AC: 21/02/2026
Item No. :2.4

SIES (Nerul) College of Arts, Science & Commerce (Autonomous)
RISE WITH EDUCATION

SIES (Nerul) College of Arts, Science and Commerce (Autonomous)

(Affiliated to University of Mumbai)

RE-ACCREDITED GRADE "A" BY NAAC (3rd CYCLE)

B.Sc. (Packaging Technology)

(WITH EFFECT FROM THE ACADEMIC YEAR 2026-2027)

Sr. No.	Heading	Particulars
1	Title of the course	B.Sc (Packaging Technology)
2	Eligibility for admission	Completed Second year Packaging Technology and earned 88 credits or as per eligibility criteria.
3	Semesters	V & VI
4	Level	UG
5	Pattern	3-4 years & 6-8 semesters Choice Based Grading System
6	To be implemented from	From Academic year 2026-27 in a progressive manner

Date: 21st February, 2026

Signature:

Dr. Koel Roychoudhury
AC Chairperson

SIES COLLEGE OF ARTS, SCIENCE AND COMMERCE (AUTONOMOUS) NERUL NAVI MUMBAI 400 706.

Dr. Trupti Wani
Head of the Department

Sri Chandrasekarendra Saraswati Vidyapuram, Plot I-C, Sector V,
Nerul, Navi Mumbai – 400706 India
Tel No: 61196409, 61196410, 61196402, 61196413, 61196414, 61196415, 27708371
Fax No: 022-27713356, **Email:** ascnsies@sies.edu.in / siesascn@yahoo.in **Website:** www.siesascn.edu.in

Programme Objectives:

1. To learn about packaging materials, technologies, design, sustainability and quality control.
2. To gain practical skills in packaging design, testing, and production processes, as well as a deep understanding of industry regulations and standards.
3. To understand the packaging industry trends and work towards sustainable solutions.
4. To pursue higher education in packaging in India and abroad.

Programme Outcomes:

1. At the end of the program, students are able to gain thorough knowledge in key areas in the subjects offered.
2. At the end of the program, students will be able to identify, formulate and analyze scientific problems and reach concrete solutions using various principles of mathematics and sciences.
3. At the end of the program, learners will be able to design solutions for complex problems and design a process/ processes that can meet specific needs. (Attainment of this is through projects at the final year level).
4. Learners will be able to communicate effectively on scientific issues with the scientific community and society at large in writing effective reports and designing documentation, make effective presentations and give and receive instructions.
5. At the end of this programme, students will be able to hone the soft-skills required in positively enhancing their academic, professional and personal pursuits towards self and societal advancement.

Preamble

As lifestyles change, materials evolve and the race for branding and marketing continues, the Packaging industry adapts & benefits. It is a very dynamic, fast-paced marketplace. Anyone working within the packaging industry should expect constant evolution and growth. For capable employees seeking to work in Packaging Industry, the possibilities are endless. This industry is innovative, stable, and creative. This being a specialized field requires special education and training.

The B.Sc. in Packaging Technology specializing in Packaging Materials, Designing, Quality & Testing is designed to impart advanced knowledge and skills that are practical-oriented, career and community oriented. Packaging is usually taught as an interdisciplinary field, bringing together elements from a variety of scientific realms. It has special relevance to industry application with hands-on laboratory training sessions.

The core philosophy of overall syllabus is to -

a. Form strong foundation of Packaging Science,

b. Introduce Packaging technologies to the students in a gradual way,

c. Groom the students for the challenges of Packaging Industry

The curriculum is designed as per the NEP Credit Framework for 4-year UG degree programme.

SIES (Nerul) College of Arts, Science and Commerce (Autonomous)

B.Sc. Packaging Technology Programme

(To be implemented from Academic Year- 2026-27)

No. of Courses	Course Code	Semester V	Credits
1	***Major***		
1	U25PT5MJ01	**Packaging Machineries & Systems**	**03**
2	U25PT5MJP01	**Packaging Machinery Laboratory**	**01**
3	U25PT5MJ02	**Food Packaging**	**03**
4	U25PT5MJP02	**Food Packaging Laboratory**	**01**
5	U26PT5MJ03	**Science and Technology in Ancient India**	**02**
2	***Major Elective (to be selected from given options)***		
1	U25PT5MJE01A U25PT5MJE01B U25PT5MJE01C	**Major Elective Theory (Select any one)** 1. **Labelling technology** 2. **Inks & Coatings** 3. **Product Design & Development**	**03**
2	U25PT5MJET01A U25PT5MJET01B U25PT5MJET01C	**Major Elective Tutorial(Select any one)** **1.Labelling technology** **2.Inks & Coatings** **3.Product Design & Development**	**01**
3	***Minor***		
1	U25PT5MI01	**Packaging & Marketing**	**03**
2	U25PT5MIT01	**Packaging & Marketing Tutorial**	**01**
4	***VSC/SEC***		
1	***U26PT5VSC01***	**Python Programming**	**01**
2	***U26PT5VSCP01***	**Python Programming Practical**	**01**
5	***OJT, FP, RP, CEP, CC***		
2	U25PT5FP01	**Field Project**	**02**
		Total Credits	**22**

1 credit = 15 lectures

1 lecture/theory = 60 minutes 1 Practical = 2 hours session

COURSE CODE	TITLE	CREDITS 3 (3Th)
U25PT5MJ01	**Packaging Machineries and Systems**	
Course objectives:	1. Understand the concept of systems & online Packaging techniques. 2. Understand the various machineries used for conversions of different packaging materials. 3. Study the different packaging machineries used for line operations and systems. 4. Study various ancillary equipment used apart from packaging machineries. 5. Understand the importance of testing, online & offline equipment's used industries.	
Course Outcomes:	Learners will be able to: 1. Suggest the packaging material use and its conversion as per the product geometry. 2. Suggest the filling machine required for the line operations. 3. Choose the ancillary machineries required in the line operations based on the product to be packed. 4. Analyse the different conveying system used for various line operations. 5. Select different online and offline testing methods that are required during the converting operations or on the packaging lines. 6. Suggest Methods and Machine used for case packing.	

Unit I: Introduction, Metal & Fibre Containers, Cartons & Flexible Laminates	**Lectures 15**

- Introduction, Machineries used for conversion, online packaging, system packaging, Ancillaries Machines and equipment, Online and Offline inspection equipment.
- Metal Cans-Three piece, DRD & DWI can manufacture machine and its various sections-Coating Equipments. Metal drum-Types-Different machines used in manufacturing. Fibre & Composite drum- Drum types-Machine used in manufacturing.
- Sacks-Types-Machine used in manufacturing of bag-Synthetic sack-Types-Manufacturing machine.
- Folding Cartons - Machines used in cartoning.
- Flexible Laminates- Different components of the Lamination Machine.

Unit II: Filling Machineries, Retort & Aseptic Packaging	**Lectures 15**

- Filling machineries by count-Filling machineries-Liquid-Carbonated, Design consideration and selection of fillers. Types of Solid fillers-Cup, Weight, Auger, Multi-head weigher
- Vertical Form fill seal (VFFS), Horizontal Form fill seal (HFFS) Machines-Machine overview, Types-Different section on the machine-New technologies available.
- Retort System-Overview-Process description, Canning Operation-Type of Retort system& machines/equipments.
- Aseptic System-Concept- Types of Aseptic Packs-Aseptic Packaging Machineries based on sterilization method

Unit III: Conveying Systems, End of Line Machineries	**Lectures 15**

- Wrapping Machine-Style of wrapping-Machines Shrink Wrapping and Stretch Wrapping Machines
- Label Applicator Machines, Capping Machines, Sealing machines.
- Coding & Marking machines, Taping machine, Strapping machine.
- Conveying systems- Transfer between conveyors-Interconnecting machinery
- Offline / online Inspections on machines used on packaging lines.

References:

1. Davis, C.G., Introduction to Packaging Machinery, Packaging Machinery Manufacturers Institute.
2. Luciano, R., How to Write Packaging Machinery Specifications, Institute of Packaging Professionals
3. Zepf, P.J., Improving Packaging Line Performance, Institute of Packaging Professionals
4. G. K. Dubey, Fundamentals of Electric Drives, Narosa Publishing house
5. Dr. J. S. Rao and Dukhipeti, Theory of M/cs and Mechanisms, New Age International
6. H. P. Garg, Industrial Maintenance, S.Chand
7. Kit L Yam,The Wiley Encyclopedia of Packaging Technology, John Wiley & Sons Inc. Publication, 2009
8. F A Paine, The Packaging User's Handbook, Blackie Academic & Professional, 4th Reprint, 1996
9. Kaushik, Chaurasia&Dhakar, "Textbook of Pharmaceutical Packaging Technology", CBS Publishers & Distributors Pvt. Ltd, 1st Edition, 2009
10. EIRI Board of Consultant & Engineer, "Handbook of Packaging Technology", Engineers India Research

The scheme of examination shall be divided into two parts:

Internal Examination 40% i.e. 40 Marks

Semester-end Examination 60% i.e. 60 Marks

(A) Internal Assessment 40 Marks:

Description	**Marks**
Internal Test of 20 Marks	20
Q.1 MCQs or True / False - 10 Marks Q.2 Attempt two of 3 question (5 Marks each) – 10 Marks	
Project / Case-studies / Viva Voce / Assignment / Presentation	10
Attendance & Class Behaviour	10
Total	**40**

(B) Semester end examination 60 Marks:

Duration - 2 Hours	**Total Marks - 60**
Q.1. (A) OR (B) – 12 Marks each	12
Q.2. (A) OR (B) – 12 Marks each	12
Q.3. (A) OR (B) – 12 Marks each	12
Q.4. (A) OR (B) – 12 Marks each	12
Q.5. (A) OR (B) – 12 Marks each	12
Total	**60**
Note: Q.1, 2, 3 & 4 may be divided into sub-questions if required Q.5 may include theory (short notes) or case study in one of the options.	

Passing criteria: Minimum 40% in Internal (16 out of 40) and 40% (24 out of 60) insemester end examination.

COURSE CODE	TITLE	CREDITS 1 (2Pr)
U25PT5MJP01	**Packaging Machinery Laboratory**	

List of Practicals:

Demonstrations of working machineries:

1. Vertical Form Fill Seal Machine
2. Horizontal Form Fill Seal Machine
3. Induction Sealing Machine
4. Pouch Band Sealer with Gas Flushing
5. Thermoforming Machine
6. ROPP Capping Machine
7. Shrink Wrapping Machine
8. Stretch Wrapping Machine
9. Heat Sealing Machines
10. Conveyor systems
11. Strapping Machines
12. Coding and Marking Machines

Other relevant machines as per curriculum.

Relevant industrial visits may be undertaken for demonstrations of various machineries and systems.

Continuous Evaluation:

Description	Marks
Laboratory Report of Machine Demonstrations	20
Industrial Visit Reports	10
Viva Voce	10
Attendance	10
Total	**50**

COURSE CODE	TITLE	CREDITS 3 (3Th)
U25PT5MJ02	**Food Packaging**	
Course Objectives:	1. Learn and understand the types of food, their modes of deterioration and the fundamentals of package barriers. 2. Learn shelf life studies and sensory evaluation based on type of product. 3. Study the various food preservation techniques with real-life packaging examples.	
Course Outcomes:	Learners will be able to: 1. Analyse and choose a barrier material for a specific food product based on barrier properties studied. 2. Analyse and choose a preservation method for a specific food product-based product sensitivity and shelf life required. 3. Determine the shelf life of given food and develop the technique to improve the same.	

Unit I: Introduction	**Lectures 15**
• An overview & Introduction to the science, technology, socio economic needs and packaging functions. • Types of food – Perishable / Semi-perishable, acidity of food product. • Gas and Vapour permeation - Basic concepts and theory of permeation and units. • Barrier materials used in Food Packaging - Food-package compatibility and migration issues.	
Unit II: Shelf-Life Studies & Sensory Evaluation	**Lectures 15**
• The concept and factors influencing or affecting shelf life - Food deterioration (Order of reactions) and intrinsic & extrinsic factors, evaluation studies and methods to assess shelf-life (Normal & Accelerated). • Sensory evaluation – Concept, Human sensory perception, Errors in sensory evaluation. • Sensory Evaluation Tests – Discriminative, Descriptive & Affective/Consumer Tests.	
Unit III: Food Preservation & Food Characteristics	**Lectures 15**
• Drying – Cold Preservation (Refrigeration, Deep Freezing) – Pickling – Sterilization (Retort/Canning, Irradiation) • Modified & Controlled Atmosphere Packaging – Gases used – Vacuum Packaging - Active Food Ingredients. • Food Characteristics & Processing Needs - Cereals and bakery products - Meat and meat products - Dairy and confectionary products, fats, oils, drinks – Fresh fruits & vegetables - frozen foods	

Text / References:

1. Mathlouthi M., Food packaging & preservation, Blackie Academic & Professional
2. Gordon L Robertson, Food packaging principles & practice, Taylor & Francis Group
3. Food packaging technology Handbook, National Institute of Industrial Research (NIIR) Board
4. Hirsch A., Flexible food packaging, Van Nostrand Reinhold Co.
5. Lee, Yam, Piergiovanni, Food Packaging Science & Technology, CRC Press.
6. Piringer&Baner, Plastic Packaging Materials for Food, Wiley – VCH verlag GmbH.

The scheme of examination shall be divided into two parts:

Internal Examination 40% i.e. 40 Marks

Semester-end Examination 60% i.e. 60 Marks

(A) Internal Assessment 40 Marks:

Description	**Marks**
Internal Test of 20 Marks Q.1 MCQs or True / False - 10 Marks Q.2 Attempt two ot of 3 question (5 Marks each) – 10 Marks	20
Project / Case-studies / Viva Voce / Assignment / Presentation	10
Attendance & Class Behaviour	10
Total	**40**

(B) Semester end examination 60 Marks:

Duration - 2 Hours	**Total Marks - 60**
Q.1. (A) OR (B) – 12 Marks each	12
Q.2. (A) OR (B) – 12 Marks each	12
Q.3. (A) OR (B) – 12 Marks each	12
Q.4. (A) OR (B) – 12 Marks each	12
Q.5. (A) OR (B) – 12 Marks each	12
Total	**60**
Note: Q.1, 2, 3 & 4 may be divided into sub-questions if required Q.5 may include theory (short notes) or case study in one of the options.	

Passing criteria: Minimum 40% in Internal (16 out of 40) and 40% (24 out of 60) insemester end examination.

COURSE CODE	TITLE	CREDITS 1 (2Pr)
U25PT5MJP02	**Food Packaging Laboratory**	

List of Practicals: (Minimum 8 to be performed)

1. Perform sensory evaluation of a given food sample.
2. Study the effect of moisture on a food sample.
3. Study the effect of temperature on a food product.
4. Determine IMC, CMC and EMC for a given food product.
5. Prepare various salt solutions in desiccators for simulating different RH Conditions.
6. Estimate shelf life of a product theoretically.
7. Estimate shelf life of a product by accelerated testing.
8. Study the effect of canning on a food product.
9. Study the effect of refrigeration on a food product.
10. Measure WVTR / OTR of a given packaging barrier.

Practical Examination:

1. **Experiment:** 20 Marks (with External Examiner)
2. **Journal:** 20 Marks
3. **Viva Voce:** 10 Marks (with External Examiner)
   Total: 50 Marks

Note:

1. Practical Examination to be conducted as per syllabus enlisted.
2. Candidates are required to present certified journal on the day of practical examination.

COURSE CODE	TITLE	CREDITS 2 (2Th)
U26PT5MJ03	**Science & Technology in Ancient India**	
Course Objectives:	1. Learn the contribution of various Indians to Science & Technology in Ancient India.	
Course Outcomes:	Learners will be able to: 1. Explain the contribution of India to the field of science and technology 2. Elaborate on various areas of science & technology where ancient India already had knowledge existing and relate it to packaging field	

Unit I: Importance of the Study of History of Science	**Lectures 15**
Introduction to Indian Sciences - Vedic cognitive science – Mathematical & Physical Sciences - Rhythms of Life – Cosmology – Astronomy – Conspets of Space, Time & Matter – Shri Yantra – Mathematics & Astrology (Baudhayan, Aryabhatta, Brahmagupta, Bhaskaracharya , Mahaviracharya and others) – Science (kanad, Varahamihira, Nagarjuna and others) – Medical Science (Sushruta, Charak, Yoga & Patanjali)	

Unit II: History of Metallurgy, Glass and Ceramics	**Lectures 15**
Technology in Ancient India – Pottery, Metallurgy, Chemistry, Alchemy, Medicine / Surgery, etc. Study of Glass & Beads – History in Ancient & Medieval India. Vedic Metallurgy (Civilisations – Mohenjodaro & Harappa), Copper, Iron, Zinc, Gold & Silver. Pottery / Ceramics (Pottery from different periods) – Types of Indian Pottery	

References:

1. R S Rana, Rajesh Purohit, Manish Vishwakarma - Indian Knowledge System of Materials in Science and Technology, Walnut Publications, 2023.
2. Mahadevan, Pavana, Bhat - Introduction to Indian Knowledge Systems – Concepts and Applications, PHI Learning, 2022
3. P P Ray - Indian Knowledge Systems, Rajmangal Prakashan, 2024
4. Rohidas Nitonde, Introduction to Indian Knowledge System : A Textbook for UG Students as per NEP 2020, Notion Press, 2024

Scheme of Examination

Total Marks: 50 - Continuous evaluation pattern.

Evaluation Criteria	Marks
Case Study / Report / Assignment	20
Presentation on a relevant topic of IKS	20
Attendance & Class Behaviour	10
Total	**50**

COURSE CODE	TITLE	CREDITS 3 (3Th)
U25PT5MI01	**Packaging & Marketing**	
Course Objectives:	1. Learn the significance of marketing in Packaging and how marketing departments undertake packaging evaluations	
Course Outcomes:	Learners will be able to: 1. Explain the marketing concepts from the point of view of packaging. 2. Elaborate on NPD and how packaging influences the same. 3. Create a marketing mix strategy for a given packaged product.	

Unit I: Introduction	**Lectures 15**

- Packaging as a Marketing Tool. Marketing definitions.
- Marketing Concepts - Marketing Process
- Marketing mix – 4Ps
- Marketing Environment & Market Potential
- Consumer Markets and buying behaviour
- Market segmentation and targeting and positioning.

Unit II: Product Specific	**Lectures 15**

- Product Decisions - concept of a Product - Product mix decisions - Brand Decision
- New Product Development – Sources of New Product idea - Steps in Product Development - Product Life Cycle strategies- Stages in Product Life Cycle,
- Price Decisions - Pricing objectives - Pricing policies and constraints - Different pricing method - New product pricing, Product Mix pricing strategies and Price adjustment strategy.

Unit III: Channel Decisions & Promotion	**Lectures 15**

- Channel Decision - Nature of Marketing Channels –. Types of Channel flows - Channel functions - Functions of Distribution Channel – Structure and Design of Marketing Channels - Channel co-operation, conflict and competition – Retailers and wholesalers.
- Promotion Decision - Promotion mix - Advertising Decision, Advertising objectives - Advertising and Sales Promotion – Developing Advertising Programme – Role of Media in Advertising - Advertisement effectiveness - - Sales force Decision.

Text / references:

1. Kit L Yam,The Wiley Encyclopedia of Packaging Technology, John Wiley & Sons Inc. Publication, 2009
2. K.S. Chandrasekar, Marketing Management Text And Cases, Tata McGraw-Hill Publication, New Delhi.2010
3. Govindarajan, Marketing Management Concepts, Cases, Challenges And Trends, Prentice Hall of India, New Delhi.
4. Philip Kotler, Marketing Management- Analysis Planning And Control, Prentice Hall of India, New Delhi,
5. Ramaswamy. V S & Namakumari. S, Marketing Management-Planning Implementation And Control, Macmillan Business Books, New Delhi, 2002

The scheme of examination shall be divided into two parts:

Internal Examination 40% i.e. 40 Marks

Semester-end Examination 60% i.e. 60 Marks

(A) Internal Assessment 40 Marks:

Description	**Marks**
Internal Test of 20 Marks	20
Q.1 MCQs or True / False - 10 Marks Q.2 Attempt two of 3 question (5 Marks each) – 10 Marks	
Project / Case-studies / Viva Voce / Assignment / Presentation	10
Attendance & Class Behaviour	10
Total	**40**

(B) Semester end examination 60 Marks:

Duration - 2 Hours	**Total Marks - 60**
Q.1. (A) OR (B) – 12 Marks each	12
Q.2. (A) OR (B) – 12 Marks each	12
Q.3. (A) OR (B) – 12 Marks each	12
Q.4. (A) OR (B) – 12 Marks each	12
Q.5. (A) OR (B) – 12 Marks each	12
Total	**60**
Note: Q.1, 2, 3 & 4 may be divided into sub-questions if required Q.5 may include theory (short notes) or case study in one of the options.	

Passing criteria: Minimum 40% in Internal (16 out of 40) and 40% (24 out of 60) insemester end examination.

COURSE CODE	TITLE	CREDITS 1 (1Tut)
U25PT5MIT01	Packaging & Marketing Tutorial	

List of Tutorial Sessions: (Minimum 5)

1. Create questionnaire for gathering primary data.
2. Perform basic primary research on specific product packaging and report the data
3. Compile secondary research data on an identified product segment.
4. Benchmark the packaging of a specific product segment.
5. Write a report on the marketing strategies employed for a given packaged product
6. Create a market mix for new product development with packaging input.

Continuous Evaluation: 50 Marks

Tutorial Reports: 20 Marks
Viva Voce: 10 marks
Assignments: 10 Marks
Class Interaction / Attendance: 10 Marks

Python Programming

COURSE CODE : U26PT6VSC01 **COURSE CREDIT: 01**

1 credit - 15 lectures

1 lecture is 60 minutes

Course Objectives:

- To explore the innards of Python Programming and understand components of Python Program

Course Outcomes:

After successful completion of this course, students would be able to:
To store, manipulate and access data in Python
To implement basic Input / Output operations in Python
To define the structure and components of a Python program.

Sr. No	Syllabus	No. of lectures
01	**Introduction:** The Python Programming Language, History, features **Variables and Expressions:** Values and Types, Variables, Variable Names and Keywords, Type conversion, Operators and Operands, Expressions, Interactive Mode and Script Mode, Order of Operations. **Conditional Statements:** if, if-else, nested if –else **Looping:** for, while, nested loops **Control statements:** Terminating loops, skipping specific conditions **Functions:** Function Calls, Type Conversion Functions, Math Functions, Composition, Adding New Functions, Definitions and Uses, Flow of Execution, Parameters and Arguments, Void Functions, Why Functions? Importing with from, Return Values, Incremental Development, Composition, Boolean Functions **Lists:** Values and Accessing Elements, Lists are mutable, traversing a List, Deleting elements from List, Built-in List Operators, Concatenation, Repetition, In Operator, Built-in List functions and methods	**15**

References:

1. Introduction to Computing and Problem Solving Using Python by E Balagurusamy, Mc Graw Hill.
2. Programming and Problem solving with Python by Ashok Namdev Kamthane and Amit Ashok Kamthane, Mc Graw Hill.
3. Python Programming by Kiran Gurbani and Ashwin Mehta, Himalaya Publications.

Python Programming Practicals

COURSE CODE : U26PT6VSCP01 **COURSE CREDIT: 01**

1 credit - 2 lectures

1 lecture is 60 minutes

Sr.No.	List of Practicals
1	Write the Python program to create a program that asks the user to enter their name and their age. Print out a message addressed to them that tells them the year that they will turn 100 years old.
2	Write the Python program to enter the number from the user and depending on whether the number is even or odd, print out an appropriate message to the user.
3	Write the Python program to enter the number from the user and display the addition of numbers.
4	Write the program that reverses the user defined value.
5	Write the Python program to print the factorial for a given number.
6	Write the program that takes a character (i.e. a string of length 1) and returns True if it is a vowel, False otherwise.
7	Write the program that computes the length of a given list or string.
8	Write the program for the following: Take a list, say for example this one: a = [1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89] and write a program that prints out all the elements of the list that are less than 5.
9	Write a python program that takes two lists and returns True if they have at least one common member.
10	Write a Python program to print a specified list after removing the 0th, 2nd, 4th and 5th elements.
11	Write a Python script to sort (ascending and descending) a list by value.
12	Write a Python script to concatenate two lists and to create a new one.
13	Write a Python program to sum all the items in a list.

SCHEME OF EXAMINATION

The scheme of examination shall be divided into two parts:

- Practical assessment 40% i.e. 20 marks
- Semester end examination 60% i.e. 30 mark

(A) Practical Assessment 20 marks

Description	Marks
One question of 10 marks practical	10
Journal	5
Viva	5
Total	20

(B) Semester end examination 30 marks PAPER PATTERN

Duration: 1 hours	
Total Marks: 30	
Description	**Marks**
Q.1 10 marks OR 10 marks	10
Q.2 10 marks OR 10 marks	10
Q.3 10 marks OR 10 marks	10
Total	30
Note: 3. Q.1, 2, 3 may be divided into sub questions if required. 4. Q.3 May include theory (short notes) /Case Study in one of the options.	

- **Passing criteria: Minimum 40% in Internal (8 out of 20) and 40% (12 out of 30) in semester end examination.**

U25PT5FP01 Field Project in Sem-V: Credits: 2

Students are expected to spend a minimum of 30 hours under the guidance of a competent professional / scientist at a company, research or testing organization with the approval of the Department Supervisor and the aim of learning techniques to handle real-life problem statements and their applications.

Or

Internship in industry / consultancy / performing benchmarking & market studies. The assessments should be based on supervisor's feedback, submission of a training report and an open presentation and Viva.

B.Sc. Packaging Technology Programme

(To be implemented from Academic Year- 2026-27)

No. of Courses	Course Code	Semester VI	Credits
1	***Major***		
1	U25PT6MJ01	**Pharmaceutical Packaging**	**03**
2	U25PT6MJP01	**Pharmaceutical Packaging Laboratory**	**01**
3	U25PT6MJ02	**Industrial Product Packaging**	**03**
4	U25PT6MJP02	**Industrial Product Packaging Laboratory**	**01**
5	U25PT6MJ03	**Sustainable Packaging**	**02**
2	***Major Elective (to be selected from given options)***		
1	U25PT6MJE01A U25PT6MJE01B U25PT6MJE01C	**Major Elective Theory(Select any one)** **1. Labelling technology** **2. Inks & Coatings** **3. Product Design & Development**	**03**
2	U25PT6MJET01A U25PT6MJET01B U25PT6MJET01C	**Major Elective Tutorial(Select any one)** **1. Labelling technology** **2. Inks & Coatings** **3. Product Design & Development**	**01**
3	***Minor***		
1	U26PT6MI01	**Project Management & Entrepreneurship**	**03**
2	U26PT6MIT01	**Project Management & Entrepreneurship Tutorial**	**01**
4	***OJT, FP, RP, CEP, CC***		
1	U25PT6OJT01	**On The Job Training**	**04**
		Total Credits	**22**

1 credit = 15 lectures
1 lecture/theory = 60 minutes 1 Practical = 2 hours session

COURSE CODE	TITLE	CREDITS 3 (3Th)
U25PT6MJ01	**Pharmaceutical Packaging**	
Course Objectives:	1. Study the fundamental characteristics of pharmaceutical drugs & their dosage forms. 2. Understand the various existing pharma package forms	
Course Outcomes:	Learners will be able to: 1. Select the right type of package form for a pharma product, based on the product nature, form & size. 2. Evaluate a pharmaceutical package considering stability of the medicine during its storage.	

Unit I: Introduction	**Lectures 15**
• Pharmaceutical vs Food Product – Definition of Drug – Characteristics – Stability – Chemical change/Reactions – Thermal Protection – Light protection – Purity & Sterility. • Dosage forms of drugs – Vaccines – Biologically-produced Pharmaceuticals – • Medical/Health/Nutritional foods – Packaging materials.	
Unit II: Aseptic Packaging & Packaging Security	**Lectures 15**
• Aseptic Packaging – Types & systems – Injectables and orals/ointments –Ampules, Vials, strip / blister packaging. • Packaging of bulk drugs – API Packaging – Anti-Counterfeiting & Migration • Reference to IP/BP/USP and significance –packaging regulations – labelling requirements – Compliances / Legal Issues.	
Unit III: Packaging Machineries	**Lectures 15**
• Blister Packaging-Blister Design Parameters-Types of Blisters, Sections on Blister packaging machines. • Strip Packaging-Strip packaging process-Materials used-Strip Packing Machinery • Case packing or Case loading- Case loading Methods-Machine used in case packing.	

Text / references:

1. Bauer E., Pharmaceutical Packaging Handbook, 1st Edition, CRC Press
2. Dean D. A., Evans E. R., Hall I. H., Pharmaceutical Packaging Technology, Taylor & Francis
3. Paine F. A., Lockhart H., Packaging of Pharmaceuticals and Healthcare Products, Springer

The scheme of examination shall be divided into two parts:

Internal Examination 40% i.e. 40 Marks

Semester-end Examination 60% i.e. 60 Marks

(A) Internal Assessment 40 Marks:

Description	Marks
Internal Test of 20 Marks Q.1 MCQs or True / False - 10 Marks Q.2 Attempt two ot of 3 question (5 Marks each) – 10 Marks	20
Project / Case-studies / Viva Voce / Assignment / Presentation	10
Attendance & Class Behaviour	10
Total	**40**

(B) Semester end examination 60 Marks:

Duration - 2 Hours	**Total Marks - 60**
Q.1. (A) OR (B) – 12 Marks each	12
Q.2. (A) OR (B) – 12 Marks each	12
Q.3. (A) OR (B) – 12 Marks each	12
Q.4. (A) OR (B) – 12 Marks each	12
Q.5. (A) OR (B) – 12 Marks each	12
Total	**60**
Note: Q.1, 2, 3 & 4 may be divided into sub-questions if required Q.5 may include theory (short notes) or case study in one of the options.	

Passing criteria: Minimum 40% in Internal (16 out of 40) and 40% (24 out of 60) insemester end examination.

COURSE CODE	TITLE	CREDITS 1 (2Pr)
U25PT6MJP01	**Pharmaceutical Packaging Laboratory**	

List of Practical Sessions: (Minimum 6)

- Demonstration of strip packaging machine
- Demonstration of blister packaging machine
- Design a strip / blister package for a given pharma product
- Study country specific regulations for pharma packaging
- Compare the US and Indian Pharmacopoeia on the basis of packaging requirements.
- Study and write the basic labelling requirements for a pharma package.
- Study and write the basic labelling requirements for a bulk drug package.

Continuous Evaluation: 50 Marks

Laboratory Reports: 20 Marks
Viva Voce: 10 marks
Assignments: 10 Marks
Class Interaction / Attendance: 10 Marks

COURSE CODE	TITLE	CREDITS 3 (3Th)
U25PT6MJ02	**Industrial Product Packaging**	
Course Objectives:	1. Study the classification, characteristics & sensitivities of various industrial products. 2. Understand package design &development approach based on the type of industrial product. 3. Study the classification and properties of wood, including the defects. 4. Study the different wood-based packaging forms and other bulk carriers. 5. Understand the product protection principles.	
Course Outcomes:	Learners will be able to: 1. Effectively choose packaging materials based on characteristics of industrial products. 2. Describe the various properties & defects of wood packaging material 3. Analyse the various hazards & environmental issues related to Packaging and select a specific protection method for the product. 4. Choose various bulk carriers for industrial packaging based on the type of product. 5. Analyse various types of internal fitments for product protection and retainment. 6. Explain the characteristics and applications of various wooden package forms.	

Unit I: **Lectures 15**

Industrial Products - Introduction & Classification

Introduction to industrial products packaging. Difference between consumer and industrial packaging needs. The packaging Considerations and package design approach, protective requirements and distribution – hazards, their sensitivity influencing packaging design and development criteria. Industrial Products Classification – Product Group Wise, Its Nature, Classification & Requirements; Heavy, Medium and Light Engineering Goods; Electronic Products; Auto Components/ Spares, Chemicals and others.

Unit II: **Lectures 15**

Wood - Packaging Material & Pack Forms

Classification of wood – Groups, softwood & hardwood, plywood, Properties of wood – Density, Moisture Content, Defects found in wood – Knots, Cross Grain, Cupping, checking and others. Introduction to Wood seasoning & Preservation.

Wooden Boxes & Crates – Difference & Types, Introduction to Wooden Pallets & Box Pallets and their various components; Wooden Dunnages

Corrosion – Types and Preventive Methods, Introduction to Desiccants, VCI/VPI

Cushioning – Concept, Fragility & Cushion Factor, Shock & Vibration. Open & Closed cell cushions and various cushioning Materials. Internal Fitments – Functions & Different Materials;

Unit III: Packaging Systems **Lectures 15**

Types of **Internal Fitments** - Corner supports, Pads, Liners/collars, Trays, Slotted Partitions and others.

Strapping- functions; Materials- Metal-steel, Plastics- HDPE / PP / PET / Nylon; Types of loads – rigid, compressible, stretching, shrinkable; Properties and Criteria for Selection of strapping Materials; Tensioning; Crimping and Sealing of straps;

Taping – functions- Kraft paper tapes- properties and types- white and coloured - BOPP/PVC self-adhesive tapes - properties and manufacturing; Tape dispensing – Manual, hand-held and automatic.

Other Bulk Packages for Industrial Products: Intermediate Bulk Containers (IBC) – Rigid & Flexible, Paper Sacks, Jerry Cans, Fibre Drums and other.

References:

1. K. L. Yam, The Wiley Encyclopedia of Packaging Technology, 3rd ed., Wiley, 2009
2. W. Soroka, Fundamentals of Packaging Technology, 4th ed., IoPP, 2009
3. J. F. Hanlon, Handbook of Package Engineering, 3rd ed., CRC Press, 1998
4. F. A. Paine, The Packaging User's Handbook, Springer, 1990
5. Friedman W.F. and J.J. Kipness, Industrial Products packaging, John Wiley & Sons
6. Klimchuck, Packaging Design & Engineering, Wiley
7. F. A. Paine, Fundamentals of Packaging, Blackie A& P
8. Friedman W.F. and J.J. Kipness, Distribution Packaging, Robert E. Krieger Publishing Co.
9. Wooden Containers/crates, Corrugated board/boxes, marking: Specification and Testing as per Indian Standards

The scheme of examination shall be divided into two parts:

Internal Examination 40% i.e. 40 Marks

Semester-end Examination 60% i.e. 60 Marks

(A) Internal Assessment 40 Marks:

Description	**Marks**
Internal Test of 20 Marks Q.1 MCQs or True / False - 10 Marks Q.2 Attempt two ot of 3 question (5 Marks each) – 10 Marks	20
Project / Case-studies / Viva Voce / Assignment / Presentation	10
Attendance & Class Behaviour	10
Total	**40**

(B) Semester end examination 60 Marks:

Duration - 2 Hours	**Total Marks - 60**
Q.1. (A) OR (B) – 12 Marks each	12
Q.2. (A) OR (B) – 12 Marks each	12
Q.3. (A) OR (B) – 12 Marks each	12
Q.4. (A) OR (B) – 12 Marks each	12
Q.5. (A) OR (B) – 12 Marks each	12
Total	**60**
Note: Q.1, 2, 3 & 4 may be divided into sub-questions if required Q.5 may include theory (short notes) or case study in one of the options.	

Passing criteria: Minimum 40% in Internal (16 out of 40) and 40% (24 out of 60) insemester end examination.

COURSE CODE	TITLE	CREDITS 1 (2Pr)
U25PT6MJP02	**Industrial Packaging Laboratory**	
List of Practicals (Min. 8)		**Lectures 15**

- Determine the density of a given cushion
- Determine the tensile strength of a given strap
- Perform strapping operation on a package
- Perform dimensional analysis of a wooden pallet
- Check the effectiveness of a given VCI Paper / Film
- Identify all the defects in a given wooden sample
- Estimate the quantity of desiccant required for a given industrial package.
- Design a wooden package as per Indian Standard
- Design a package for a given industrial product

Practical Examination:

1. **Experiment:** 20 Marks (with External Examiner)
2. **Journal:** 20 Marks
3. **Viva Voce:** 10 Marks (with External Examiner)
   Total: 50 Marks

Note:

1. Practical Examination to be conducted as per syllabus enlisted.
2. Candidates are required to present certified journal on the day of practical examination.

COURSE CODE	TITLE	CREDITS 2 (2Th)
U25PT6MJ03	**Sustainable Packaging**	
Course Objectives:	1. To understand concepts of sustainable development 2. To study metrics for sustainable packaging & LCA 3. To various waste management systems 4. To study biopolymers & biobased polymers	
Course Outcomes:	Learners will be able to: 1. Describe the need & scope of sustainability in a process, product/package or equipment. 2. Describe & analyze the metrics & LCA for packaging sustainability. 3. State & explain the various waste management systems. 4. Describe the need of biopolymers & biobased polymers in sustainable economy.	

Unit I: **Lectures 15**

- Sustainable Development & Processes, Need Today, Three Pillars of Sustainability & their effects on sustainable growth - Relation with environment waste management
- Relevance of Sustainable Development in Packaging Sector - Traditional Packaging vs. Sustainable Packaging - Important terminologies - Sustainable Packaging in India & Abroad - Concept of 3R's & Source Reduction - Concept of Sustainable Packaging & Printing Processes - Concept of Sustainable Design - Twelve Principles of Sustainable Packaging - Examples of sustainable materials and processes
- Introduction to Metrics of Sustainable Packaging - Terminologies - Case studies for metrics & their evaluation - Packaging Sustainability Metrics in developed & developing economies.

Unit II: **Lectures 15**

- Introduction to LCA Methodology- Implications from ISO 14000-ISO 14044. Softwares & some Case Studies, Modelling & Analysis.
- Environmental Compliance: National & International Legislations - Cost Factors & their implications - Sustainable Development Policies - Corporate Social Responsibility & Key Performance Indicators (KPIs) – Waste Management
- Introduction to Biopolymers & biobased packaging - Types & synthesis - Applications - Implications in Sustainable Packaging

Texts / References:

1. Scott Boylston, Designing Sustainable Packaging, Laurence King Publishing, 2009.
2. Wendy Jedlicka, Packaging Sustainability: Tools, Systems and Strategies for Innovative Package Design, 1st Edition, Wiley, 2009
3. Wendy Jedlicka, Sustainable Graphic Design: Tools, Systems and Strategies for Innovative Print Design, 1st Edition, Wiley, 2009
4. Sustainable Materials, Processes and Production, 1st Edition, Thames and Hudson, 2013
5. M. Braungart, W. McDonough,Cradle to Cradle: Remaking the Way We Make Things, 1st edition, North Point Press, 2002
6. W. Klöpffer, B. Grahl, Life Cycle Assessment (LCA), Wiley VCH, 2014
7. L. Lakshmi, Waste Management: Environmental Impact, icfai university press 2008.
8. J. M. Dewan, K. N. Sudarshan, Solid Waste Management Hardcover, Discovery Publishing Pvt. Ltd., 1999

The scheme of examination shall be divided into two parts:

Internal Examination 40% i.e. 20 Marks

Semester-end Examination 60% i.e. 30 Marks

(A) Internal Assessment 20 Marks:

Description	**Marks**
Internal Test of 10 Marks Q.1 MCQs or True / False - 5 Marks Q.2 Attempt one out of 2 question (5 Marks each) - 5 Marks	10
Attendance & Class Behaviour	10
Total	**20**

(B) Semester end examination 30 Marks:

Duration - 1 Hour	**Total Marks - 30**
Q.1. (A) OR (B) – 10 Marks each	10
Q.2. (A) OR (B) – 10 Marks each	10
Q.3. (A) OR (B) – 10 Marks each	10
Total	**30**
Note: Q.1, 2 may be divided into sub-questions if required Q.3 may include theory (short notes) or case study in one of the options.	

Passing Criteria: Minimum 40% in Internal (8 out of 20) and 40% (12 out of 30) in end semester examination

Course Code	TITLE	Credits
U26PT6MI01	**Project Management and Entrepreneurship**	**3 (3Th)**

Objectives:

1. To get acquainted with various aspects of project management
2. To study different scheduling and planning techniques used in the industry
3. To study various applications of inventory and project management with respect to the Printing and Packaging Industry.
4. To study Lifecycle of the project
5. To develop and strengthen entrepreneurial quality in students.
6. To impart basic entrepreneurial skills and understandings to run a business efficiently and effectively.

Outcomes: At the end of the course, learners should be able to;

1. Describe the fundamental concepts in Project management
2. Analyze the various scheduling and planning techniques
3. Understand and apply suitable strategy for any specific project
4. Apply project management principles in business situations to optimize resource utilization and time.
5. Demonstrate skills needed to run a successful business.

Sr. No.	Details	Hrs
1.	**Module 1 - Introduction to Project Management** Project Management – Definition –Goal - Lifecycles. Project Selection Methods. Project Portfolio Process – Project Formulation. Project Manager – Roles-Responsibilities and Selection – Project Teams. **Planning and Budgeting** The Planning Process – Work Break down Structure – Role of Multidisciplinary teams. Budget the Project – Methods. Cost Estimating and Improvement. Budget uncertainty and risk management.	15
2.	**Module 2 – Scheduling and Control** **Scheduling and Resource allocation** GANTT Chart, PERT & CPM Networks, GERT, Crashing – Project Uncertainty and Risk Management – Simulation –Gantt Charts **Project control and conclusion** The Plan-Monitor-Control cycle – Data Collecting and reporting – Project Control – Designing the control system. Project Evaluation, Auditing and Termination.	15
3.	**Module 3 – Entrepreneurial competence** Entrepreneurship concept – Entrepreneurship as a Career – Entrepreneurial Personality -Characteristics of Successful, Entrepreneur – Knowledge and Skills of Entrepreneur. **Business plan Preparation** Sources of Product for Business - Prefeasibility Study - Criteria for Selection of Product -Ownership - Capital - Budgeting Project Profile Preparation - Matching Entrepreneur with the Project - Feasibility Report Preparation and Evaluation Criteria.	15

	Launching and Management of Small business Finance and Human Resource Mobilization Operations Planning - Market and Channel Selection -Growth Strategies –Break even analysis- Product Launching – Incubation, Venture capital. Monitoring and Evaluation of Business - Preventing Sickness and Rehabilitation of Business Units- Effective Management of small Business.	

Texts / References:

1. John M.Nicholas, "Project management for business/Technology", Pearson
2. Uddesh Kohli, K.K Chitkara, "Project Management Handbook", Tata McGraw Hill
3. Samuel J.Mantel et al, "Project management", Wiley India
4. S.Choudhury, "Project Management", Tata McGraw Hill
5. P K Joy, "Total Project Management –The Indian context", Macmillan
6. Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi, 2001
7. S.S.Khanka, Entrepreneurial Development, S. Chand and Company Limited

The scheme of examination shall be divided into two parts:

Internal Examination 40% i.e. 40 Marks

Semester-end Examination 60% i.e. 60 Marks

(A) Internal Assessment 40 Marks:

Description	**Marks**
Internal Test of 10 Marks Q.1 MCQs or True / False - 10 Marks Q.2 Attempt 2 out of 3 question (5 Marks each) - 10 Marks	20
Project / Case-studies / Viva Voce / Assignment / Presentation	10
Attendance & Class Behaviour	10
Total	**40**

(B) Semester end examination 60 Marks:

Duration - 1 Hour	**Total Marks - 60**
Q.1. (A) OR (B) – 10 Marks each	12
Q.2. (A) OR (B) – 10 Marks each	12
Q.3. (A) OR (B) – 10 Marks each	12
Q.4. (A) OR (B) – 12 Marks each	12
Q.5. (A) OR (B) – 12 Marks each	12
Total	**60**
Note: Q.1, 2, 3 & 4 may be divided into sub-questions if required Q.5 may include theory (short notes) or case study in one of the options.	

Passing Criteria: Minimum 40% in Internal (16 out of 40) and 40% (24 out of 60) in end semester examination

COURSE CODE	TITLE	CREDITS 1 (1Tut)
U26PT6MIT01	**Project Management Tutorial (Sem-VI Minor)**	
List of Tutorials:		

1. Plan a Work-Breakdown Structure for a given project.
2. Estimate the project cost.
3. Prepare a GANTT chart for project monitoring
4. Using CPM / PERT structure the project flow.
5. Case study of a packaging company project.
6. Idea Generation and putting it through stage gate process.
7. Make a draft business proposal for a start-up venture.
8. Case study for starting a packaging business.
9. Preparing and analyzing online tools of GANTT chart/ CPM/ PERT.

Tutorials may also include objective tests, live case studies, presentation, etc.

Tutorial Reports: 10 Marks
Presentation + Viva Voce: 30 Marks
Class Behaviour / Attendance: 10 Marks
Total: 50 Marks

Course Code	Course Name	Credits
U25PT6OJT01	**On The Job Training**	**4**

Objectives

1. To impart practical exposure to industry.
2. To develop corporate/business ethics and learn organization culture.
3. To enhance entrepreneurial aptitude
4. To understand the workings of an organization, project management, among others.

Outcomes: At the end of the course, learners will be able to;

1. Exhibit the corporate culture/ethics in their workspace/career.
2. Identify the size and scale of operations in Industry.
3. Accomplish allotted tasks within deadlines.
4. Demonstrate an understanding of various constraints in industry.
5. Learn problem solving techniques and also work as a team.
6. Apply the knowledge learnt in their own career.

Guidelines for Evaluation/Assessment

The total duration for presentation shall be maximum 20 minutes, inclusive of 10 minutes for presentation and 10 minutes for discussion.

Evaluation/Assessment of the Term Work Marks

1. Introduction, Acknowledgements, references, Company background/activities. Synopsis/Abstract of the Project/General presentation, neatness and accuracy of the data furnished.	10
2. Internship/Training details, Interest taken, personal involvement and contribution.	25
3. Technical contents of the report with data / observations, graphs, drawings, etc. and Quality of work carried out and details furnished based on personal Observations/involvement.	30
4. Results/ Conclusion.	10
5. Industry Evaluation.	25
	Total – 100

Oral examination / Presentation:

Final End-semester Oral presentation to be conducted by internal and external examiners for **50 marks.**

Industrial Training Guidelines

1. In Industrial Training (in-plant/industrial training) students will be allotted/placed in company/industry/plant or a factory related to printing & packaging technology for min. duration of 8 weeks.
2. Training can also include working under a Research Scholar to assist in research, joining as a trainee in private institutes/laboratories/organizations/small firms for the said period.
3. The student shall spend the training period for observational training and solving assignments/projects given by the organization. Students are expected to analyze the problems systematically and offer suggestion / concluding remarks.
4. Students are required to observe and learn the organization mission/vision/objective, the executive hierarchy, functioning, production, management and laws/regulation/compliance with Indian and International standards.
5. Students are required to maintain a diary to record daily activities at the organization w.r.t. processes/systems learnt, or work done.
6. Industrial training shall also include fortnightly reports submission and discussions by students with respective guides.

Project Guidelines

1. The student shall submit a report on project, suggested by industry where he/she is undergoing industrial training.
2. Project may be of the following types, but not limited to:
   - Manufacturing / Fabrication of a prototype including selection, concept design, material selection, manufacturing the components, assembly of components, testing and performance evaluation.
   - Improvement of existing machine / equipment / process.
   - Design and Fabrication of parts, tools, special purpose equipment, gauges, measuring instruments, etc.
   - Computer aided design, analysis of components such as stress analysis, etc.
   - Problems related to productivity improvements.
   - Problems related to value engineering.
   - Problems related to material handling system.
   - Product design and development
   - Detailed cost estimation of product.
   - Analysis, evaluation and experimental verification of any engineering problem encountered.
   - Quality system and management, Total quality management.
   - Quality improvements In-process Inspection Online
   - Waste management system, Safety, etc.
   - Market analysis in conjunction with production, planning and control.
   - Any other relevant topic, as approved by the internal guide.
3. The student shall submit a detailed report based on the project work as part of final presentation
4. Each student is to have an internal guide from the Institute and one external guide from the corresponding organization.
5. End-semester evaluation and viva voce shall be conducted.

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Course Code	Course Name	Credits
	Labelling Technology (Major Elective – Option 1)	**3 (3Th)**

Objectives

1. To study the different types of labels, their features and manufacturing process.
2. To understand the process of printing, finishing and applying labels on the packs.
3. To study the types of labels and materials used on the different packages.
4. To study the designing of the labels of all types along with the compensations.
5. To study the new trends in the labelling industry.

Outcomes: At the end of the course, learners will be able to;

1. Explain and compare the different types of labels, their features and manufacturing process.
2. Explain the process of printing, finishing and applying labels on the packs.
3. Select a type of label and material based on the package type.
4. Design the labels of all types along with the compensations.
5. Describe the new trends in the labelling industry.
6. Choose a label based on product-package needs.

Module	Details	Hrs
1.	**Introduction:** Functions of labels – Role of labels- growth, market share, types of labels, labelled products. Primary and secondary labels, labels in logistics, coding. Selection of substrates- runnability, printability requirements for different products. Printing methods, analog – flexography, gravure, offset and screen printing and digital- inkjet, thermal transfer and electrophotography, combi presses - types of combinations. Finishing on labels- foil stamping, varnishing, lamination, embossing, holograms, perforation. Overprinting and coding. Pretreatment of containers for labelling. **Plain Adhesive Labels:** Glued on labels- materials and properties, pre-gummed labels. Printing and finishing, label applicator - machines and workflow. Direct mail address labels with variable data printing.	**15**
2.	**Pre adhesive Labels** Types - pressure and heat sensitive. Heat sensitive adhesive label types - instantaneous and delayed action. Printing, cutting and applying, precautions for heat sensitive labels. Self-adhesive labels construction, Types – Permanent, removable and repositionable, applications. Materials – substrate, release liner, release coating, adhesives and manufacturing. Considerations for different types of products. Designing, Printing and finishing - process and machines, die cutting. Label rewinding, applicator types - single and multi-label applicator, applicator fitted with over printer, fixing. New developments - recycling compatibility, liner processing, linerless labels. **Shrink Sleeve labels** Shrink labels- materials – selection for different types of packs, advantages and disadvantages. Designing, Printing and finishing, process and machines. Surface and reverse printing. Shrink tunnel – construction and working, variables affecting shrinkage. Compensating	**15**

	distortion in design due to shrinkage.	
3.	**Other types of labels** In mould labels-materials, properties, Printing and finishing, label application process. Thermal transfer labels, reversible, tie on and insert labels, tags. Specific products for the label types. **Trends** Customized labels with variable data printing. Smart and intelligent labels – functions - security, tracing, safety and preservation of the product, convenience, information transfer. Some of the technologies – RFID, thermo-chromic inks, barcodes. Online shopping and labels.	**15**

Texts / References:

1. Technical Handbook of Self-adhesive labels, FINAT
2. Kit L. Yam, Wiley Encyclopedia of Packaging Technology,2010
3. FA Paine, Packaging user handbook, Blackie A & P, 1990
4. Joseph Hanlon, Hand Book of Package engineering, Technomic Publishing, Third edition

The scheme of examination shall be divided into two parts:

Internal Examination 40% i.e. 40 Marks

Semester-end Examination 60% i.e. 60 Marks

(A) Internal Assessment 40 Marks:

Description	**Marks**
Internal Test of 20 Marks	20
Q.1 MCQs or True / False - 10 Marks Q.2 Attempt two ot of 3 question (5 Marks each) – 10 Marks	
Project / Case-studies / Viva Voce / Assignment / Presentation	10
Attendance & Class Behaviour	10
Total	**40**

(B) Semester end examination 60 Marks:

Duration - 2 Hours	**Total Marks - 60**
Q.1. (A) OR (B) – 12 Marks each	12
Q.2. (A) OR (B) – 12 Marks each	12
Q.3. (A) OR (B) – 12 Marks each	12
Q.4. (A) OR (B) – 12 Marks each	12
Q.5. (A) OR (B) – 12 Marks each	12
Total	**60**
Note: Q.1, 2, 3 & 4 may be divided into sub-questions if required Q.5 may include theory (short notes) or case study in one of the options.	

Passing criteria: Minimum 40% in Internal (16 out of 40) and 40% (24 out of 60) insemester end examination.

Course Code	Course Name	Credits
	Labelling Technology Tutorial (Major Elective – Option 1)	**1 (Tut)**

Tutorial Sessions:

During tutorial sessions learners should understand the various testing methods & equipments used for evaluating types of labels as per FINAT/IS/ASTM or other standards.

Minimum eight tutorials to be conducted and minimum two assignments to be given under each elective. Assignments may also include objective tests, live case studies, presentation, etc.

Tutorial Reports: 10 Marks
Viva Voce: 30 marks (with External Examiner)
Class Behaviour / Attendance: 10 Marks
Total: 50 Marks

Course Code	Course Name	Credits
	Inks and Coatings (Major Elective – Option 2)	**3 (3Th)**

Objectives:

1. To study the ink formulation and its components.
2. To study the requirements of inks for different printing processes and materials.
3. To understand the working of different coatings

Outcomes: At the end of the course, learners should be able to;

1.Explain the formulation for different types of inks
2.Explain the ink components for different printing processes and materials
3.Test and analyse the properties of inks and coatings.
4.Suggest ink for a given process
5.Toubleshoot problems related to ink synthesis
6.Suggest suitable varnish for a given application.

Sr. No.	Details	Hrs
1.	**Module - 1: Raw Materials** Introduction & History of inks - Applications of ink - Ingredients and their functions- Pigments and dyes in printing Inks - organic and inorganic – pigments for different colours and effects - their sources and processing. Vehicle components - oil, resin, solvent, additives – Oils – drying and non-drying – oils for odours – Solvents – diluents/drying/dissolving, distillate and volatile. Resins – their functions- natural and synthetic – Additives – driers, anti-oxidants, plasticizers, anti-setoff, anti-foaming, anti-settling, anti-pinhole and anti-misting agents, surfactants, gelling agent.	15
2.	**Module - 2: Types of Inks** Printing Inks for different processes - letterpress, lithography, dry offset, gravure, flexographic, inkjet and screen inks - formulation, components and functions - troubleshooting for ink related problems Inks as per different drying process- cold-set, heat-set, quickset, UV curable – the formulation and working. Different Processes and their application: Inks for different substrates – absorbent, non-absorbent- coated paper, newsprint, tinplate, flexible packaging, Processing of substrate for ink adhesion.	15
3.	**Module - 3:** **3.1 Manufacturing Process** Making of varnish – Paste ink and liquid ink - Mills for mixing the components- Roll mill – two, three and four roll - Ball and bead mill - Mixers- Rotor/stator, cavitation. Storage and Handling – liquid & paste inks – Ink Packaging – Health, Safety and Environment- Estimation of ink requirements and ordering. **3.2Properties and Testing** Optical properties- colour, transparency, tint, gloss. Flow properties- rheology- Newtonian/non-newtonian, viscosity, tack. Resistance properties- light, acid and alkali, heat, abrasion. **3.3 Other Coatings:** Varnish types – overprint and spot varnish coating methods, Priming coats, lacquers for metals – formulations and coating methods, Other functional coatings- corrosion resistant, water resistant and	15

	chemical resistant, silicone release, biocides, self-seal adhesives.	

Texts / References:

1. R.H.Leach & R.J.Pierce, The Printing Ink Manual, 5th ed., Kluwer, 1991
2. Arthur Tracton, Coatings Materials and surface Coatings, 3rd ed., CRC Press, 2007
3. NIIR, Modern Technology of Printing & Writing Inks, 1st ed., Asia Pacific Business Press
4. NPCS, "Inks, Paints, Lacquers, Varnishes and Enamels", NPCS

The scheme of examination shall be divided into two parts:

Internal Examination 40% i.e. 40 Marks

Semester-end Examination 60% i.e. 60 Marks

(A) Internal Assessment 40 Marks:

Description	Marks
Internal Test of 20 Marks Q.1 MCQs or True / False - 10 Marks Q.2 Attempt two ot of 3 question (5 Marks each) – 10 Marks	20
Project / Case-studies / Viva Voce / Assignment / Presentation	10
Attendance & Class Behaviour	10
Total	**40**

(B) Semester end examination 60 Marks:

Duration - 2 Hours	Total Marks - 60
Q.1. (A) OR (B) – 12 Marks each	12
Q.2. (A) OR (B) – 12 Marks each	12
Q.3. (A) OR (B) – 12 Marks each	12
Q.4. (A) OR (B) – 12 Marks each	12
Q.5. (A) OR (B) – 12 Marks each	12
Total	**60**
Note: Q.1, 2, 3 & 4 may be divided into sub-questions if required Q.5 may include theory (short notes) or case study in one of the options.	

Passing criteria: Minimum 40% in Internal (16 out of 40) and 40% (24 out of 60) insemester end examination.

Course Code	Course Name	Credits
	Inks and Coatings Tutorial (Major Elective – Option 2)	**1 (Tut)**

Tutorial – Inks & Coatings

During tutorial sessions learners should understand the various testing methods & equipments used for evaluating inks & coatings as per IS/ASTM or other standards.

Minimum eight tutorials to be conducted and minimum two assignments to be given under each elective. Assignments may also include objective tests, live case studies, presentation, etc.

Tutorial Reports: 10 Marks
Viva Voce: 30 marks (with External Examiner)
Class Behaviour / Attendance: 10 Marks
Total: 50 Marks

Course Code	Course Name	Credits
	Product Design & Development (Major Elective – Option 3)	**3 (3Th)**

Objectives

1. To acquaint with various approaches in designing and developing new products.
2. To familiarize with various software solutions for designing and developing products.
3. To familiarize with modern approaches like concurrent engineering, product life cycle management, robust design, rapid prototyping / rapid tooling, etc.

Outcomes: At the end of the course, learners will be able to;

1. Develop competency in designing and developing products right from the conceptual level incorporating cost effective solutions.
2. Get familiarized with computer aided product design approach.

Module	Details	Hrs
1.	**1.1 Introduction:** Definition of product design, Classification of products, Design by evolution, Design by innovation, Various phases in product development and Design, Morphology of Design, Considerations in product design, Product specifications. **1.2 Conceptual Design:** Market research, Need-based origin of product, Technology driven products, Analysis of ideas from various angles of design methodology and user needs, Function analysis and component process study, 2-D and 3-D. **1.3 Materials:** Overview of materials including new generation materials, Tailor made material concepts, Material selection process. **1.4 Design for manufacturing (DFM):** Producibility requirements, Accuracy and Precision requirements, Manufacturing (Forging and casting) for various metal forms like sheets, wires, etc and manufacturing for various plastics. **1.5 Design for Assembly (DFA):** Analysis of assembly requirements, Standardization, Ease of Assembly and disassembly, Design for bolted, welded and riveted components, Design for hinge and snap fit assemblies, maintenance, consideration of handling and safety, Modular concepts.	**15**
2.	**2.1 Strength considerations in Design:** Criteria and objectives, designing for uniform strength, designing for stiffness and rigidity, Practical ideas for material saving in design of ribs, corrugations, rim shapes, bosses, laminates, etc. **Designing with plastics:** Mechanical behavior, special characteristics and considerations, **2.2 Value Engineering:** Product value and its importance, Value analysis job plan, Steps to problem solving and value analysis, Value analysis tests, Value Engineering idea generation check list, Material and process selection in value engineering, Cost reduction, case studies and exercises.	**15**
3.	**3.1 Product Ergonomics:** Environmental conditions, thermal, noise, vibration, displays, illusions, Psycho and psychological aspects etc. **3.2 Product Aesthetics:** Visual awareness, Form elements in context of product design, Concepts of size, shape and texture, Introduction to colour and colour as an element in design, **5.3 Product Graphics:** Graphics composition and layout, Use of grids	**15**

	in graphics composition. **5.4 Creativity:** Role of creativity in problem solving, Vertical and lateral thinking, Brain storming. **5.5 Modern Applications:** Concurrent Engineering, QFD, Robust Design, Sustainable Design, Rapid Prototyping, Rapid Tooling, Product Life Cycle Management techniques and application areas.	

Texts / References:

1. Design Fundamentals, R. G. Scott.
2. Design methods inter science, Jomes.
3. Creative Engineering Design, Buhl H. R.
4. The Science of Engineering Design, Holt, Hill Percy H.
5. Ergonomics, Merilyn Joyce, Ulrika Waller Steiner.
6. Human Factors in Engineering & Design, 4th edition
7. Human Engineering Guide & Equipment Design, Morgon C. T. & Others
8. Barron D.ed, Creativity, New York, Art Directors
9. Design for Production, Baldwin E. W. & Niebel B. W. Edwin, Homewood Illinois.

The scheme of examination shall be divided into two parts:

Internal Examination 40% i.e. 40 Marks

Semester-end Examination 60% i.e. 60 Marks

(A) Internal Assessment 40 Marks:

Description	Marks
Internal Test of 20 Marks Q.1 MCQs or True / False - 10 Marks Q.2 Attempt two ot of 3 question (5 Marks each) – 10 Marks	20
Project / Case-studies / Viva Voce / Assignment / Presentation	10
Attendance & Class Behaviour	10
Total	**40**

(B) Semester end examination 60 Marks:

Duration - 2 Hours	Total Marks - 60
Q.1. (A) OR (B) – 12 Marks each	12
Q.2. (A) OR (B) – 12 Marks each	12
Q.3. (A) OR (B) – 12 Marks each	12
Q.4. (A) OR (B) – 12 Marks each	12
Q.5. (A) OR (B) – 12 Marks each	12
Total	**60**
Note: Q.1, 2, 3 & 4 may be divided into sub-questions if required Q.5 may include theory (short notes) or case study in one of the options.	

Passing criteria: Minimum 40% in Internal (16 out of 40) and 40% (24 out of 60) insemester end examination.

Course Code	Course Name	Credits
U25PT5MJET01C	**Product Design & Development Tutorial** (Major Elective – Option 3)	**1 (Tut)**

Tutorial:
During tutorial sessions learners should learn at least 5 case-studies of product design & development, which should include at least three case-studies from the packaging. Packaging Design & Development executives from the industry may be invited for interactions and learnings.

Assignments may also include objective tests, live case studies, presentation, etc.

Tutorial Reports: 10 Marks
Viva Voce: 30 marks (with External Examiner)
Class Behaviour / Attendance: 10 Marks
Total: 50 Marks