Coat Weight Measurement Kit	1	40,000
10	Peel Strength Tester	1	5,00,000
11	Tensile Strength Tester (UTM)	1	10,00,000
12	Heat Seal Tester	1	6,00,000
13	Coefficient of Friction (COF) Tester	1	7,00,000
14	WVTR Tester (Water Vapor Transmission Rate)	1	25,00,000
15	OTR Tester (Oxygen Transmission Rate)	1	35,00,000
16	Gloss Meter	1	3,00,000
17	pH Meter (for coating solutions)	1	20,000
18	Magnetic Stirrer with Hot Plate	2	40,000
19	Brookfield Viscometer	1	6,00,000
20	Spray Coating Gun Setup	1	80,000
21	Digital Thickness Scanner (Film Analyzer)	1	5,00,000
22	Laboratory Laminating Rollers (Manual)	1	1,00,000
23	Sample Cutter / Die Punch	2	50,000
24	Microscope (Optical)	1	2,00,000
25	Fume Hood (for solvent coatings)	1	5,00,000

ADDITIVE MANUFACTURING			
S. No.	**Description**	**Quantity**	**Approx. Total Price (INR)**
1	Industrial High-End 3D Printing Machine (FDM/SLS – Advanced)	1	2500000
2	Desktop 3D Printers (FDM type – ₹80,000 each)	10	800000
3	Wire Arc Additive Manufacturing (WAAM) Setup / Wire Extruder System	1	2000000
4	3D Scanning System (Professional grade)	1	1500000
5	CAD/CAM Software (SolidWorks/AutoCAD/ANSYS licenses)	10 licenses	500000
6	Slicing Software (Simplify3D / Cura premium setup)	10	100000
7	High-performance Workstations (Design + Simulation)	10	1500000
8	Post-processing equipment (polishing, curing, finishing tools)	1 set	300000
9	UV Curing Chamber (for resin prints)	1	200000
10	Filament Extruder Machine (for recycling filament)	1	300000
11	Filament Dryer (industrial grade)	1	150000
12	Raw Materials (PLA, ABS, Nylon, Resin, Metal wire feedstock)	Lot	500000
13	Heat Treatment Furnace (for metal AM parts)	1	800000
14	CNC Milling Machine (for hybrid finishing)	1	2000000

15	Air Compressor (for cleaning/support removal)	1	150000
16	Safety Equipment (gloves, shields, ventilation system)	Lot	200000
17	Dust/Fume Extraction System	1	300000
18	Measuring Instruments (Vernier, micrometer, gauges)	Set	100000
19	Surface Roughness Tester	1	400000
20	Universal Testing Machine (UTM – basic)	1	1200000
21	UPS & Power Backup System	1	500000
22	Workbenches and Lab Furniture	Set	300000
23	Training & Installation Cost	-	200000
24	Annual Maintenance (AMC initial provision)	-	300000

COMPUTER AIDED DESIGN & DRAFTING			
S. No.	**Description**	**Quantity**	**Approx. Total Price (INR)**
1	High-end Workstations (i7/i9, 32 GB RAM, GPU for rendering)	20	3000000
2	CorelDRAW Graphics Suite (Professional License)	20 licenses	1000000
3	Autodesk AutoCAD Full License (Commercial)	20 licenses	2500000
4	ArtiosCAD Software (Packaging Design – Premium License)	5 licenses	3000000
5	Autodesk 3ds Max Software License	10 licenses	1200000
6	Server system for license management (Network license server)	1	500000
7	High-speed LAN network setup (switches, cabling, racks)	1	300000
8	High-resolution large format plotter (A0 size)	1	400000
9	Professional A3/A2 colour printer (photo quality)	1	100000
10	High-resolution scanner (A3 size)	1	50000
11	Professional graphic tablets (Wacom or equivalent)	10	300000
12	Colour calibration device (X-Rite / Spyder)	1	50000
13	UPS and power backup system (for full lab)	1	800000
14	Ergonomic workstation furniture (chairs, tables)	20 sets	600000
15	Air conditioning system (for lab environment)	2 units	200000
16	Projector / Interactive smart board	1	150000
17	External storage (NAS/server backup system)	1	300000
18	Software for rendering & plugins (V-Ray, KeyShot etc.)	10 licenses	500000
19	Antivirus & security software (enterprise level)	1	100000
20	Training & installation charges	-	300000
21	Annual Maintenance Contract (AMC provision)	-	500000

PACKAGING WASTE MANAGEMENT			
S. No.	**Description**	**Quantity**	**Approx. Price (INR)**
1	Desktop Computer / Workstation	10	45,000
2	LCD Projector	1	55,000
3	Digital Weighing Balance	2	85,000
4	Laboratory Analytical Balance	1	2,00,000
5	Hot Air Oven	1	35,0000
6	Muffle Furnace	1	60,0000

7	Binocular Laboratory Microscope	2	20,0000
8	Sieve Shaker with Sieve Set	1	35,0000
9	Plastic Shredder / Granulator (Lab Scale)	1	1,50,000
10	Granule / Sample Drying Unit	1	50,000
11	pH Meter	2	10,000
12	Water Testing / Sample Preparation Kit	1	25,000
13	Universal Testing Machine (UTM)	1	6,00,000
14	Pyrolysis Demonstration Unit / Trainer	1	4,00,000
15	Fume Hood / Exhaust Safety Unit	1	1,50,000
16	Personal Protective Equipment Set	20 sets	2,000
17	Segregation Bins and Sample Containers	10	3,000
18	Moisture Analyzer / Moisture Balance	1	40,0000
19	openLCA Software	5 licenses	25,0000
20	SimaPro / LCA Software	2 licenses	1,50,000
21	MS Excel / Spreadsheet Software	10 licenses	15,0000
22	CAD / Packaging Design Software	5 licenses	75,0000
23	IoT / Data Logging Software	2 licenses	50,0000

RECYCLING OF PACKAGING MATERIAL

S. No.	Description	Quantity	Approx. Price (INR)
1	Assorted packaging waste samples (plastic, paper, glass, metal)	Lot	5000
2	Segregation bins (color-coded)	10	3000
3	Hand gloves, masks, safety kits	20 sets	3000
4	Magnifying lens for contamination identification	5	1500
5	Paper pulping unit (lab scale)	1	80000
6	De-inking setup (basic chemical + apparatus)	1	25000
7	Sheet forming unit (manual handsheet former)	1	60000
8	Fiber analyzer / microscope	1	50000
9	Plastic identification kit (density test, float-sink setup)	1	20000
10	Plastic shredder (lab scale)	1	150000
11	Washing tank with agitator	1	40000
12	Metal separation setup (magnetic separator)	1	30000
13	Glass crushing / cullet preparation unit	1	70000
14	Sieves for glass sorting	1 set	15000
15	Pyrolysis demonstration unit	1	400000
16	Weighing balance (digital)	2	17000
17	Moisture analyzer	1	40000
18	Compression / strength testing machine (basic)	1	300000
19	Drying oven	1	350000
20	Stop watch / timer	3	1000
21	Computer system for data analysis & design	5	200000
22	Software for data analysis (Excel/LCA tools)	5 licenses	100000
23	Drawing & prototyping materials for sustainable packaging design	Lot	10000

PACKAGING MACHINERY AND AUTOMATION

S.No.	Description	Quantity	Approx. Price (INR)
1	Training packaging machine mockup (filling/sealing)	2	50,000
2	PLC training kit with software	5	25,000
3	HMI touch panel simulator	3	15,000
4	Industrial sensors kit (proximity, pressure, photoelectric)	10 sets	5,000

5	Robotic arm training kit (4-axis)	2	75,000
6	Conveyor belt training unit	3	20,000
7	Motor-gear assembly training panel	5	8,000
8	Electrical control panel trainer	3	30,000
9	IoT sensor module kit	5	10,000
10	Multimeter and testing tools set	10	2,500
11	Safety gear (helmets, gloves, goggles)	25 sets	1,500
12	Tool kit (screwdrivers, pliers, spanners)	10	3,000
13	Laptop for PLC/HMI programming	5	50,000
14	Simulation software license (Factory I/O or similar)	5	12,000
15	Power supply units (variable DC/AC)	10	4,000
16	Wiring and terminal block kit	10 sets	2,000
17	Fault simulation panels	3	18,000
18	Projector and training board	1	35,000
19	Consumables (wires, connectors, labels)	Bulk	5,000
20	First aid and safety kit	2	2,500

STRATEGIC BRANDING AND PACKAGING LABORATORY			
S. No.	**Description**	**Quantity**	**Approx. Price (INR)**
1	Paper cutter (heavy duty)	2	8,000
2	Precision knife (cutter)	10	2,000
3	Scissors	10	1,500
4	Cutting mat (A3 size)	5	3,000
5	Steel scale (30 cm)	15	1,500
6	Measuring tape	5	1,000
7	Set square & compass set	10	2,000
8	Pencils, markers, sketch pens set	25 sets	5,000
9	Color pencils set	10	2,500
10	Erasers & sharpeners	25	1,000
11	Fevicol (adhesive)	10 bottles	2,000
12	Glue sticks	20	1,500
13	Double-sided tape	10	1,500
14	Masking tape	10	1,000
15	Hot glue gun	3	2,400
16	Drawing sheets & cartridge paper	Bulk	5,000
17	Mount board & foam board	Bulk	6,000
18	Corrugated board sheets	Bulk	3,000
19	Tracing paper	Bulk	2,000
20	Graph paper	Bulk	1,000
21	Printer (basic color)	1	15,000
22	Ink cartridges	5 sets	5,000
23	Watercolors / acrylic colors	10 sets	3,000
24	Brushes set	10	1,500
25	Computer/Laptop	5	2,50,000
26	Graphic design software (license/basic)	5	25,000
27	Scoring & embossing tools	5	2,000
28	Hole punch & stapler	5 each	1,500
29	Lamination sheets	Bulk	2,000
30	Safety kit (gloves, first aid)	2 sets	1,500
31	Miscellaneous (clips, pins, rubber bands, folders)	Bulk	2,000

(ANNEXURE-I)

PROCEDURES / FORMATS FOR ORGANIZING INTERNSHIPS.

STUDENT INTERNSHIP PROGRAM APPLICATION

Complete and submit to the TPO/ Internship Program Coordinator.

1. Student Name:		Enroll. No.:	
2. Campus Address:		Phone:	
3. Home Address:		Phone:	
4. Student email address:			
5. Branch:		6. Internship Semester: _____	
7. Internship Preferences			
	Company/Industry	Core Area	Location
Preferance-1			
Preferance-2			
Preferance-3			
Faculty mentor Signature: _____Date_____.			
Student Signature: _____Date_____. Signature confirms that the student agrees to the terms, conditions, and requirements of the Internship Program			

Signature with seal
HOD/Principa

(ANNEXURE-I)

REQUEST LETTER FROM INSTITUTE TO INTERNSHIP/INDUSTRIAL TRAINING PROVIDER

Ref. No.: _____ Date: _____

To,
The HR Manager/Training Coordinator
……
……

Subject: Request for Internship/Industrial Training for Diploma Students

Sir/Madam,

We are pleased to introduce……., a premier institution affiliated with Board of Technical Education, Uttar Pradesh, offering diploma programs in various diploma disciplines.

As a part of the curriculum, our students are required to undergo Internship/Industrial Training to gain practical exposure and enhance their technical competencies. Therefore, we kindly request your esteemed organization to provide Internship/Training opportunities to our students during the period from …… to ……..

S. No.	Name	Enroll. No.	Semester/Year	Discipline

Yours sincerely,

(Head of Department/Principal)

(ANNEXURE-II)

PROFORMA FOR EVALUATION OF INTERNSHIP BY INDUSTRY

Student Name: ……Evaluation Date: ……
Industry Supervisor Name: …… Company/Organization: …… Title of the Project: ……

Please evaluate your intern by indicating the frequency with which you observed the following behaviors:

Parameters	Max. Marks	Marks Given
Attendance and Punctuality	20	
Discipline and Professional Behavior	20	
Technical Knowledge and Understanding of Processes	30	
Practical Skills and Quality of Work	20	
Ability to Apply Theoretical Knowledge	20	
Problem Solving and Analytical Ability	10	
Communication and Interpersonal Skills	20	
Teamwork and Collaboration	10	
Internship Report/Documentation	20	
Presentation and Viva-Voce	30	
Total Marks	200	

Additional comments, if any:

Signature with seal of Industry supervisor
HR Manager

(ANNEXURE-II)

INTERNSHIP REPORT

STUDENT'S DIARY/ DAILY LOG

The main purpose of writing daily diary is to cultivate the habit of documenting and to encourage the students to search for details. It develops the students' thought process and reasoning abilities. The students should record in the daily training diary the day to day account of the observations, impressions, information gathered and suggestions given, if any. It should contain the sketches & drawings related to the observations made by the students.

The daily training diary should be signed after every day by the supervisor/ in charge of the section where the student has been working. The diary should also be shown to the Faculty Mentor visiting the industry from time to time and got ratified on the day of his visit.

Student's Diary and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed and stamped by the industry to the Institute immediately after the completion of the training. It will be evaluated on the basis of the following criteria:

- Regularity in maintenance of the diary.
- Adequacy & quality of information recorded.
- Drawings, sketches and data recorded.
- Thought process and recording techniques used.
- Organization of the information.

INTERNSHIP REPORT

After completion of Internship, the student should prepare a comprehensive report to indicate what he has observed and learnt in the training period. The student may contact Industrial Supervisor/ Faculty Mentor/TPO for assigning special topics and problems and should prepare the final report on the assigned topics. Daily diary will also help to a great extent in writing the industrial report since much of the information has already been incorporated by the student into the daily diary. The training report should be signed by the Internship Supervisor, TPO and Faculty Mentor. The Internship report will be evaluated on the basis of following criteria:

i. Originality.

ii. Adequacy and purposeful write-up.

iii. Organization, format, drawings, sketches, style, language etc.

iv. Variety and relevance of learning experience.

v. Practical applications, relationships with basic theory and concepts taught in the course.

MONITORING & EVALUATION OF INTERNSHIP

The industrial training of the students will be evaluated in three stages:

1. Evaluation by Industry.

2. Evaluation by faculty supervisor of Industry.

3. Evaluation through seminar presentation/viva-voce at the Institute.

1. EVALUATION BY INDUSTRY

The industry will evaluate the students based on the Punctuality, eagerness to learn, Maintenance of Daily Diary and skill test in addition to any remarks.

2. MONITORING/ SURPRISE VISIT BY TPO/ STAFF/ FACULTY MENTOR

TPO/Staff/ Faculty Mentor of the institutes will make a surprise visit to the internship site, to check the student's presence physically, if the student is found absent without prior intimation to the T & P Cell, entire training will be cancelled. Students should inform the TPO, faculty mentor as well as the industry supervisor at least one day prior to availing leave by email. Students are eligible to avail 1-day leave in 4 weeks and 2 days leave in 6 weeks of the internship period apart from holidays and weekly offs.

3. EVALUATION THROUGH SEMINAR PRESENTATION/VIVA-VOCE AT THE INSTITUTE

The student will give a seminar based on his training report, before an expert committee constituted by the concerned department as per norms of the institute. The evaluation will be based on the following criteria:

• Quality of content presented.

• Proper planning for presentation.

• Effectiveness of presentation.

• Depth of knowledge and skills.

• Attendance record, daily diary, departmental reports shall also be analyzed along with the Internship Report.

Seminar presentation will enable sharing knowledge & experience amongst students & teachers and build communication skills and confidence in students.